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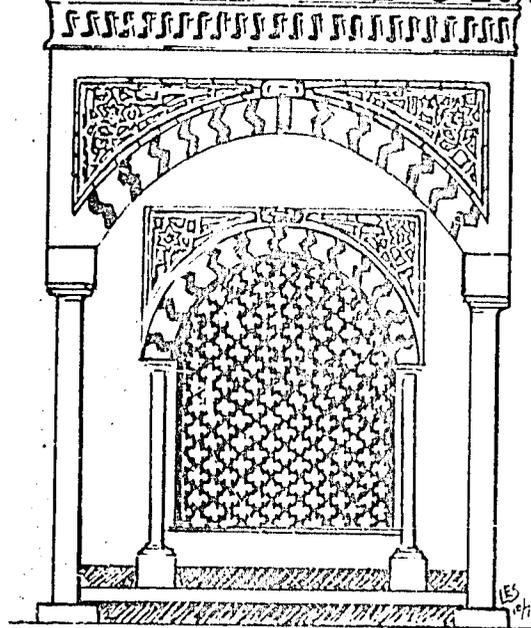
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MINISTRY OF DEVELOPMENT  
AND NEW COMMUNITIES

MANAGEMENT AND TARIFF STUDIES  
RELATIVE TO WATER/SEWERAGE SYSTEMS

MANAGEMENT SYSTEMS

DATA PROCESSING

FINAL REPORT



بِسْمِ اللّٰهِ الرَّحْمٰنِ الرَّحِیْمِ  
وَجَعَلْنَا مِنَ الْمَآءِ كُلَّ شَيْءٍ حَيٍّ  
صَدَقَ بِهِ الْعَظِیْمُ

BVI-ATK ASSOCIATES WITH SABBOUR ASSOCIATES

BLACK & VEATCH  
INTERNATIONAL  
CONSULTING ENGINEERS

A.T. KEARNEY, INC.  
MANAGEMENT CONSULTANTS

SABBOUR ASSOCIATES  
CONSULTING ENGINEERS

OCTOBER 1979

U.S.A.I.D. GRANT NO. 293-0025

# MANAGEMENT SYSTEMS

## DATA PROCESSING

### FINAL REPORT

#### The Story of Our Cover:-

On our cover is a sketch of a sybil, which is a fountain. During the Ottoman Empire these were a common source of drinking water. A well is located at ground level and a balcony on the second level where children were taught the Koran. Usually located near mosques, sybils were built and then donated to the public by various benefactors.

Beneath the sketch is a quote from the Koran, "We made from water all living things".



BLACK & VEATCH INTERNATIONAL  
CONSULTING ENGINEERS

A. T. KEARNEY, INC.  
MANAGEMENT CONSULTANTS

WITH SABBOUR ASSOCIATES  
CONSULTING ENGINEERS

OUR REF: 79-240  
YR REF:  
DATE: October 8, 1979

Engineer Soliman Abd El Hai, Chairman  
Advisory Committee for Reconstruction  
Ministry of Development and New Communities  
1 Ismail Abaza Street  
Cairo, A.R.E.

Dear Engineer Abd El Hai:

Pursuant to the provisions of Paragraph 6.5 of Appendix 1 to the Contract dated April 6, 1978 between the Ministry of Housing and Reconstruction and BVI-ATK Associates for Management and Tariff Studies Relative to Water and Sewerage Systems, we are pleased to submit the Final Report on Management Systems - Data Processing. It is responsive to the provisions of Paragraph 5.3.9 of Appendix 1 to the Contract and incorporates, as appropriate, material related to the review comments on the Interim and Draft Final Reports.

Your attention is directed to Section 0.0 of this report, Executive Summary, where a brief synopsis of the findings and recommendations may be found.

We wish to acknowledge the assistance and cooperation of the many individuals, agencies and organizations contacted during the course of the study.

We appreciate the opportunity to serve the Ministry on this important assignment.

Very truly yours

BVI-ATK ASSOCIATES

*John R. Scott*  
John R. Scott  
Project Director

cc: USAID  
TAMS  
Mr. A. F. Naguib

بلاك أند فيتش العالمية  
استشارات هندسية  
أ. ت. كارني  
استشارات إدارية  
المكتب الهندسي الاستشاري « صبور »  
استشارات هندسية

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- Appendix 5 Equipment and Application Costing

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Note: Exhibits are located at the end of the Section in which they are referenced. Appendices are located at the end of the Report.

List of Abbreviations and Terms

CPU - Central Processing Unit

KW - Thousands of Words

KB, KC - Thousands of Characters

KB/s, KC/s - Thousands of Characters per second

MB, MC - Millions of Characters

lpm - Lines per minute

cpm - Cards per minute

VDU, Video - Visual Display Unit, containing a television-type screen

## O.O BACKGROUND AND EXECUTIVE SUMMARY

This Data Processing Report has been prepared in accordance with the terms of reference supplied to BVI-ATK Associates by the Ministry of Development and New Communities of the Arab Republic of Egypt. It forms part of a series of reports on water and sewerage management practices at:

- General Organization for Greater Cairo Water Supply (GOGCWS).
- Alexandria Water General Authority (AWGA).
- Suez Canal Authority (SCA).
- General Organization for Sewerage and Sanitary Drainage (GOSSD).

A detailed review has been carried out concerning the methods of data processing in the existing organizations. Local conditions have been examined and taken into account when considering the manner in which data processing should be carried out and potential computer applications have been identified in line with the anticipated future needs of the authorities.

Various alternative methods of applying computers to the work of the authorities have been considered and recommendations have been made concerning the most appropriate method for providing computer services.

Recommendations for short-term improvements in existing data processing procedures have been made consistent with the long-term strategy proposed.

0.1 EXISTING DATA  
PROCESSING PRACTICES

Data processing equipment is currently applied at GOGCWS, AWGA and SCA to carry out several main types of work concerned with the administration of water supply. These are shown in Table O.1 below. No data processing equipment is used at GOSSD.

TABLE O.1  
MAIN TYPES OF WORK FOR WHICH  
DATA PROCESSING EQUIPMENT IS USED

Application	GOGCWS	AWGA	SCA
Customer Water Billing	X	X	X
Payroll	X	X	X
Inventory Accounting		X	X
Costing			X

The volumes of information to be processed for these types of work vary considerably between authorities. GOGCWS and AWGA have water billing loads of approximately the same size, but GOGCWS supplies a much larger population and has a payroll substantially larger than AWGA. In terms of the water operations alone, the volume of data processed by SCA is much smaller than that of GOGCWS or AWGA.

Each authority uses different equipment. At SCA a computer is available in Ismailia and is used to provide a centralized service. In Cairo GOGCWS also provides a centralized service, using punched card processing equipment. AWGA uses several types of machines to provide a centralized service in Alexandria for payroll and stock accounting, and a service which is largely decentralized at branches for customer water billing.

The computer system at SCA is modern and is well-suited to carrying out the work required of it. The computer facility provides services not only for the water operations of SCA but also for Navigation and other departments. Payroll, stock accounting and costing applications are standardized and are used throughout the Authority. Input information is transported from offices in Port Said, Suez and Ismailia to the computer center and is prepared and processed there. The results are distributed by the same method.

The punched card installation at GOGCWS is now rapidly becoming obsolete and equipment failures are the cause of some erroneous results being provided to users. Input documentation is supplied to the punched card center, where it is key punched and processed.

The data processing facilities at AWGA are, with some exceptions, generally in need of replacement. Over 80% of the customer billing work is done on machines which are over 20 years old. The machine doing the payroll and stock accounting work is now eight years old and its performance is beginning to deteriorate. The exceptions are eight billing machines which have recently been purchased, but these are currently failing to achieve the expected processing rates.

It is clear from the investigations that the equipment at GOGCWS should be replaced as soon as possible, since the errors which it generates require clerical effort to detect and eliminate. The majority of the old AWGA equipment should be replaced because the maintenance costs are becoming unacceptably high. Additionally, the disappointing performance of the new billing machines at AWGA should be investigated.

## 0.2 RECOMMENDED EQUIPMENT AND APPLICATIONS

The water operations of SCA should for the present time continue to be served by the SCA computer center, and new computer facilities should be procured to meet the needs of GOGCWS, AWGA and GOSSD or the authorities to be located in Cairo and Alexandria.

The equipment to be provided would consist of:

- Data preparation equipment to be located at the main offices of the authorities.
- A single computer in Cairo to provide a centralized computer service.

The business applications for which the computer would be used are:

- Customer Billing and Accounting, for the water authorities.
- Payroll and Labor Cost Accounting.
- Inventory Control and Accounting.
- General Accounting.

The computer should also be capable of technical applications within the time available.

### 0.3 CONTROL, STAFFING AND MANAGEMENT

The computer center should ideally be under the joint control of GOGCWS, AWGA and GOSSD, but in any case the authorities should be represented on the governing board of the computer center. This will ensure that the authorities are able to take appropriate action to maintain a high-quality service.

It is necessary to use highly-skilled computer staff if a reliable service is to be obtained. Special payment arrangements for employees should be investigated with the objective of making salaries available which are close to those in the private sector, thus reducing the likelihood of fast turnover of staff.

Consideration should be given to using the services of external specialists to assist in setting up and operating the computer center, and in training new computer personnel. These specialists could be hired under a facilities management contract

### 0.4 SYSTEMS DESIGN AND PROGRAMMING

A reputable external software company should be hired for the work of system design and programming for the authorities. A substantial amount of standardization appears possible and this would be promoted economically by using a single company to carry out this work.

0.5 COSTS WHICH WILL  
BE INCURRED

All equipment should be rented with an option to purchase during the introductory phases of the systems development and operations. On this basis the general levels of external costs incurred in setting up the recommended systems to meet the current work loads of the authorities will be as shown in Table 0.2:

TABLE 0.2  
EXTERNAL DATA PROCESSING COSTS

Once-Only Charge

- Systems Design and Programming	LE 102,000
----------------------------------	------------

Annual Charges

- Equipment Rental and Maintenance	LE 122,000
------------------------------------	------------

- Computer Operations Staff and Management	LE 24,000
--	-----------

Total Annual Charges	<u>LE 146,000</u>
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These costs would be allocated to the authorities as shown in Table 0.3 on the following page. In the report on Organizational Environment and Structure it is recommended that Cairo and Alexandria should have separate sewerage organizations. If the recommendation is accepted then the GOSSD costs would be transferred to these organizations.

TABLE O.3

EXTERNAL COSTS ATTRIBUTABLE TO AUTHORITIES (LE)

Cost Factor	Present Organizations			
	GOGCWS (LE)	AWGA (LE)	GOSSD (LE)	All Organi- zations (LE)
<u>Once-Only Costs</u>				
Systems Design and Programming	38,000	38,000	26,000	102,000
<u>Annual Costs</u>				
Equipment Rental and Maintenance:				
- Data Preparation	26,000	20,000	16,000	62,000
- Processing	28,000	19,000	13,000	60,000
Computing Operations Staff and Management	11,000	8,000	5,000	24,000
Total Annual Costs	65,000	47,000	34,000	146,000

#### 0.6 BENEFITS OF USING A COMPUTER

The main benefit which will be obtained by introducing well-planned computer procedures at the authorities is that the output information provided for management purposes will be much more accurate, timely and detailed. Management will have a tool for greatly improved decision-making and control.

A secondary benefit is that it will be possible to reassign to other tasks many staff at present carrying out routine clerical work. Preliminary estimates show that in each authority over 150 personnel could be transferred to more useful work with the introduction of computer processing.

External costs which are currently being incurred using the present equipment will be eliminated and will assist in justifying the use of new equipment in direct financial terms as shown in Table 0.4:

TABLE 0.4  
EFFECT OF NEW EQUIPMENT ON ANNUAL  
EXTERNAL COSTS AND STAFFING

Cost and Staffing	Present Organizations			
	GOGCWS	AWGA	GOSSD	All Organizations
Present annual external data processing costs (LE)	26,000	53,000	-	79,000
Estimated annual external data processing costs, using new equipment (LE)	65,000	47,000	34,000	146,000
Increase in annual costs (LE)	39,000	(6,000)	34,000	67,000
Net staff available for reassignment to other work	195	192	167	554

AWGA can justify economically the use of improved computing facilities. The maintenance charges on the present equipment at AWGA more than cover the rental and maintenance costs which would be attributable to using the new equipment. In addition about 192 personnel would be available for reassignment to other work.

Although GOGCWS will incur additional annual external costs under the new procedures, the present equipment urgently requires replacement and additional costs are to be expected. Since the additional cost of about LE 39,000 per year enables 195 clerical personnel to be reassigned to other work, the benefits are large.

GOSSD will incur additional annual external costs of about LE 34,000 per year, which is the equivalent of 70 personnel at LE 40 per month. The number of personnel who could be reassigned to other work would be about 167, and consequently the benefits of applying computer procedures are large. Under the proposed organizational arrangements 20% of this number would be available from Alexandria and the remainder from the main office in Cairo.

#### 0.7 SCHEDULE FOR INTRODUCTION OF PROCEDURES

It is most unlikely that all the computer systems can be operational, for all authorities, in a period much less than four years from the start of systems design. It would be possible however, to introduce selected systems at individual authorities and to have at least one application operational at each authority within about two years from the start of systems design.

## 0.8 ALTERNATIVE COMPUTING STRATEGY

It may prove difficult or impossible to make suitable arrangements for the authorities jointly to control and operate a single computer facility. We consider that the next best alternative would be to have two computers, one in Alexandria and one in Cairo. If the present organizational structure is retained then AWGA would use the computer in Alexandria and the computer in Cairo would be shared by GOGCWS and GOSSD. If the proposed organizational structure is to be used then each of the water and sewerage authorities in Alexandria and Cairo could use joint computer facilities.

In adopting this approach the annual costs involved would be larger overall than for a single installation. It would also be necessary for the management of each facility to obtain skilled computer staff and to be able to retain them within their payment structure, or alternatively to use some form of external service to operate the computer.

At the same time, the alternative strategy might consider other local data processing requirements (e.g., Alexandria city and harbor requirements) to broaden the base of computer applications. In this situation it may be possible to reduce the costs of data processing to the water and sewerage organizations to a level comparable with that available from a single computer facility in Cairo serving these organizations.

0.9 SHORT-TERM  
IMPROVEMENTS REQUIRED

The main area in which immediate improvements could usefully be made relates to GOGCWS, SCA and, to a lesser extent, AWGA. It concerns the physical presentation of data to be processed and also the level of accuracy of the data at the start of processing. A significant amount of effort is currently devoted to checking all data processing output because of lack of control over input data. Recommendations have been made to assist in eliminating this problem.

## 1.0 INTRODUCTION

Although the term data processing has only been in common use for the last 20 years, data has been processed ever since the human race could read and write. By processing we mean converting data from one form to another, for example by adding a column of figures to form a total or by collecting data from several sources to provide a single set of information. We process data every day, using manual procedures, and it is only in recent times that automated aids, such as calculators and computers, have become available. Today data processing implies the use of computers or other automatic equipment for handling information.

When computers first became available it was quite common for a company first to purchase a computer and subsequently to decide what to do with it. Computers were considered by some people to be a universal cure for business ailments. Experience, however, in many cases very costly experience, has shown that this reasoning is completely fallacious. A computing facility not only needs good equipment but also a well thought-out computing plan and systems, skilled personnel and reliable maintenance, and it can be very expensive to set up and operate. The business requirements need to be studied thoroughly in the same way that any other project involving large investment should be studied, and only if tangible benefits will be obtained should a computing system be introduced.

Any advantages which a computer may appear to provide should be evaluated in strictly business terms. For the water and sewerage authorities the main factors involved are:

- Enabling the efficiency of the administrative procedures to be improved by providing information which is:
  - . More timely.
  - . More accurate.
  - . In greater detail, as necessary.
- Being able to undertake a significantly higher administrative work load in line with future investment plans.

Improvements in systems can be evaluated using the criteria of accuracy, speed of response, provision of detailed and well-structured information, and punctuality of reporting. Any computer applications will have to meet the same criteria. Additionally, it is desirable to provide for these needs in the most cost-effective manner.

Computers may be applied to the work of a business in many different ways and the computer itself is only a useful tool in the overall procedures. It is absolutely imperative that appropriate consideration be given also to such features as:

- The design of the basic systems to be used.
- Communication between the computer department and those departments supplying data and using the processed information.
- Means of ensuring that data supplied for processing is accurate.
- Obtaining suitably skilled staff to operate the computer reliably.

This Report describes the work which has been carried out in analyzing the needs of the authorities and determining the most suitable methods of data processing to meet these needs. A large number of options have been considered and evaluated against appropriate criteria, and these analyses show that it is indeed possible to set up computer systems which will be able to provide a greatly improved service to the management of the authorities.

## 2.0 ELECTRONIC DATA PROCESSING IN EGYPT

Automated data processing systems started to be applied in Egypt in the 1930's in the form of punched card installations parallel with their application in other parts of the world. Subsequent developments have also generally been in line with advances elsewhere.

The first electronic computer in Egypt was an IBM 1620, which was installed at the National Planning Institute in 1963. In 1964 another IBM 1620 was installed at Alexandria University and then other governmental bodies started to apply computers in their own fields.

Until 1965 the applications were largely scientific, but commercial applications started to emerge at about this time and were followed about two years later by industrial types of application. Currently many different types of work are being processed in Egypt, using a wide range of equipment.

This Section reviews the EDP background for this Report under the following headings:

- Demand for Data Processing in Egypt
- Government Regulations and Plans
- Existing Computer Installations
- Current Salaries for Computer Staff
- Existing Computer Suppliers in Egypt
- Software Expertise and Suppliers
- Maintenance Facilities
- Telecommunications
- Power Supplies
- Summary

## 2.1 DEMAND FOR DATA PROCESSING IN EGYPT

Since 1965 many organizations in both the private and the governmental sectors have recognized the benefits which can be achieved by applying computers in their work and initially many organizations set out to purchase their own computers. Lack of foreign currency with which to purchase computers led to a shift in emphasis, shortly after 1965, to the use of computer bureaus. This trend has continued until quite recently, not only because of currency problems, but also because many companies with their own computers realized that they did not have the necessary skills to use them effectively and could obtain a better data processing service by other means.

Between 1963 and 1975 there was a slow upward trend in the number of computers operating in Egypt. During this period of 12 years about 40 machines were installed. This number has more than doubled during the last two years, largely due to:

- Lifting of governmental restrictions on imports of computers.
- Availability of smaller, less expensive computers.
- Availability of reconditioned machines which could be sold in local currency.

The overall pattern of growth is shown in Exhibit 2.1.

An analysis of the size of computers shows that most growth is taking place in the medium and small ranges. In the medium range there was a significant increase during 1976. This pattern is shown in the bar charts of Exhibit 2.2.

Although IBM had an early lead in the supply of data processing equipment it has recently been overtaken by ICL. This has occurred because of a temporary reduction in marketing effort by IBM, which has now ended. IBM is restricting its sales and service within Egypt to its 370 series of computers and has still not introduced its smaller System 3 range of equipment. Exhibit 2.3 shows the pattern of growth for IBM, ICL and NCR, which are the three major suppliers of computer equipment in Egypt.

The overall trend in growth is in line with the use which could be made of computing power but there is a possibility that the growth will not be maintained. This is due to the current shortage of skilled personnel able to program and operate these machines.

## 2.2 GOVERNMENT REGULATIONS AND PLANS

In 1964 government legislation was introduced which authorized the National Mobilization Department to plan and control the use of computers within government bodies and the public sector. These regulations were framed in such a way as to control the selection of the manufacturer, the contract terms and the pricing policy but they did not provide any real guidance in terms of how best to utilize the capacity of these machines, though the National Mobilization Department itself has conducted studies and provided valuable advice.

This legislation was rescinded in 1975 and no further legislation in this area has been introduced. Individual government agencies are now free to adopt whatever methods they consider best suited to their work and can obtain computing equipment through the normal purchasing channels.

### 2.3 EXISTING COMPUTER INSTALLATIONS

The number of computers in 1977 in the various economic sectors are summarized in the table below:

TABLE 2.1  
DISTRIBUTION OF COMPUTERS  
BY ECONOMIC SECTOR (1977)

Economic Sector	Quantity	Percent
Government	23	24½%
Universities and Scientific Institutes	15	16
Commerce and Services	35	37
Manufacturing Industry	21	22½
All Sectors	94	100%

Sources: Data Processing Services Company (DPS) market survey and manufacturers' data.

This shows that at the present time the government is a major user of computing power within Egypt.

Exhibit 2.4 provides details of the major governmental computer installations. Some of these computers are also used to provide external services and details of the facilities available are shown in Exhibit 2.5. None of these installations presently provides a comprehensive service for external users.

The computers in use at universities and scientific institutes are, with one exception, not used commercially for providing external services. The exception is the NCR 8250 machine at Cairo American University for which NCR has an agreement enabling it to use the machine to provide back-up services for other NCR customers.

Among the manufacturers only IBM and ICL provide normal service bureau facilities. IBM's facilities are extremely good and modern, whereas ICL currently has only a relatively small and dated set of facilities. ICL states, however, that if special facilities are required they will carry out the work elsewhere. Details are shown in Exhibit 2.6.

No other companies specialize in providing computer bureau services but many companies owning computers are willing to sell available time. Systems analysis and programming assistance are not normally available and the customers may be expected supply their own staff to operate the computer. A small number of private companies do, however, provide full service bureau facilities. The details of six of these major suppliers are shown in Exhibit 2.7.

#### 2.4 CURRENT SALARIES FOR COMPUTER STAFF

Trained computer staff are currently in great demand in Egypt. A highly-skilled person working in the private sector can expect to receive a relatively high salary for this type of work.

Table 2.2 on the following page indicates salary levels in the major companies in Egypt, in the private sector. Bonuses are normally paid in addition to these salaries.

TABLE 2.2

DATA PROCESSING PERSONNEL - EXPERIENCE  
DESIRED AND ASSOCIATED PRIVATE SECTOR REMUNERATION

Personnel	Estimates of Education and Experience Needed to be Fully Effective	Remuneration - LE per month	
		Basic Salary	Total Compensation
Data Processing Manager	-Technical Institute plus English language -Management - 1 year -Applications - 2 years -Systems analysis - 2 years	160-565 Average 360 (1)	204-635 Average 435 (1)
Systems Analyst	-Technical Institute plus English language -Equipment experience - 6 months -Applications experience - 2 years -Systems analysis - 2 years -Programming - 1 year	160-470 Average 310 (1)	215-580 Average 400 (1)
Programmer	-Technical Institute plus English language -Programming - 1 year -Equipment experience - 1 year	Senior 150-290 Average 220 (1)	Senior 190-390 Average 290 (1)
Computer Operator	-Secondary education plus English language -Equipment experience - 6 months - 1 year	68-215 Average 109 (1)	106-308 Average 208
Data Controller	-Secondary education -Application experience - 6 months	50-70 (2)	Not Estimated
Data Preparation	-Secondary education -Key punch experience - 3 months	40-60 (2)	Not Estimated

Sources: (1) Middle East Advisory Group (MEAG) 1978 survey of salary levels in Egypt.  
(2) Data Processing Services Company (DPS) estimates.

A graduate entering Government service can expect to receive a basic salary of LE 30-40 per month. Once he is trained in computer techniques his opportunities and salary potential are much higher in the private sector, and consequently young trained staff will tend to leave.

## 2.5 EXISTING COMPUTER SUPPLIERS IN EGYPT

At the present time the only computer manufacturers with their own offices in Egypt are IBM, ICL and NCR.

Other manufacturers are represented in Egypt by agents, a sample of which are listed in Table 2.3:

TABLE 2.3  
SELECTION OF MANUFACTURERS WITH AGENTS IN EGYPT

Manufacturer	Agent
Digital Equipment Corporation	Giza Systems Engineering Company
Data General	TEA Computers SA - Cairo
Wang	Balsam Engineering Company - Cairo
Borroughs	Modern Management Methods - Cairo
Hewlett Packard	International Engineering Associates - Cairo
Interdata	M.R.C. - Cairo

Although IBM, ICL and NCR have offices in Egypt, and are therefore the best-equipped to assist in data processing matters, IBM has recently been limiting its marketing effort. This may indicate that it is able to obtain more profitable business in other parts of the world.

The hardware and software support available to customers through agents varies in quality and depends largely on the indirect assistance provided by the individual manufacturer concerned. It is most unlikely that any agent could provide support comparable to that available from IBM, ICL or NCR.

## 2.6 SOFTWARE EXPERTISE AND SUPPLIERS

In Europe and the US it has long been recognized that specialist software companies can play a significant role in the design and development of business systems.

Although some level of software expertise is available from most existing computer installations, service bureaus and manufacturers' agents, we are aware of only one company in Egypt which provides specialized and independent services in this field. This company is Data Processing Services (DPS), with its main office in Cairo.

It is likely that additional Egyptian companies will be formed to meet the demand for software which is certain to emerge during the next three to five years. At the present time it must be recognized that there is still only a limited number of companies in this field in Egypt and skilled software expertise is scarce.

## 2.7 MAINTENANCE FACILITIES

Maintenance facilities for equipment are currently available only from manufacturers or their agents in Egypt.

Although independent maintenance companies operate in Europe and the U.S. their growth has taken place largely because manufacturers do not wish to continue to maintain obsolescent equipment. Egypt is still a relatively young computer market and it will probably be ten years before any independent maintenance companies appear here.

## 2.8 TELECOMMUNICATIONS

The Egyptian telephone network is old and telephone facilities are limited. Long-distance communication in many cases can only be carried out by pre-booking calls, which are then connected by the operators when lines become available.

The cost and availability of private telephone links, such as are already in use by the Suez Canal Authority, have been investigated. The monthly rental costs of such lines is LE 22.6 per kilometer between towns and LE 12 per kilometer within towns. Although trunk lines between towns are available there is a great shortage of local lines and at the present time spare local lines are not available.

Information has been requested concerning the present reliability of the telephone systems and also proposed developments in the near future.

## 2.9 POWER SUPPLIES

At the present time power failures involving a complete lack of electricity are a not infrequent occurrence. Any data processing being carried out would naturally be brought to a halt. In addition the supply voltage varies considerably, making it necessary to apply voltage regulators to assure that the computer may continue to function satisfactorily during periods of low or high voltage.

The electricity company may require that space be made available for them to install a separate transformer for the electrical supply to the computer.

Information has been requested concerning the present reliability of electrical supplies and also proposed developments in the near future.

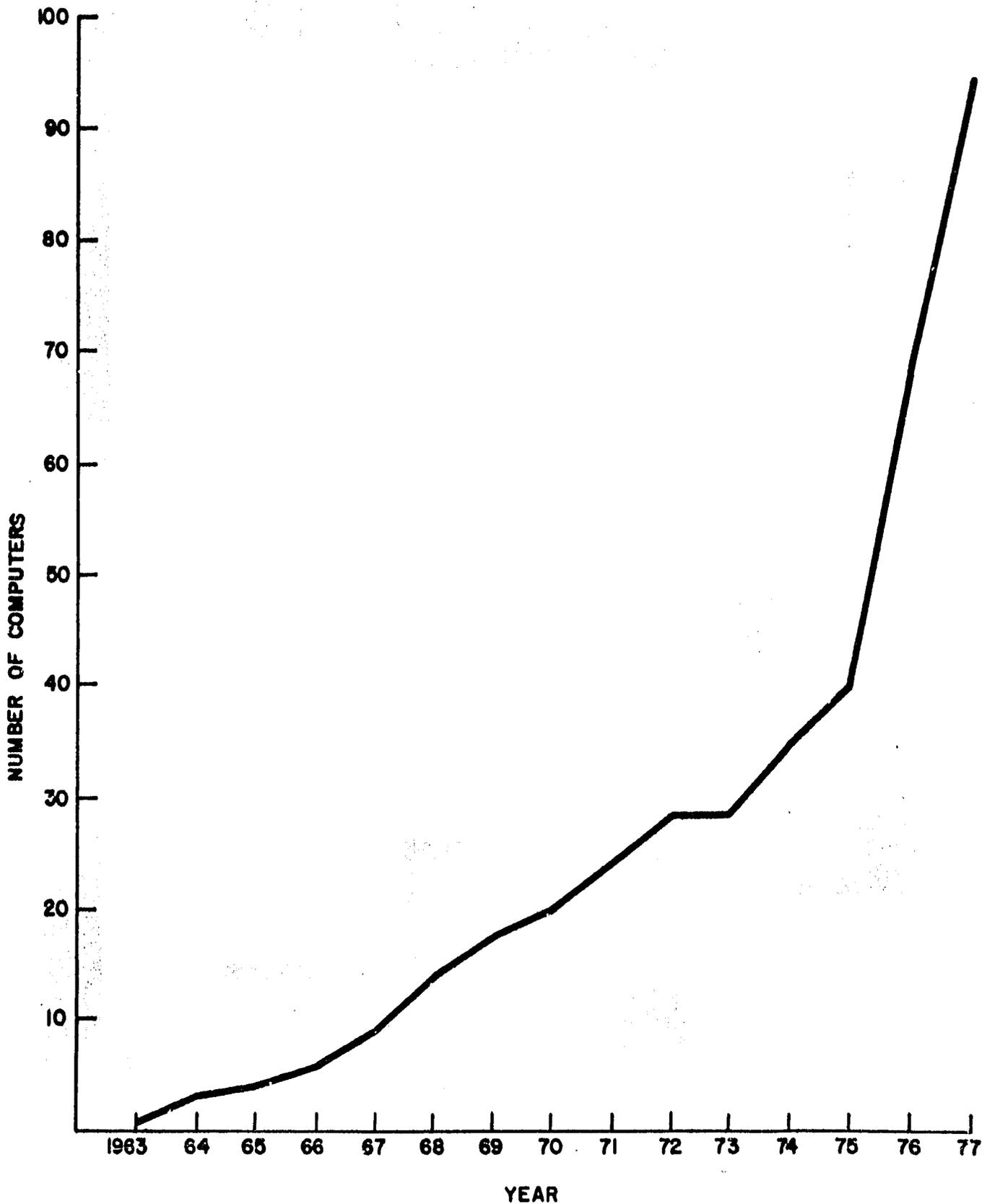
## 2.10 SUMMARY

Although computers have been in use in Egypt since 1963 development has been slow and there is still lack of expertise in this area. This is particularly so in systems analysis and programming where only one company is devoted entirely to this work.

Only three computer manufacturers, IBM, ICL and NCR, have offices in Egypt and consequently only they are able to supply reliably a complete range of services associated with their equipment. They are also the only suppliers of anything approaching a dedicated computer service bureau and IBM is the best equipped in this respect.

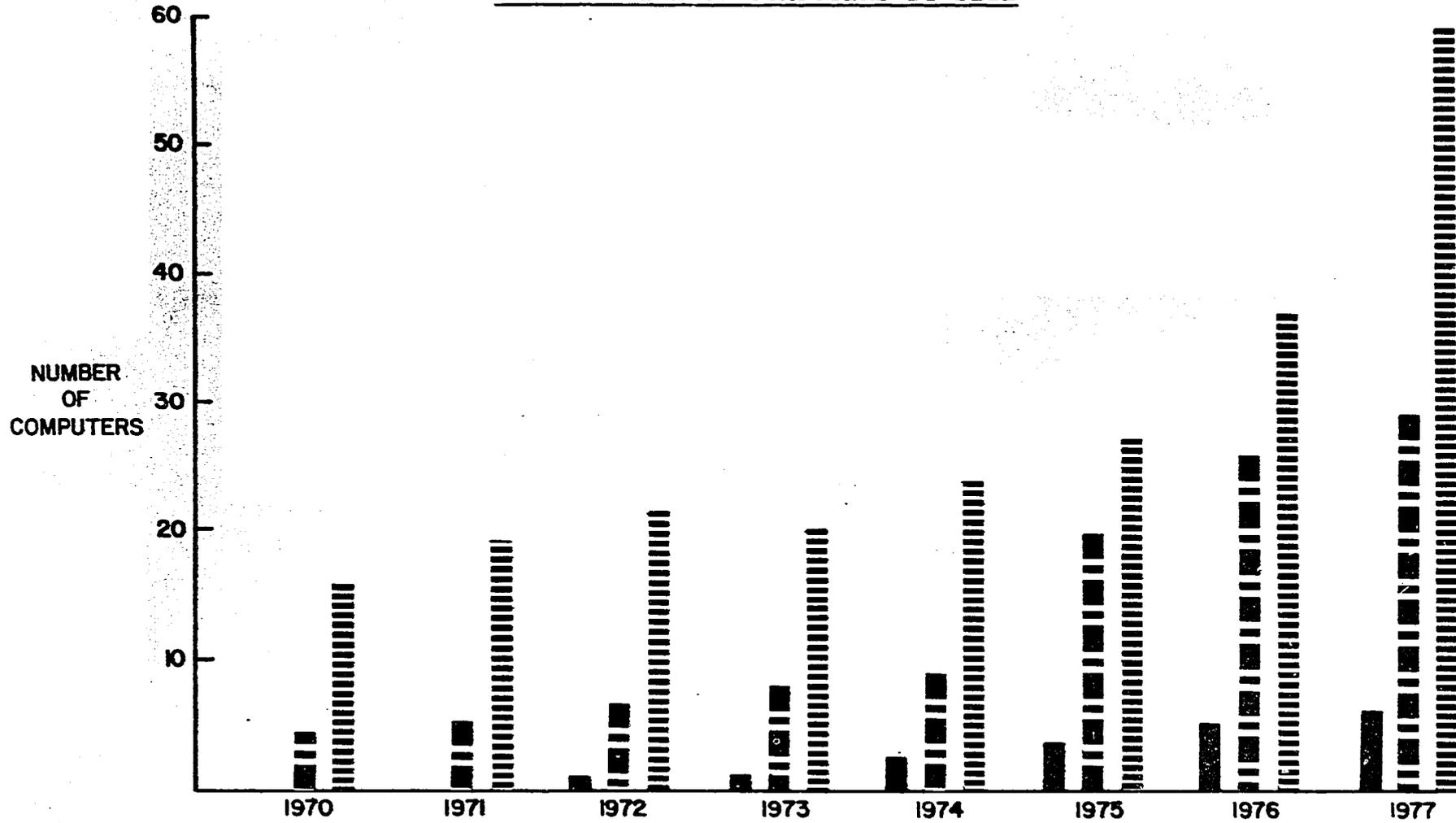
In the private sector there is a large demand for computers and this is driving up the salary rates paid to skilled computer personnel. The associated effect is that skilled computer staff tend to move to the private sector in preference to the governmental areas, where salaries are based mainly on seniority.

TOTAL NUMBER OF COMPUTERS IN EGYPT



Source: Data Processing Services Company (DPS) market and manufacturer's information.

DISTRIBUTION OF COMPUTERS BY SIZE

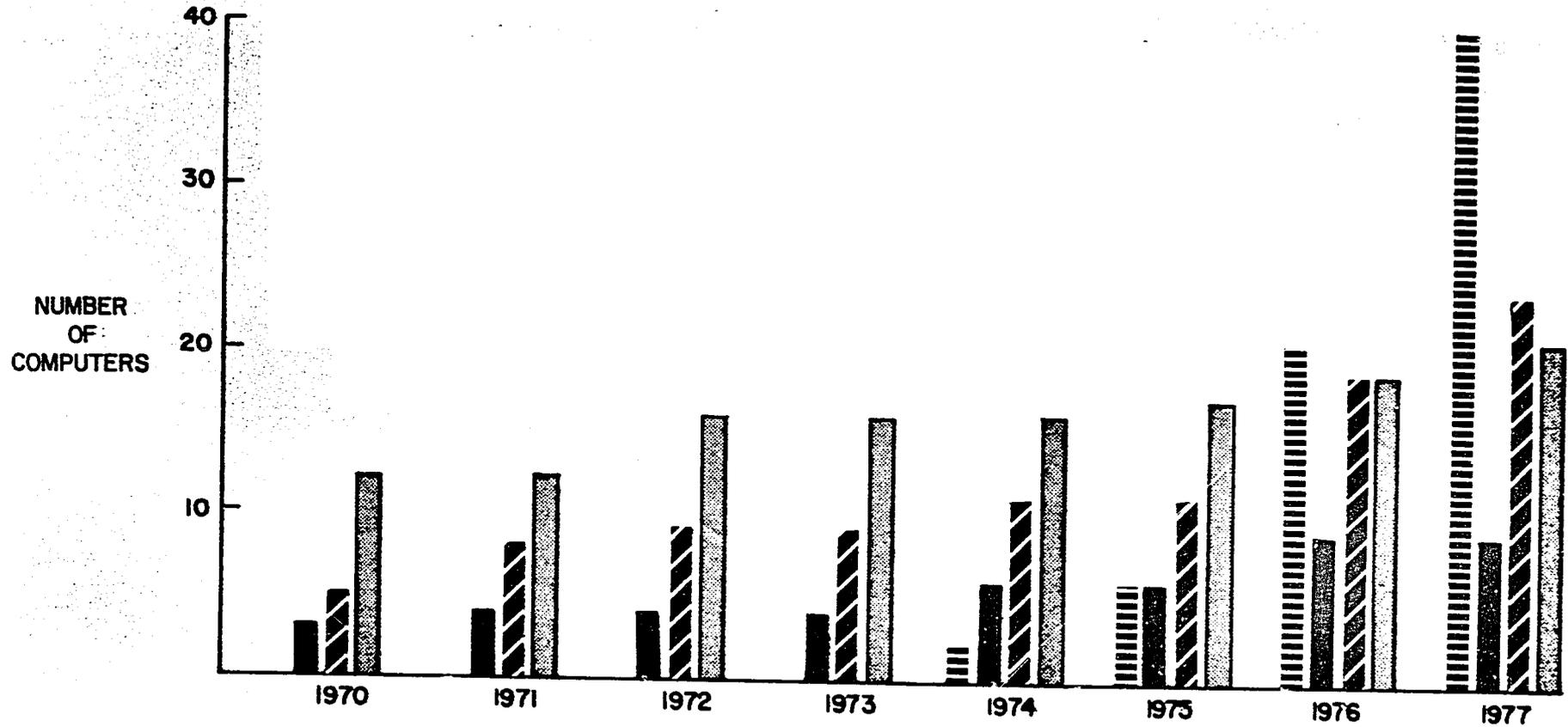


LEGEND:

- ||||| SMALL AND MINI
- ■ ■ MEDIUM
- ■ ■ LARGE

Source: DPS market survey and manufacturers' information.

DISTRIBUTION OF COMPUTERS BY MANUFACTURER



**LEGEND:**  
 ■ N.C.R.  
 ▨ I.C.L.  
 ▩ I.B.M.  
 ||||| OTHERS

Source: DPS market survey and manufacturers' information.

MAJOR GOVERNMENT COMPUTER INSTALLATIONS

Name	Location	Equipment and Facilities	Outside Work	Remarks
Ministry of Interior	Cairo	2 CII IRIS 50      128 KW	No	
Ministry of Communication	Cairo	1 NCR Criterion      96 KB	Yes	
Mobilization	Cairo	1 ICL 2904      48 KW	Yes	
Government Insurance Organization	Cairo	1 ICL 1902 T      32 KW	Yes	By special arrangement
Social Insurance	Cairo	1 IBM 370/145      128 KB	No	
Meteorology	Cairo	1 IBM 370/145      512 KB	Yes	
NCC	Cairo	1 ICL 1906 S      256 KW	Yes	
Suez Canal Authority	Ismailia	1 ICL 2903      28 KW	No	
MOFA	Cairo	1 IBM 370/145      512 KB	No	
Cairo Governorate	Cairo	1 NCR C101      32 KB	Yes	
Central Bank	Cairo	1 NCR C201      32 KB	No	
Presidential Secretary	Cairo	1 Digital PDP 11      32 KB	No	
Military	Cairo	2 Digital PDP 11      64 KB	No	
		6 Data General NOVA      65 KB	No	
		1 CII Mitra 125      96 KW	No	
		1 ICL 1901A      16 KW	No	
	Total	23		

Source: DPS survey and manufacturers' information.

MAJOR GOVERNMENT SERVICE BUREAUS

Name	Location	Equipment and Facilities	Services	Prices
CAPMAS	Nasr City,	ICL 2904 CPU 48 KW 4 Disc drives 30MC each 1 Card Reader 2000 2 Line Printers 1500 lpm 3 Videos 4 Magnetic tape units 1 Paper tape reader 1000 cps 1 Paper tape punch 110 cps	A microwave data transmission network has been contracted for and by the end of 1979 there will be the possibility of connecting users to the 1906 computer at the National Computing Center (NCC).	By negotiation
NCC	Nasr City, Cairo	ICL 1906S CPU 265 KW 10 EDS Units 30MC each 2 Card readers 2000 cpm each 4 Line Printers 1500 lpm 160 pp per line each 10 Videos 2 Magnetic tape units, 4 decks each 9 track, transfer rate 80 K cps 1 Magnetic tape unit, 4 decks 7 track, transfer rate 60 K cps 1 Paper tape reader 1000 cps 1 Paper tape punch 110 cps 1 Card punch 300 cpm 1 Graph plotter 31 inches		

Source: Above data as provided by Central Agency for Public Mobilization and Statistics (CAPMAS).

MAJOR GOVERNMENT SERVICE BUREAUS

Name	Location	Equipment and Facilities	Services	Prices
Mobilization	Cairo	ICL 2904 CPU 48 KW 4 Disc drives 30 MC each 1 Card reader 2 Line printers 1500 lpm 3 Videos 4 Magnetic tape units 1 Paper tape reader 1 Paper tape punch		By negotiation
Meteorology	Cairo	IBM 370/145 CPU 512 KB 1 Line printer 1000 lpm 4 Magnetic tape units 3 Disc units 29 MB each 1 Card reader 1000 cpm 1 Card punch 1 Plotter		By negotiation

Source: DPS survey and manufacturer's information.

MAJOR GOVERNMENT SERVICE BUREAUS

Name	Location	Equipment and Facilities	Services	Prices
Government Insurance Organization	Cairo	ICL 1902 T CPU 2 Disc drives 4 Magnetic tape units 1 Line printer 1 Line printer 1 Card reader	32 KW 60 MC each 1500 lpm 1100 lpm	By negotiation
Ministry of Communication	Cairo	NCR C201 CPU 2 Magnetic tape units 2 Magnetic tape units 3 Disc drives 2 Disc drives 1 Line printer  1 Card reader	96 KB 7 tracks 9 tracks 300 MB total 8 MB total 1500 lpm  300 cpm	By negotiation
Cairo Governorate	Cairo	NCR C101 CPU 1 Disc drive 2 Magnetic tape units 1 Card reader 1 Line printer	32 KB 10 MB 300 cpm 1000 lpm	By negotiation

Source: DPS survey and manufacturers' information.



OTHER MAJOR SERVICE BUREAUS

Name	Location	Equipment and Facilities	Services	Prices
AMAC (El-Ahram)	Cairo	IBM 370/145 CPU 148 KB 1 card reader 1000 cpm 2 Line Printers 1100 lpm 4 Disc drives 2x 70 MB 2x 35 MB 2 Diskette units 1 output 1 input 3 Tape units 1 Card Punch	- System analysis - Programming - Data preparation (Diskette)	150 LE/hr
AMAC (El-Ahram)	Alexandria	IBM 360/40 CPU 128 KB 3 Disc drives 70 MB each 2 Tape units 1 Printer 1100 lpm 1 Card reader 1000 cpm	- System analysis - Programming - Data preparation	100 LE/hr
AMAC (Dar Al Maarif)	Cairo	IBM 370/125 CPU 128 KB 4 Disc drives 79 MB each 2 Tape units 9 tracks 1 Tape unit 7 tracks 1 Line Printer 1100 lpm 1 Card reader 1000 cpm	- System analysis - Programming - Data preparation	150 LE/hr

OTHER MAJOR SERVICE BUREAUS

Name	Location	Equipment and Facilities	Services	Prices
NASR Vehicle Company	Helwan	IBM 370/135 CPU 196 KB 4 Disc drives 70 MB each 4 Magnetic tape units 1 Card reader 1000 cpm 1 Card punch 300 cpm 1 Line printer 1000 lpm	- Data preparation - System analysis - Programming	By negotiation
Military Factories' Computer Center	Cairo	ICL 1902 S CPU 32 KW 3 Disc drives 30 MC each 4 Magnetic tape units 9 tracks 4 Magnetic tape units 7 tracks 1 Card reader 3 Line printers	- Data preparation - System analysis - Programming	60 LE/hr
Petroleum Cooperative Organization	Cairo	NCR C 8550 CPU 128 KB 2 Disc drives 200 MB total 4 Magnetic tape units 1 Line printer 1100 lpm 1 Card reader 600 cpm		By negotiation

Source: DPS survey and manufacturers' information.

### 3.0 DATA PROCESSING ACTIVITIES OF WATER AND SEWERAGE AUTHORITIES

Data processing equipment is currently in use at three of the authorities. Five types of work are carried out and six types of equipment are applied. Table 3.1 summarizes the situation:

TABLE 3.1  
DATA PROCESSING WORK OF WATER  
AND SEWERAGE AUTHORITIES

Authority	Applications	Types of Equipment
General Organization for Greater Cairo Water Supply (GOGCWS)	<ul style="list-style-type: none"> <li>. Meter billing</li> <li>. Payroll</li> <li>. Medical service records</li> </ul>	<ul style="list-style-type: none"> <li>. ICL punched card handling and tabulating machines</li> </ul>
Alexandria Water General Authority (AWGA)	<ul style="list-style-type: none"> <li>. Meter billing</li>   <li>. Payroll</li> <li>. Stock accounting</li> </ul>	<ul style="list-style-type: none"> <li>. NCR 399 and 499 programmable accounting machines</li> <li>. NCR non-programmable machines</li> <li>. Addressograph machines</li> <li>. NCR 500 machine</li> <li>. NCR 500 machine</li> </ul>
Suez Canal Authority (SCA)	<ul style="list-style-type: none"> <li>. Meter billing</li> <li>. Payroll</li> <li>. Stock accounting</li> <li>. Costing</li> <li>. Additional applications related to operating the Suez Canal have been omitted from this list.</li> </ul>	<ul style="list-style-type: none"> <li>. ICL 2903 computer</li> </ul>
General Organization for Sewerage and Sanitary Drainage (GOSSD)	<ul style="list-style-type: none"> <li>. None</li> </ul>	<ul style="list-style-type: none"> <li>. None</li> </ul>

The data processing work carried out by the three authorities is reviewed in this Section of the Report.

In the final Paragraph 3.4 of this Section, the overall data processing work and the major problem areas are summarized,

### 3.1 DATA PROCESSING AT GOGCWS

The Data Processing Department at GOGCWS is under the control of the Stores and Supplies Manager.

GOGCWS operates an ICL punched card data processing system which was originally installed in 1965. Though now outmoded, it is still carrying out useful work. The equipment is leased from Computer Leasing Ltd. of London, England.

Significant maintenance problems are being experienced. The equipment is old, spare parts are difficult to obtain, and there is a shortage of skilled engineers able to work on this obsolete equipment. Thirty-three personnel, including four supervisors, operate the department on a two-shift basis, six days per week, and the total annual cost of operating the installation is approximately LE 40,000. Most of the present machine operating staff are well-experienced and have been with GOGCWS for at least three years.

The policy of GOGCWS is to recruit untrained staff and to give on-the-job training in the specific procedures to be carried out.

Details of the facilities, staffing and costs are shown in Exhibit 3.1.

### 3.1.1 Types and Volumes of Data Processing Work

Four types of work are carried out - Meter Billing, Normal Payroll, Overtime Payroll and Medical Service Records; Salient features are summarized below:

#### - Meter Billing

. Number of locations to be billed	224,000
. Billing frequency	Two-month intervals

#### - Normal Payroll

. Number of employees	8,500
. Payroll frequency	Monthly

#### - Overtime Payroll

. Number of employees eligible for overtime	7,000
. Overtime payroll frequency	Monthly

#### - Medical Service Records

. Number of prescriptions per month	7,000
. Medical statement frequency	Monthly

A summary of the major processing volumes for these procedures is shown in Table 3.2 on the following page.

TABLE 3.2  
MAJOR DATA PROCESSING VOLUMES - GOGCWS

MAIN FILES	Records	Characters
Meter Billing - Customer Records	224,000	14.8 Million
Payroll - Employee Records	8,500	4.8 "
Total	232,500	19.6 Million
INPUT DATA - Monthly	Records	Characters
Meter Billing	112,000	5.0 Million
Overtime Payroll	7,000	0.3 "
Medical Service	7,000	0.1 "
Total	126,000	5.4 Million
OUTPUT INFORMATION - Monthly	Print Lines	Characters
Meter Billing	673,120	21.5 Million
Normal Payroll	212,500	6.9 "
Overtime Payroll	29,500	1.6 "
Medical Service	10,500	0.1 "
Total	925,620	30.1 Million

### 3.1.2 Costs of Applications

A series of analyses has been carried out showing how the data preparation and processing effort and costs are divided among the four current applications. The annual costs incurred in operating the facilities have been allocated to the four applications according to the proportions of supplies and effort required. The summary of cost allocations in Table 3.3 on the following page shows the effective cost per transaction for each of these applications.

TABLE 3.3  
SUMMARY OF ANNUAL COST ALLOCATIONS  
SHOWING DERIVED UNIT COST - GOGCWS

Type of Cost	Billing	Normal Payroll	Overtime Payroll	Medical Service Records
Wages (LE)	6,640	1,253	1,168	267
Equipment Rental and Maintenance (LE)	8,908	3,805	3,054	603
Supplies (LE)	11,434	1,044	727	727
Total Annual Cost (LE)	26,982	6,102	4,949	1,597
Current Transactions per Year	1,344,000	102,000	84,000	84,000
Cost per Transaction (Piasters)	2	6	5.9	1.9

### 3.1.3 Service to Users

User departments at GOGCWS have not expressed direct criticism of the Data Processing Department. The procedures have been in operation now for a considerable time and it is probable that the users have come to accept as normal any deficiencies which exist in the service provided.

A large amount of effort is applied in checking computer output and there is an apparently high error rate in the output information. In order to determine the significance of the various factors which may give rise to errors a sample of the output information has been analyzed. This analysis shows clearly that, except for meter billing, the major source of error is lack of control over data entering the Data Processing Department as summarized in Table 3.4 on the following page.

TABLE 3.4  
 SAMPLE ERROR ANALYSIS OF  
 PROCESSED OUTPUT - GOGCWS

Failure Leading to Output Error	Meter Billing	Normal Payroll	Overtime Payroll
Input Data Control	.15%	1.9%	2.63%
System Design	.8		
Processing Control	.43		
Machine	.38	.1	.55
Total - All Failures	1.76%	2.0%	3.18%

Source: A.T. Kearney Analysis of Errors.

The data processing is carried out using informal documentation and a large amount of the work relies on the memories of the personnel directly involved. This practice could give rise to errors and also make the training period for new personnel unnecessarily long.

Certain personnel in GOGCWS have expressed the hope that more up-to-date computing equipment will prove to be beneficial in terms of reliability, accuracy and ability to meet future needs. This implies that they consider that the present data processing procedures do not fully meet the needs of GOGCWS.

At the present time the equipment is able to accommodate a modest increase in the processing load for existing applications. Saturation will be reached when maintenance work on the equipment starts to interfere seriously with the timing of the application work loads. It is estimated that an increase in load of between 15% and 25% could be accommodated before this type of problem will become serious.

### 3.1.4 Main Conclusions

The main conclusions regarding the data processing work currently carried out at GOGCWS are:

- It is necessary to replace the present equipment because of the increasing frequency of breakdowns and lack of skilled maintenance staff.
- The number of errors initially present in output information is large and the service to users must be considered poor.
- The age and lack of reliability of the present punched card processing equipment are not the major source of errors in output information.
- Except for meter billing, the major cause of errors is insufficient control over the data flowing in to, within and out of the Data Processing Department.
- The present punched card equipment has sufficient capacity for some increase in the volume of the data processing load but will be unable to accomodate any additional large or complex applications.
- The present informal methods of data and work specification will be totally inadequate for any additional applications or increases in existing applications.

### 3.2 DATA PROCESSING AT AWGA

Payroll processing and inventory accounting are carried out monthly at the main office, and customer billing operations are carried out at two-month intervals both at the main office and at branches.

AWGA uses several different types of equipment:

- NCR 500 (programmable) for Payroll and Inventory Accounting
- NCR 399 and 499 (programmable) for Customer Billing
- NCR 32 and Payroll machines for Customer Billing
- Addressograph metal plate machines for Customer Billing and Payroll.

The NCR 500 machine was installed at the main office in 1971 and AWGA is now experiencing significant problems of machine reliability and maintenance. Programming was carried out by one of the AWGA personnel.

Eight NCR 399 and 499 machines have been installed at the main office since June 1977 to overcome a six-month backlog of billing work. These new machines are working reasonably well at the present time. Initially four 399 machines were obtained, but when it was found that these were not able to cope with the work load four 499 machines were added. Programming of these machines was carried out by NCR, but the processing rate achieved has been disappointingly slow.

A large number of manual NCR 32 and Payroll machines are installed for billing, both at the main office and at branch offices. These machines are now generally almost 20 years old and have started to require substantial maintenance.

The Addressograph machines are used both in billing and payroll work. They, too, are generally about 20 years old, and maintenance is again a problem.

The processing equipment consists entirely of key-board machines, each requiring the presence of an operator. In excess of 70 operators are currently applied in carrying out the work and the total annual cost of processing is about LE 150,000 per year.

Details of the facilities, staffing and costs are shown in Exhibit 3.2.

### 3.2.1 Types and Volumes of Data Processing Work

Three types of work are carried out - Meter Billing and Accounting, Payroll and Inventory Accounting. The salient features are summarized below:

	<u>Using NCR 399 and 499 Machines</u>	<u>Using other Machines</u>
<u>Meter Billing</u>		
Number of locations to be billed	45,000	185,000
Billing frequency	Two-month intervals	Two-month intervals
	<u>Using NCR 500 Machines</u>	
<u>Payroll</u>		
Number of employees	3,300	
Payroll frequency	Monthly	
<u>Stock Accounting and Recording</u>		
Number of inventory items	30,000	
Number of movements per month	20,000	
Inventory accounting frequency	Monthly	

A summary of the major processing volumes for these procedures is given in Table 3.5 on the following page:

TABLE 3.5

MAJOR DATA PROCESSING VOLUMES - AWGA

<u>MAIN FILES</u>	<u>Records</u>
Customer Billing Data	230,000
Customer Accounts Data Ledgers	230,000
Payroll Ledgers	3,300
Inventory Ledgers	30,000
Total	<u>493,300</u>
<u>INPUT DATA - Monthly</u>	<u>Records</u>
Meter Readings	115,000
Payment Records	115,000
Departmental Wages Salary Data	3,300
Stores Transactions	20,000
. Total	<u>253,300</u>
<u>OUTPUT INFORMATION - Monthly</u>	<u>Print Lines</u>
Customer Bills	345,000
Billing Controls	115,000
Billing Summary	115,000
Payroll	3,300
Pay Envelopes	13,200
Cashier Sheets	3,300
Check Listing for Payroll	3,300
Payroll Analyses	6,600
Inventory Level Analysis	10,000
Movement Analysis	20,000
Inventory Account Analysis	20,000
Total	<u>654,700</u>

### 3.2.2 Cost of Applications

Analyses have been prepared showing how effort and costs are divided among the three basic types of applications. Because of the various approaches used in different locations, Customer Billing has been subdivided into three parts:

- Main Office billing using the NCR 399 and 499 machines.
- Main Office billing using the Payroll and NCR 32 machines.
- Branch billing using the Payroll and NCR 32 machines.

The results of these cost analyses in Table 3.6, on the following page, shows the effective cost per transaction for each of these applications. This summary shows that the cost of bill preparation using NCR 399 and 499 machines is high. An analysis of the processing on this equipment shown in Appendix 1 indicates that these high costs are unlikely to be reduced significantly unless the utilization of the equipment is increased substantially.

### 3.2.3 Service to Users

User departments at AWGA appear to be reasonably satisfied with the immediate situation regarding accuracy of processed work and punctuality of results. The backlog of meter billing at the main office has now been largely eliminated and the information provided is of acceptable accuracy.

TABLE 3.6

## MAIN COST ELEMENTS OF DATA PROCESSING OPERATIONS - AWGA

Detail Equipment	Total Costs Per Year  (LE)	Customer Billing			Payroll Main Office NCR 500 Cost/Yr(LE)	Stock Accounting Main Office NCR 500 Cost/Yr(LE)
		Main Office NCR 399 and 499 Cost/Yr(LE)	Main Office Payroll and NCR 32 Cost/Yr(LE)	Branches <sup>(1)</sup> Payroll and NCR 32 Cost/Yr(LE)		
Equipment Depreciation	56,683	55,600	(1)	(1)	455 <sup>(1)</sup>	628 <sup>(1)</sup>
Equipment Maintenance	60,141	18,273 (2)	9,174 (2)	30,196 (2)	1,540 (2)	958
Total Equipment Costs and Maintenance	116,824	73,873	9,174	30,196	1,995	1,586
Machine Operators	25,172	5,232 (2)	3,900 (2)	13,040 (2)	1,378 (2)	1,622
Total Cost of Machine Operations	141,996	79,105	13,074	43,236	3,373	3,208
Current Transactions per Year		270,000	270,000	840,000	42,000	240,000
Cost per Transaction (Piasters)		29.3	4.8	5.2	8	1.3

- Notes: (1) Equipment depreciation has been excluded because of obsolescence. Replacement equipment would involve considerable expenditure.
- (2) Addressograph equipment performs some minor functions for these procedures. The costs of equipment and operators for the machines specified in the Table have been augmented by the estimated costs attributable to the Addressograph work.

The costs of preparing bills using the NCR 399 and 499 machines apparently have not previously been analyzed and AWGA personnel have expressed dismay at the high costs. These are considered to be far too high and it is recognized that steps have to be taken to improve the economy of the billing operations.

The NCR 500 machine is starting to require progressively more maintenance and users are concerned about its ability to continue operating reliably. NCR states that servicing will become progressively more difficult and users are concerned that the payroll and inventory accounting service may be impaired unless steps are taken soon to provide other methods of processing.

The systems which are applied in the other billing procedures, which provide over 80% of the bills, rely on Payroll and NCR 32 machines which have largely come to the end of their economical working life. The annual maintenance cost of over LE 30,000 indicates that the machines have become unreliable, and users wish to apply alternative procedures as soon as possible to improve economy and also to enable improved management information to be speedily available after billing.

### 3.2.4 Main Conclusions

The main conclusions regarding the data processing work carried out at AWGA are:

- No significant improvement in service to users can be expected, using the present equipment.
- Service will deteriorate within three to five years unless steps are taken to apply improved equipment and procedures.
- At the present time AWGA is totally reliant on NCR for its data processing service.
- The latest NCR 399 and 499 equipment purchased by AWGA is expensive and is unlikely to be cost-effective for customer billing.
- It may be possible to improve the performance of the NCR 399 and 499 machines by applying a modified method of processing.
- Additional operators will be required for the NCR 399 and 499 machines to enable the machines to be used to their maximum capacity and hence to improve the economy of bill preparation.

### 3.3 DATA PROCESSING AT SCA

SCA has a data processing center in Ismailia, which serves all parts of the Authority. At the present time the center has a new ICL 2903 computer system and an old ICL 1902A system which is now almost redundant.

The 1902A was originally installed, on a rental basis, in 1969. The 2903 was installed in 1977 and now almost all the processing which was carried out on the 1902A has been transferred to the newer machine, which also is rented from ICL in Cairo. The 1902A equipment will be returned to ICL in the near future.

The maintenance service and assistance provided by ICL appears to be of a high standard, since SCA states that it is satisfied with this and with the performance of the new 2903 equipment.

The policy of SCA for data preparation and computer operating staff is to recruit untrained staff and to train them, first of all for data preparation and subsequently for computer operating. There is no real problem in finding staff for this type of work. Trainees are accepted for programming and they are expected to be able to develop their talents as system analysts within the SCA organization.

Ten different applications are processed in Ismailia, but only four of these are associated with the business of supplying water. These applications are shown in Table 3.7.

TABLE 3.7

COMPUTER PROCEDURES AT SCA

Procedures	Applied to		
	Water Supply Only	Water and Other	Other
Meter Billing and Accounting	X		
Payroll		X	
Inventory Accounting		X	
Navigation Statistics			X
Budgeting			X
Costing		X	
Contract Costing			X
Maintenance Costing			X
Canal Trade Statistics			X
Clothing Allowance			X

The work of water supply for SCA is largely decentralized, with administrative facilities being available at Ismailia, Port Said and Suez. All data to be processed on the computer is sent by road to Ismailia and the results are returned using the same method.

The payroll, inventory accounting and costing work is carried out using the same procedures for the water operations and the other operations of the Authority.

Both computer processing and data preparation facilities are available. Twenty-six personnel, including the manager and supervisors, operate on a two-shift basis.

The total annual cost of operating the installation is approximately LE 104,000 exclusive of cost of supplies.

Details of the facilities, staffing and costs are shown in Exhibit 3.3.

### 3.3.1 Types and Volumes of Data Processing Work

Four types of work are carried out for the water operations of SCA - Meter Billing and Accounting, Payroll, Stock Accounting and Costing:

#### - Meter Billing and Accounting

- . Number of locations to be billed 20,000
- . Billing frequency Three or six-month intervals

#### - Payrolls - Salaries and Wages (For all SCA)

- . Number of staff employees 2,000
- . Number of hourly-paid employees 11,000
- . Payroll frequency Monthly

#### - Inventory Accounting (For part of SCA)

- . Number of inventory movements per month 7,000
- . Inventory accounting frequency Monthly

#### - Costing

- . Number of material transactions per month 7,000
- . Number of labor transactions per month 40,000
- . Other transactions - per month 3,000
- . Cost procedure frequency Monthly

### 3.3.2 Costs of Applications

It has not been possible to carry out a fully detailed analysis of the application costs for the water operations since many of the computer activities involved are linked to the other work of the SCA. Nevertheless, estimates have been made of the proportions of the computer time which are applied at SCA to the four activities concerning water supply.

For analysis it has been assumed that the costs must be allocated to all the applications involved. The costs of programmers and systems analysts in these calculations have not been included. Also, since the cost of the data preparation personnel is small compared with the cost of the computer, any error in allocating data preparation costs to applications will also be small and, for practical purposes, can be excluded. Details of the analyses are shown in Tables 3.8 and 3.9 on the following page. Table 3.9 also shows the derived costs for transactions for each of the four applications concerning water supply.

### 3.3.3 Service to Users

User departments of SCA have not expressed criticism of the Data Processing Department. The stock accounting procedures will shortly be revised but this is no reflection on the performance.

During the course of investigations, it was noted that a great deal of work is being carried out in detailed checking of the computer output documents. Lack of control over input to the computer is a source of much additional unnecessary work.

TABLE 3.8

PROPORTION OF COMPUTER TIME  
SPENT ON APPLICATIONS - SCA

Application	Percent of Total
Meter Billing and Accounting	5%
Payroll	40
Inventory Accounting	20
Costing	15
Other SCA Activities	20
Total	100%

Source: Deputy Data Processing Manager

TABLE 3.9

COST ALLOCATIONS -SCA

Type of Cost	Billing and Accounting (5%)	Payroll (40%)	Inventory Accounting (20%)	Costing (15%)
Wages of Data Preparation Clerks and Computer Operators (LE 11,400)	570	4,560	2,280	1,710
Equipment Rental and Maintenance (LE 82,320)	4,116	32,928	16,464	12,348
Total	4,686	37,488	18,744	14,058
Current Transactions Per Year	66,000	156,000	84,000	600,000
Cost Per Transaction (Piasters)	7.1	24	22.3	2.3

In connection with payroll procedures, a comment was made that it is currently not possible to reconcile the wages paid against the hours worked, except by very laborious manual calculations. This indicates that some additional computer analyses could usefully be provided in this area. It is understood that wage procedures will soon be investigated in an attempt to eliminate this problem.

There appears to be scope for additional computer information and analyses which would eliminate the need for some existing clerical effort. One example was noted in which analyses of water consumption were being prepared manually from computer output documents.

#### 3.3.4 Comments and Conclusions

The relatively high processing costs for payroll and inventory accounting are not representative of the cost levels which could be achieved.

The Terms of Reference relate specifically to water and sewage operations and data was not available enabling the overall utilization of the computer to be verified independently of the data shown in Table 3.8. It is possible, therefore, that the proportions of computer time shown in the Table are subject to some error. There appears to be scope (See Paragraph 3.3.3.) for improving the processing speed, and lack of input control is a source of much additional work (and hence re-input of information). It is considered that these factors are the main causes of the high processing costs incurred.

Additional areas in which comment would be helpful are:

- Processing techniques.
- Accuracy of data preparation.

3.3.4.1 Processing techniques. The processing techniques applied to the computer operations appear to meet the fundamental need for reliability, which is of prime importance. There appears to be some opportunity for improving the speed of the procedures, but this will become important only when additional capacity is required.

3.3.4.2 Accuracy of data preparation. When prime data is being prepared the only control over information accuracy occurs when computer input data is being key-punched. In this situation it is not possible to ensure that data supplied to the computer will result in accurate output information. Additional control information, supplied by users, is required if the present detailed manual checking of output is to be eliminated.

#### 3.4 SUMMARY OF DATA PROCESSING WORK AND PROBLEM AREAS

The data processing work at present carried out by GOGCWS, AWGA and SCA is concerned entirely with clerical-type procedures involved in the day-to-day operations of the businesses. The methods applied are simple and the data processing equipment is used to reduce clerical effort. Any statistics or detailed analyses are usually prepared manually.

It has been found in almost all cases that input data provided for processing is unaccompanied by any form of control information. This makes it necessary to carry out detailed checks on the accuracy of processed output and results in delays, additional clerical effort and wastage of data processing effort.

At GOGCWS and AWGA the equipment used is, with some exceptions, obsolete and it is necessary to take urgent action for its replacement:

- At GOGCWS this urgency is increased by the fact that the equipment is now a source of inaccuracies in the output.
- Preliminary steps to overcome this situation at AWGA have been unsuccessful and have resulted in high processing costs.

SCA's new computer system uses basically the same processing methods which were applied with the previous computer. There appears to be some opportunity to improve the speed of processing.

DATA PROCESSING FACILITIES, STAFFING  
AND COSTS AT GOGCWS

Data Preparation Equipment - ICL

9 Card Punches  
5 Card Verifiers

Processing Equipment - ICL

2 Card Sorters  
2 Card Collators  
1 Interpreter  
2 Card Reproducers  
2 Calculating Punches  
2 Card Tabulators

Staffing

Data Preparation - 18 Punch Operators + 2 Supervisors  
Processing - 11 Machine Operators + 2 Supervisors  
Total - 33 Personnel

Shifts

8:30 a.m. - 1:30 p.m. and 2:00 p.m. - 7:00 p.m.  
6 days per week

Costs

LE per year

1. Data Preparation Personnel (Wages)

18 Punch Operators	4,380
2 Supervisors	893
Subtotal	5,273

2. Processing Personnel (Wages)

11 Machine Operators	2,739
2 Supervisors	1,316
Subtotal	4,055

3. Equipment Rental and Maintenance Charges

Punch and Verifier Rental	2,562
Processing Equipment Rental	13,808
Subtotal	16,370

DATA PROCESSING FACILITIES, STAFFING  
AND COSTS AT GOGCWS

	<u>LE per year</u>
4. <u>Supplies</u>	
Punched Cards, for Data Preparation	10,026
Stationery, for Processing	3,592
Ancillaries, for Processing	<u>314</u>
Subtotal	13,932
TOTAL	LE 39,630 per year

FUNCTIONAL COST ANALYSIS

<u>Feature</u>	<u>Data Preparation</u> LE	<u>Processing</u> LE	<u>Total Cost</u> LE	<u>Percent of Total</u>
Wages	5,273	4,055	9,328	24%
Equipment Rental and Maintenance	2,562	13,808	16,370	41
Supplies	<u>10,026</u>	<u>3,906</u>	<u>13,932</u>	<u>35</u>
Total	17,861	21,769	39,630	100%

DATA PROCESSING FACILITIES,  
STAFFING AND COSTS AT AWGA

PROCESSING EQUIPMENT

Main Office

Four NCR 399 - programmable  
 Four NCR 499 - programmable  
 One NCR 500 - programmable  
 Two NCR Payroll machines - manual  
 Four NCR 32 - manual  
 Six Addressograph machines

Branches

Seven NCR Payroll machines - manual  
 Ten NCR 32 - manual  
 Twelve Addressograph machines

STAFFING

Main Office

Machine Operations

	<u>Number of Personnel</u>
NCR 399 and 499 machines	17 including 2 supervisors
NCR 500 machines	7
NCR 32 and Payroll machines	9 including 1 supervisor
Addressograph machines	7 including 1 supervisor
Total	40

Ancillary Operations

For NCR 399 and 499 machine systems	8 checkers
For NCR 500 machine systems	14 preparers and checkers
For NCR 32 and Payroll machine systems	14 transcribing, checking bills and checking balances
Total	36

Branches

All machines 42 personnel

DATA PROCESSING FACILITIES,  
STAFFING AND COSTS AT AWGA

Shifts

NCR 399 and 499 systems: 8 a.m. - 2 p.m., 2 p.m. - 8 p.m.  
6 days per week

NCR 500 system: 8 a.m. - 2 p.m., 5 p.m. - 7 p.m.  
6 days per week

Branches: 8 a.m. - 2 p.m., 2 p.m. - 8 p.m.  
6 days per week

COSTS

Items	LE	LE per year
<u>1. Equipment</u>		
Four NCR 399 @ LE 27,900	111,600	22,320 (20% Depreciation/yr)
Four NCR 499 @ LE 41,600	166,400	33,280 (20% Depreciation/yr)
One NCR 500 @ LE 5,416	5,416	1,083(1)
Manual machines	-	- (1)
Total		56,683
<u>2. Programming Charges</u>		
NCR 399 and 499 programs	11,715	2,343 (20% Depreciation/yr)
<u>3. Data Processing Personnel Wages and Salaries</u>		
	<u>Direct</u>	<u>Ancillary Staff</u>
<u>Main Office</u>		
NCR 500 personnel	2,796	6,054
NCR 399 and 499 personnel	4,416	3,622
Main office manual systems	4,920	10,314
Total	12,132	19,990
<u>Branches</u>		
Manual systems	13,040	

DATA PROCESSING FACILITIES,  
STAFFING AND COSTS AT AWGA

<u>Items</u>	<u>LE</u>	<u>LE per year</u>
<b>4. <u>Equipment Maintenance</u></b>		
NCR 500, including spares		1,651
NCR 399		7,445
NCR 499		7,445
Manual billing machines and Addressographs		<u>43,600</u>
Total		60,141
<b>5. <u>Supplies and Ancillaries</u> (2)</b>		
Air Conditioning for 399 and 499	5,080	381 (7½% Depreciation per year)
Ledger Cards (Quantity 125,000)	16,250	3,250 (20% Depreciation per year)
Cassettes for 399 and 499 (Quantity 500)	4,543	909 (20% Depreciation per year)
Ledger Card Trays (Quantity 45)	4,032	806 (20% Depreciation per year)
Total	<u>29,905</u>	<u>5,346</u>

Notes: (1) The NCR 500 machine is now fully depreciated but a small amount has been included. The manual machines are now so old that even a small amount has not been included.

(2) Exclusive of normal stationery.

Source: AWGA Statistics and Accounts

DATA PROCESSING FACILITIES,  
STAFFING AND COSTS AT SCA

Data Preparation Equipment

8 Card Punches  
8 Direct Data Entry Terminals  
5 Card Verifiers

Processing Equipment

ICL 2903 Computer  
Main Memory - 28K words  
Disc Drives - 2 x 60 MC exchangeable  
Tape Drives - 2 x 40 KC/s  
Card Reader - 600 cpm  
Printer - 1500 lpm, 160 positions  
Console VDU and Slow Printer

Staffing

Data Preparation - 15 key punch operators  
Computer Operators - 4, including 2 shift leaders  
Programmers and System Analysts - 7, including DP  
deputy manager  
Total 26 Personnel

Shifts

8 a.m. - 2 p.m. and 5 p.m. - 12 p.m., 5 days per week  
8 a.m. - 2 p.m., 1 day per week

<u>Costs</u>	<u>Approximate LE per year</u>
1. <u>Data Preparation Personnel</u>	
15 @ LE 50 per month (average)	9,000
2. <u>Computer Operators</u>	
4 @ LE 50 per month (average)	2,400
3. <u>Programmers and System Analysts</u>	
7 @ LE 120 per month (average)	10,080
4. <u>Equipment and Maintenance Charges</u>	
LE 5,560 per month (Computer)	66,720
13 Punches and Verifiers @ LE 100 per month	15,600
Total	<u>103,800</u>

FUNCTIONAL COST ANALYSIS  
(LE)

Feature	Data Preparation	Processing	Programming and System Analysis	Total
Wages	9,000	2,400	10,080	21,480
Equipment Rental and Maintenance	15,600	66,720	-	82,320
Total	24,600	69,120	10,080	103,800

#### 4.0 POTENTIAL AREAS FOR AUTOMATION

During the next two or three years it is likely that Egypt will receive a substantial amount of money from overseas, designed to provide assistance for the Egyptian economy. It is also likely that the water and sewerage authorities will receive a sizeable share of this money to enable them to provide improved services to the Egyptian population.

The manner in which the water and sewerage authorities will spend the money may vary in detail, but in principle it will consist of:

- Enabling a larger proportion of the population to be supplied with water and sewerage facilities, by designing, constructing and operating new plants and pipe networks.
- Providing a better service to existing consumers, by ensuring that plants and networks operate more reliably. This will involve a substantial program of maintenance and renovation of facilities.

It is important that these construction and maintenance projects are handled as efficiently as possible, to ensure really effective use of the available money.

Once a larger number of consumers is being serviced by the authorities there will be a larger work load in administering the customers, the networks and the treatment plants.

Table 4.1 summarizes the main managerial responses which are necessary to meet efficiently the future operational needs.

TABLE 4.1

REQUIRED MANAGEMENT  
RESPONSE TO EXTENDED OPERATIONS

Operational Needs	Management Response Required
Design and construction of new facilities	<ul style="list-style-type: none"> <li>. Improved project planning, reporting and control</li> <li>. Improved materials management</li> </ul>
Maintenance and renovation of existing facilities	<ul style="list-style-type: none"> <li>. Improved work planning, reporting and control</li> <li>. Improved materials management</li> </ul>
Increased administrative work load	<ul style="list-style-type: none"> <li>. Improved effectiveness of routine administrative procedures</li> <li>. Improved control and reporting</li> </ul>

These required management responses have been analyzed further as shown in Table 4.2. This shows in more detail the implications involved, in terms of the specific actions which should be taken by the higher management of the authorities.

TABLE 4.2

ACTIONS TO BE TAKEN BY HIGHER MANAGEMENT

Required Management Responses To Operational Needs	Procedures Involved
Improved project and maintenance work planning, control and reporting	<ul style="list-style-type: none"> <li>- Preparing detailed plans for:               <ul style="list-style-type: none"> <li>. Labor</li> <li>. Materials</li> <li>. Cost</li> <li>. Time</li> </ul> </li> <li>- Detailed labor and material reporting against plans</li> </ul>
Improved administrative control and reporting	<ul style="list-style-type: none"> <li>- Labor time-reporting</li> <li>- Departmental and sectional Costing</li> </ul>
Improved materials and assets management	<ul style="list-style-type: none"> <li>- Inventory control</li> <li>- Asset control</li> <li>- Purchase control</li> </ul>
Improved routine administrative procedures	<ul style="list-style-type: none"> <li>- Customer billing and accounting</li> <li>- Payroll</li> </ul>

#### 4.1 COMPUTER APPLICATIONS

The manner in which data processing equipment could be applied to assist in meeting these requirements has been considered. It is concluded that automated methods could, in principle, be applied in all areas except that of preparing detailed plans. Although planning and control techniques such as PERT are available for use on computers, this is only fully effective when the complexity and size of an individual project are very large, which is unlikely in the normal work of the authorities. Experience has shown that CPM networks of less than about 300 activities can be most effectively prepared and updated manually. There is no definite requirement at the authorities for larger CPM networks. Accordingly all detailed planning work should continue to be carried out manually.

Data processing equipment can only be applied effectively if the volumes of data to be processed are large or if the calculations to be carried out on data would otherwise involve a great deal of skilled work. None of the potential applications involves extensive and complex calculations, but the data volumes may be large enough to warrant using automated methods.

Among the technical applications which have been considered are:

- Monitoring current operations      This would require complex sensing equipment such as for measuring liquid height and chemical constitution, and would be uneconomical to install and difficult to operate in comparison with manual procedures. Existing equipment carrying out this function has deteriorated and ceased to work through lack of maintenance.

- Numerical loading and scheduling  
At the present time this would not be possible because of lack of procedures. (See Procedures and Methods Report.) Manual procedures should be instituted and continued until a system has been established. At that time computer studies could be initiated.
- Operational designs  
The engineering design work presently carried out can be done by skilled designers using desk calculators. These infrequent calculations could be facilitated through the use of a computer.
- Statistical analyses and correlations  
At the present time none of the statistical analyses and correlations in the water and sewerage operations are sufficiently complex or frequently used to warrant the use of a computer. As the various reports recommended in the Management Information Report are introduced, the benefits of using a computer would increase.
- Model design for manpower planning, material usage  
The same remarks apply as for statistical analyses and correlations.

The normal life of a computing system is five to ten years. During this period it is invariably found that applications change significantly and that technological advances make it desirable to install new and more efficient equipment. One of the main objectives of this Study is to determine how to

introduce improved systems, and any analysis based on likely conditions 20 years from now would be subject to extreme error. If suitable computer systems could be introduced in two or three years then in 1987 the systems would have been operational for about six years, which is a suitably long introductory time-span. Accordingly estimates of the information volumes which would apply in 1987 have been made. This is the best possible statement of computing requirements for the purpose of making a practical, economical and effective computer evaluation with the technology currently available.

Exhibit 4.1 shows the current volumes and likely volumes by 1987 of the potential applications for each authority. From this information it may be concluded that:

- Asset control and accounting should continue to be carried out manually. The effort involved in maintaining control over assets and carrying out the depreciation calculations is small and does not warrant specially-prepared computer programs and data files.
- Although details of purchases could be entered into a computerized accounting system at some future date, at the present time these should be kept on a manual basis. The volume of orders is not very large and appropriate manual methods would be perfectly adequate.
- GOSSD only provides bills for customers when a sewer connection is made. With only 170 connections per month at the present time, manual procedures should be retained for this aspect of the work of GOSSD.

The procedures which could be considered as general candidates for automation are:

- Customer billing and accounting for water authorities.
- Payroll.
- Inventory control.
- Detailed cost and financial accounting.
- Cost reporting against plans and budgets.

The relationships of these elements in the overall systems are shown schematically in Exhibit 4.2. This shows that there is inter-dependence between certain of these elements, which must be taken into account when deciding on the best sequence in which to introduce improved procedures.

It would, of course, be possible to use a computer for technical or scientific programs but the computer processing time required would be small and the programming time relatively long. Computers capable of carrying out the proposed commercial procedures would be able to carry out this type of work within the spare time available.

#### 4.2 NATURE OF THE APPLICATIONS

The principal applications can be automated in various ways. It is clear that a batch process would be eminently satisfactory, since the majority of the outputs are required on a regular periodic basis.

In order to avoid unnecessary peak volumes of input data the procedures should enable data preparation to be carried out continuously. Batches of input data should be supplied by users at weekly intervals, if possible, so that a relatively smooth flow of data is maintained. In addition, to avoid unnecessarily high volumes of input data being stored on computer files awaiting processing, the processing work should be carried out relatively frequently. It is likely that the various types of processing can be carried out at standard intervals of one week, two weeks and one month, with additional processing runs being carried out as necessary for special procedures, urgent validation checks and other purposes.

To provide reasoned estimates of the data volumes to be processed by computer systems and hence to enable an estimate to be prepared of the equipment sizes, some conceptual outlines of computer procedures which would fulfill the needs of the authorities are shown in Appendix 2 together with:

- A chart showing processing frequencies which could be applied.
- A summary of the data volumes for input, output and file storage.

Details of the input and output information loads which will be incurred are shown in Table 4.3. This shows that:

- GOGCWS and AWGA need the largest input and output capabilities, due completely to the customer billing and accounting procedures.
- GOGCWS and GOSSD both need substantial capabilities to carry out the payroll and time allocation procedures.

- A relatively small amount of data preparation effort should be devoted to inventory control and accounting, but GOGCWS has to be able to accommodate a significant peak output load for this application.
- In all cases the data preparation needs for general accounting are negligible, since information from other computer procedures will automatically be provided. The output load will nevertheless be significant for GOGCWS and for GOSSD.
- Overall GOGCWS will have to be able to handle the largest volumes of information. The information load of SCA (water) is small.

TABLE 4.3

DATA PREPARATION EFFORT AND PRINTING  
CAPABILITY REQUIRED AT CURRENT VOLUMES

Application	GOGCWS	AWGA	SCA (Water)	GOSSD
<u>Customer Billing and Accounting</u>				
Data preparation operators	7.2	6.6	0.5	-
Maximum lines of output per week	303,000	300,000	18,000	-
<u>Payroll and Time Allocations</u>				
Data preparation operators	4.8	1.8	0.9	5.2
Maximum lines of output per week	202,000	79,000	41,000	210,000
<u>Inventory Control and Accounting</u>				
Data preparation operators	1.9	1.1	1.1	1.2
Maximum lines of output per week	88,000	38,000	37,000	37,000
<u>General Accounting</u>				
Data preparation operators	Negligible	Negligible	Negligible	Negligible
Maximum lines of output per week	131,000	70,000	51,000	137,000
<u>All Applications</u>				
Data preparation operators	14	10	3	7
Maximum lines of output per week	724,000	487,000	147,000	384,000

### 4.3 BENEFITS TO BE OBTAINED

Two main types of benefit can be obtained through using computer procedures. These are:

- Improved information for management.
- Reduction of clerical staff.

#### 4.3.1 Improved Information for Management

The management information available from the selected applications will be improved substantially in terms of level of details, accuracy and timeliness:

- In customer billing and accounting, bills and consumption statistics will be available sooner, and statistics will be available in more detail.
- Allocation of labor to cost and project accounts will enable much more reliable and detailed costing information to be prepared.
- Improved inventory control procedures will provide timely information which could result in more consistent and effective inventory policies, leading to improved service from stores and possibly a reduction in inventory costs.
- In the area of cost accounting and reporting, more comprehensive and detailed reports will enable managers to monitor performance more effectively and enable effort to be allocated to those areas needing it most.

### 4.3.2 Reduction of Clerical Staff

The high level of accuracy available by using well-implemented computer systems will greatly reduce the amount of effort required in checking documentation.

The fact that the processing can be automatic will reduce the number of clerical staff carrying out simple calculations to prepare data for processing. In areas in which processing will be introduced the existing clerical staff requirement will be reduced.

Table 4.4 shows estimates of the numbers of staff in each of the authorities that could be made available for training and reassignment by the introduction of the proposed computer procedures. Current data preparation and processing staff have been included because new procedures will be required. Additional details are provided in Appendix 3.

TABLE 4.4

#### ESTIMATES OF STAFF AVAILABLE FOR REASSIGNMENT

Staff	GOGCWS	AWGA	GOSSD
Clerical staff superseded by proposed computer applications	184	127	180
Current Data Preparation and Processing Staff	33	82	-
Total	217	209	180
Annual Cost (LE) @ LE 30 per month	78,120	75,240	64,800

#### 4.4 INTRODUCTION OF COMPUTER PROCEDURES

It is desirable to introduce first the most immediately beneficial procedures and then, when these are operating satisfactorily, to add subsequent procedures to the work load. It would appear reasonable, if no internal constraints prevailed, to adopt the following sequence for the introduction of improved data processing procedures:

- Customer water billing and accounting. For the water companies it is most important to ensure that their income is reliably maintained. Some of the clerical staff currently engaged in checking and preparing statistics could be assigned to more useful work.
- Payroll and labor cost allocations. The present payroll procedures are labor intensive and a reliable payroll system is of great importance in any organization. Labor cost allocation procedures are required if effective cost accounting is to be carried out. Clerical staff could be reassigned to more useful work.
- Materials movements and accounting. Improved movement recording will result in more reliable stores performance and may also result in a reduction of costs. The normal work of materials accounting will be reduced. Clerical staff could be reassigned to more useful work.
- Inventory control. Improved inventory control will result in more reliable stores performance and may also result in a reduction of costs.
- Cost accounting. Improved cost accounting will highlight areas of high expenditure and will assist in making internal economies. From this information cost reports against plans and budgets could readily be prepared manually. Some clerical staff could be redeployed to more useful work.
- External payment procedures. This will assist in maintaining reliable accounts.
- Cost reporting against plans and budgets. More comprehensive and detailed reports will enable managers to monitor performance more effectively and will assist in the allocation of effort to those areas needing it most.

ESTIMATES OF DATA VOLUMES

These estimates have been prepared from information supplied by the authorities, from observations and projections, and from the estimates of other consultants.

It has not been possible at this time to make precise estimates of all the volumes associated with the water operations of SCA. Forecasts have been made only for the customer billing procedures. In all the other areas of SCA the work of water supply is almost totally merged with other activities. In this situation the estimates for SCA water supply are based on judgement in comparison with GOGCWS and AWGA.

The information currently available from GOSSD concerning inventory cannot readily be converted to the detail required to make reliable estimates for computer sizing. This has been discussed with GOSSD and it is agreed that the inventory data allowed for should be sufficient to enable the procedures to be carried out in practice.

ESTIMATES OF DATA VOLUMES

<u>Information Details</u>	<u>GOGCWS</u>		<u>AWGA</u>		<u>SCA Water</u>		<u>GOSSD</u>	
	<u>1978/79</u>	<u>1987</u>	<u>1978/79</u>	<u>1987</u>	<u>1978/79</u>	<u>1987</u>	<u>1978/79</u>	<u>1987</u>
<u>Customer Billing</u>								
Number of Connections <sup>(1)</sup>	232,000	320,000	230,000	312,000	20,000	30,600	-	-
New Connections/Month <sup>(1)</sup>	1,050	1,100	600	700	40	110	170	200 <sup>(5)</sup>
Repairs/Month <sup>(2)</sup>	1,800	2,500	-	-	360	500	-	-
Water Bills/Month <sup>(3)</sup>	116,000	160,000	115,000	156,000	6,680	10,200	-	-
Bills Outstanding-Maximum <sup>(4)</sup>	464,000	640,000	460,000	624,000	40,000	61,200	-	-
Cut-Offs and Removals/Month (Allow 10% of bills)	11,600	16,000	11,500	15,600	668	1,020	-	-

- Notes: (1) Based on population projections and industry estimates.  
 (2) Based on proportion of connections.  
 (3) Based on connections and billing period.  
 (4) Two bills per connection.  
 (5) Estimated from GOGCWS and AWGA volumes.

ESTIMATES OF DATA VOLUMES

<u>Information Details</u>	<u>GOGCWS</u>		<u>AWGA</u>		<u>SCA Water</u>		<u>GOSSD</u>	
	<u>1978/79</u>	<u>1987</u>	<u>1978/79</u>	<u>1987</u>	<u>1978/79</u>	<u>1987</u>	<u>1978/79</u>	<u>1987</u>
<u>Inventory</u>								
Total Different Types of Items <sup>(1)</sup>	82,000	82,000	30,000	30,000	30,000 <sup>(3)</sup>	30,000 <sup>(3)</sup>	30,000	30,000
Item Withdrawals Per Month <sup>(2)</sup>	17,000	23,500	18,000	23,400	18,000 <sup>(3)</sup>	23,400 <sup>(3)</sup>	18,000	24,400
<u>Purchases</u>								
Items Received Per Month	5,450 <sup>(4)</sup>	5,450	2,000	2,000	1,000	1,000	1,000	1,000

- Notes: (1) Estimates of current volumes. Forecasts assume rational inventory control procedures.  
 (2) Estimated proportional to increase in numbers of connections.  
 (3) Estimated at same level as AWGA.  
 (4) Estimates based on following turnover rates of inventory:  
     10% @ 3 turnovers/year  
     50% @ 1 turnover/year

ESTIMATES OF DATA VOLUMES

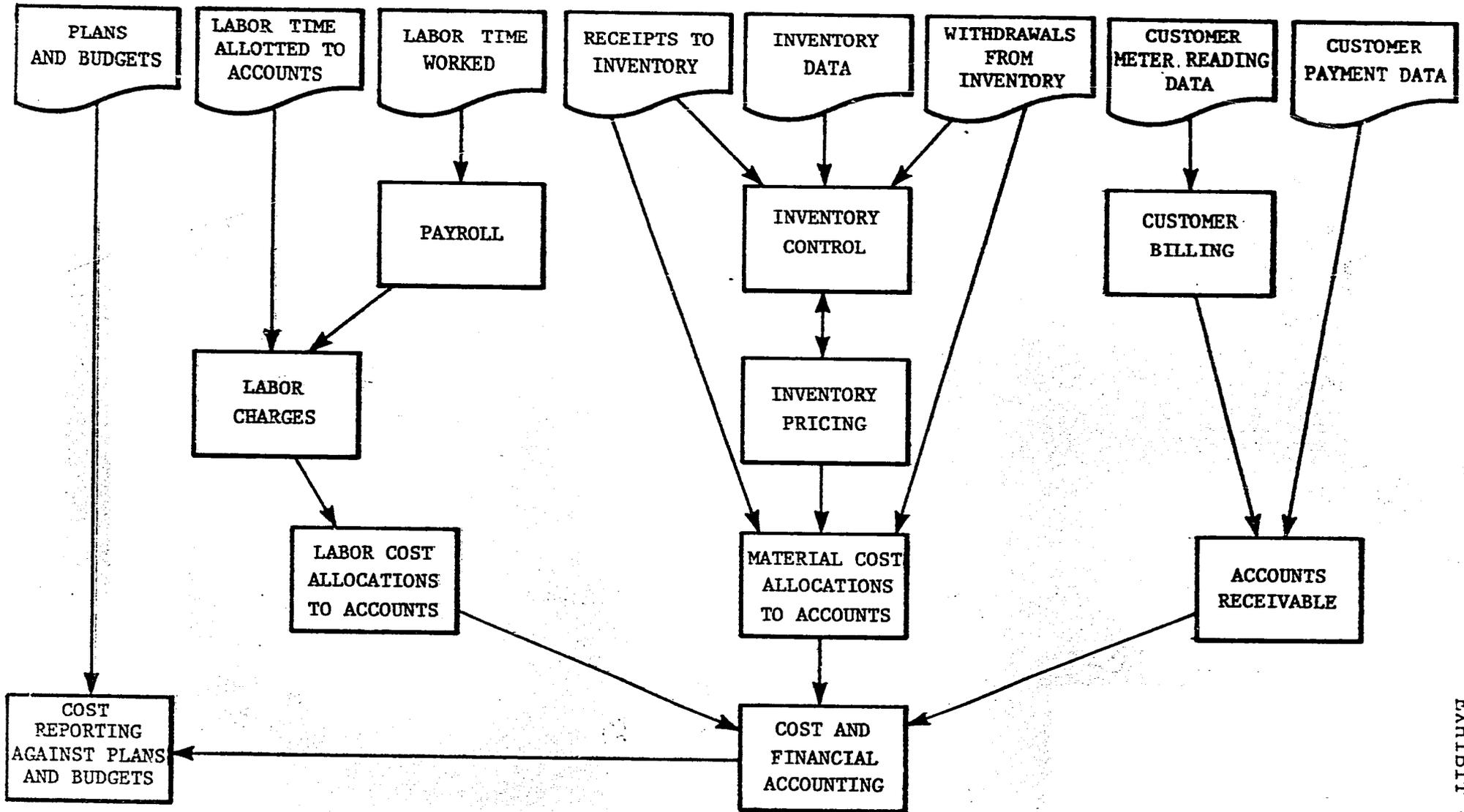
<u>Information Details</u>	<u>GOGCWS</u>		<u>AWGA</u>		<u>SCA Water</u>		<u>GOSSD</u>	
	<u>1978/79</u>	<u>1987</u>	<u>1978/79</u>	<u>1987</u>	<u>1978/79</u>	<u>1987</u>	<u>1978/79</u>	<u>1987</u>
<u>Monthly Payroll</u>								
Number of Employees <sup>(1)</sup>	8,500	9,350	3,300	3,630	1,700 <sup>(3)</sup>	1,870	8,850	9,735
Labor Accounts Charged/Month	4	4	4	4	4	4	4	4
<u>Accounting Procedures</u>								
<u>Transactions Per Month</u>								
Inventory <sup>(2)</sup>	17,000	23,500	18,000	23,400	18,000	23,400	18,000	23,400
Labor <sup>(2)</sup>	34,000	37,400	13,200	14,520	6,800	7,480	35,400	38,940
Purchases <sup>(2)</sup>	5,450	5,450	2,000	2,000	1,000	1,000	1,000	1,000
<u>Physical Assets</u>								
Number of Identified Assets—Approximate	500,000		200,000		250,000		200,000	

Notes: (1) Allowance of 10% increase in staff by 1987.

(2) Based on previous data in this Exhibit.

(3) Estimated at half AWGA staffing level.

RELATIONSHIPS OF SYSTEM ELEMENTS



## 5.0 NATURE OF COMPUTING SERVICES TO BE PROVIDED

The objective of data processing is to provide a service to the end user. Three main needs have to be fulfilled, namely:

- Carrying out the actual data processing work.
- Preparing and testing new computer programs and changes to existing programs.
- Providing advice regarding economical and useful applications of data processing.

Each of these needs involves different aspects of service. The nature of the computing services to be provided is discussed under the following headings:

- Basic Needs of the Authorities
- Constraints
- Criteria for Evaluation
- Computing Facilities
- Programs and Program Changes
- Advisory Services
- Rental of Excess Computer Time
- Rent or Buy Arrangements

### 5.1 BASIC NEEDS OF THE AUTHORITIES

In top management terms the basic needs of the authorities for data processing are:

- To have a good and reliable service available on a continuing basis for processing data.
- To be able to meet new and changed processing requirements reliably and speedily.
- To be able to obtain good advice concerning the most suitable data processing strategy to adopt in changing circumstances.

The computing service covers the two associated aspects of data preparation and the actual processing of the data, and is concerned with both equipment and personnel. The service may or may not be under the direct control of the authority using the results of the processing, and the users would require:

- Accuracy.
- Reliability of promised dates.
- A speedy processing service.
- Economy.
- Likely continuity of service.

New or changed processing requirements mean that computer programs have to be written or modified. This is the work of systems analysts and programmers who may or may not be working in the organization providing the computing service. The users need:

- Accuracy and thoroughness of work resulting in reliable computer operations.
- Reliability of promised program delivery dates.
- Speed of response to requests.
- Economy.

Good data processing advice is often difficult to obtain, and it is only too easy to be persuaded that technology will solve business problems which may arise. In a problem situation which may involve considering high capital expenditure, it is most important to obtain good advice which relates computer experience to business experience and which is absolutely impartial.

## 5.2 CONSTRAINTS

When considering the nature of computing methods to be applied, four types of constraints should be taken into account:

- Locations and communications
- Power supplies
- Availability of skilled data processing personnel
- Availability of maintenance and back-up facilities

### 5.2.1 Locations and Communications

The major offices of the Authorities are located in Cairo, Suez, Ismailia, Port Said and Alexandria. The main concentrations of effort in the Authorities are:

- GOGCWS - Mainly in Cairo, but extending to Helwan and Heliopolis.
- AWGA - mainly in the Alexandria area, but water supplies and provided for the Western Desert regions and portions of the Beheira Governorate.
- GOSSD - Covers all of Egypt, but the major concentrations are in Cairo and Alexandria.
- SCA - Main locations are Ismailia, Port Said and Alexandria.

5.2.1.1 Road system. The road distances between the major office locations are given in Table 5.1 on the following page, showing that the greatest distance between the offices is 359 kilometers, between Alexandria and Suez. Generally an office can be reached from any other in a day's drive.

TABLE 5.1  
DISTANCES BETWEEN MAJOR OFFICE LOCATIONS  
 (KILOMETERS)

From \ To	Alexandria	Port Said	Ismailia	Suez	Cairo
Cairo	225	200	120	134	
Suez	359	168	88		
Ismailia	280	80			
Port Said	248				
Alexandria					

5.2.1.2 Rail. Rail connections are available between all the major office locations, though to travel between Alexandria and Port Said it is necessary to pass through Ismailia.

5.2.1.3 Telephones. Telephone communications within Egypt are sparse and not always reliable at the present time, though plans are being made to correct the situation. Any data processing system which relies on telephone links is unlikely to prove effective, at least for the next few years.

5.2.1.4 General. Although it is governmental policy that decentralization should be promoted, it is important to bear in mind the fact that data processing machines need regular and careful maintenance and that their operators must be highly skilled. Branches which are at an appreciable distance from a center of population are unlikely to be able to use electronic data processing equipment effectively because of inadequate maintenance back-up and a lack of skilled staff.

### 5.2.2 Power Supplies

Failures in the supply of electricity, as a complete failure or as a significant voltage change, are likely to occur at all locations from time to time. Rural areas are more likely to be affected than urban areas. This implies that:

- Special precautions will be necessary to enable computer processing to be restarted reliably after a power failure.
- Remote branch offices may be unable to apply electronic equipment effectively.

Standby electrical generating capacity should only be considered where high penalties will quickly be incurred when a power failure occurs. At the present time power failures are insufficiently protracted to result in such penalties. An alternative approach which could be used is to obtain two separate power supplies from separate electricity areas. This is not uncommon in Cairo.

It has become of lesser importance to ensure that a constant temperature is maintained in the computer room, and hence failure of power for air conditioning is similarly less important. Modern solid state computing technology is well able to accommodate such temporary failures as are likely to occur.

### 5.2.3 Availability of Skilled Manpower

Any data processing equipment requires the use of trained personnel and more complex equipment requires more highly-trained personnel. Even a small computer installation carrying out several different types of work requires:

- A data processing manager.
- Normally at least two computer operators.
- A data controller.

Additionally, if programs are to be written or modified within the installation it is necessary to have at least:

- A systems analyst.
- One or more programmers.

The standard salary scales in operation at the authorities present a significant obstacle to hiring staff suitable for operating a computer installation within the organization. Further, it is extremely unlikely that highly skilled computer staff would remain with the organization when the private sector offers much greater salaries and opportunities for advancement.

It is not possible to carry out reliable computer processing of several different applications with a staff composed entirely of personnel who have had training courses only. It is absolutely vital that skilled and experienced personnel should be present if the problems which are certain to arise during operations are to be overcome quickly and reliably.

#### 5.2.4 Availability of Maintenance and Back-up Facilities

Any type of equipment requires reliable maintenance. For computers this is normally provided in two ways:

- Regular weekly visits from an engineer to carry out routine adjustments and servicing.
- Speedy service to repair equipment after a breakdown has occurred. A computer should not be out of action for more than one or two consecutive days. Otherwise the business of the organization may be jeopardized.

It may also be possible to use the services of a manufacturer's engineer, resident in the computer installation.

The factors involved in ensuring adequate maintenance services are:

- Availability of skilled manufacturer-trained staff.
- Adequate supplies of spare parts.
- Good communications and speedy access between the installation and the maintenance center.

If a major breakdown occurs it is desirable to be able to use another similar installation in the same area. This would normally be arranged by personal contact between data processing managers, assisted by the manufacturer's local staff.

### 5.3 CRITERIA FOR EVALUATION

The main criteria for evaluation are related to the basic needs of the Authorities and are summarized in Table 5.2 below:

TABLE 5.2  
EVALUATION CRITERIA

Type of Service Required	Main Evaluation Criteria
Carrying out data processing work	Accuracy of output information  Reliability of the planned timescale of processing operations  Speed of response to data availability  Economy  Likely continuity of service
Preparing and testing new programs, and carrying out program changes	Proven accuracy and modularity of programming, and documentation quality  Reliability of the planned timescale for introduction of operational programs  Speed of response to requests for new programs or program changes  Economy
Advice on data processing applications	Experience  Impartiality

#### 5.4 COMPUTER FACILITIES

The features for which options have been considered are:

- Communications.
- Computer locations.
- Data preparation:
  - . Media and equipment.
  - . Locations.
- Computer operations staff.
- Ownership of computer facilities.
- Control and management of computing operations.
- Use of other equipment at branches.

Each of these features has been considered separately, and the various options available and their associated problems and benefits have been outlined. It has proved possible to eliminate some of the options by using the basic criteria of practicality and effectiveness. A list of the features and the options considered is shown in Table 5.3 on the following page.

A second stage of evaluation has also been carried out. In this evaluation the options remaining open have been reconsidered in combination and further judgements have been applied. In this way it has proved possible to present reasoned analyses concerning the benefits and drawbacks of various arrangements and to make a recommendation concerning the best computing strategy to adopt.

TABLE 5.3

COMPUTING FACILITIES FEATURES AND OPTIONS

Features	Options Considered			
Communications	Physical transportation		Telecommunications	
Computer Locations	External location	Authority main office		
Data Preparation:  -Locations  -Media  -Equipment Types	External computer locations	Authority main office	Authority branches	
	Punched cards	Magnetic media		
	Simple	With print facility	With checking facility	With mini-computer facility
Computer Operations Staff	Authority trainees	Employees with special payment arrangements	External personnel	External management company
Ownership of the Computer Facilities	Government	Jointly by authorities	Authority	External
Control and Management of Computer Operations	Authority employees	External personnel	External facilities management company	
Use of Other Equipment at Branches	No other equipment	Simple equipment	Small computer	

#### 5.4.1 Evaluation of Facilities, Features and Options

A detailed analysis has been made of the various options, problems and benefits associated with each of the features. In this way it has proved possible to eliminate some options and to arrive at a firm conclusion about how best to provide a certain feature:

- Communications. Use physical transportation when communication is necessary.
- Data preparation. This should take place at main offices and large branches, using magnetic media and being carried out on equipment with checking and printing facilities.
- Use of branch computing equipment. This is not worthwhile if full-scale computing facilities are readily available.

Details of these analyses are shown in Appendix 4.

In considering the computer locations, staffing, ownership and management it has not proved possible to use such straightforward judgments in selecting the best methods. Options are still open as shown in Exhibit 5.1.

#### 5.4.2 Computer Location and Ownership

The two features of location and ownership are interrelated. As shown in Table 5.4, certain combinations are considered not feasible, others extremely feasible and the remainder feasible but with special problems.

TABLE 5.4

COMBINATIONS OF COMPUTER LOCATIONS AND OWNERSHIP

Location	Ownership		
	Government	Jointly by Authorities	By Individual Authorities
External Location	<u>Feasible</u> Problems of control by the authorities are likely to occur.	<u>Extremely feasible</u>	<u>Not feasible</u> <u>Impractical</u>
At Each Authority	<u>Not feasible</u> Funds very unlikely to be made available by Government.	<u>Not feasible</u> Funds very unlikely to be made available by authorities.	<u>Extremely feasible</u>

The main possibilities for selection, those considered extremely feasible, are:

- A computer center jointly-owned by authorities.
- Computer centers sited at each authority office, and owned by each authority.

It might, also, be possible to set up a government-owned center with special arrangements enabling the authorities to exercise adequate control.

#### 5.4.3 Computer Staffing and Management

The two features of staffing and management of the computer installation are to some extent interrelated. The various possible combinations are shown in Table 5.5. Only one of these combinations is clearly not feasible, that of the directly-employed manager supervising facilities management staff.

Any of the remaining combinations could, in principle, be applied but it would be undesirable to engage an external facilities manager to supervise operational staff engaged by the authority under separate and independent contractual arrangements.

TABLE 5.5  
COMBINATIONS OF COMPUTER STAFFING AND MANAGEMENT

Management	Staffing		
	Employees With Special Pay Arrangements	External Contract	Facilities Management Personnel
Direct Employment of Specially-Paid Data Processing Manager	<u>Feasible</u> -Relatively inexpensive.	<u>Feasible</u> -Fairly high cost. -Possible problems of staff continuity.	<u>Not feasible</u>
Data Processing Manager Supplied under Facilities Management Contract	<u>Feasible</u> -Fairly high cost. -Possible lack of managerial continuity in the long term.	<u>Feasible, but not desirable</u> -High cost. -Possible lack of continuity in the long term. -Potential contractual problems unless all contracts are acceptable to facilities management company.	<u>Feasible</u> -High cost. -Possible lack of continuity in the long term.

Assuming that the quality of the directly-employed manager and the externally-supplied manager would be comparable then it is preferable to use a directly-employed manager for potential long-term continuity. It is possible, though, that a company offering facilities management services would have skilled staff available of a quality higher than normally obtainable.

During the start-up phase of any installation it is vital that a great deal of expert attention can be made available. Subsequently, when normal operations have been established and the installation is running smoothly, the data processing skills of the manager would become less important. Consideration should therefore be given to adopting a facilities management approach during the first two to four years of operation and during this period to engage and train a permanent directly-employed manager and operating staff.

#### 5.4.4 The Basic Alternatives

The figures shown in Exhibits 5.2 and 5.3 illustrate the arrangements using either an external computer or a computer at each authority's main office.

In purely physical terms the use of an external computer means an additional trip for data communication. In managerial terms there are differences in economy of operation, the control available to authorities and the ease with which effective control can be exercised. Exhibit 5.4 presents a summary evaluation of all the features associated with these two basic alternatives.

#### 5.4.5 Practical Considerations

Up to this point no account has been taken of the facts that:

- At GOGCWS and AWGA it is necessary to take action as soon as possible to improve the present data processing situation.
- The magnitude of the needs for computing services varies substantially between the authorities.

- The water operations of SCA form only a small part of its total work and data processing is already being carried out on a new computer in Ismailia.
- The main offices of GOGCWS and GOSSD are in Cairo, which is a significant distance from AWGA in Alexandria and from SCA in Ismailia, Suez and Port Said.
- It has been recommended in the Organizational Environment and Structure Report that separate sewerage organizations should be set up in Cairo and Alexandria.

GOGCWS and AWGA are the two authorities most in need of improved computing facilities, because their data volumes are high and their present methods are in need of improvement. At GOSSD the procedures could be improved by applying computer methods but this is of lower priority compared with GOGCWS and AWGA.

The computing facilities in use at SCA are meeting the basic needs of its water supply operation. It would be justifiable to change to other facilities only if real benefits are to be obtained. Accordingly the initial stages of implementation and operations of new systems should be conducted by GOGCWS, AWGA and GOSSD alone. If, at some future time, SCA (water) wishes to apply methods superior to those which may be available from their parent organization's computer center, this may then be investigated and appropriate action taken.

Any centralized computing facility should be located in or very near Cairo, since the main offices of GOGCWS and GOSSD are in Cairo and also since skilled staff will be more readily available there. SCA is able to provide a reliable data transportation service between Ismailia and the two towns of

Suez and Fort Said, and there is no reason to assume that a similar service could not be provided to an external computing facility in Cairo for GOGCWS, GOSSD and AWGA.

Since the main offices of GOGCWS and GOSSD are both located in Cairo it is reasonable to consider an arrangement such that if AWGA has an independent computer in Alexandria, GOGCWS and GOSSD would share a computer facility in Cairo.

If GOSSD were to be split so that sewerage authorities are formed in Cairo and Alexandria then shared computing arrangements can be considered in each city for the sewerage authority and the water authority.

Overall, the various computing facilities to be considered are those for:

- GOGCWS
- AWGA
- GOSSD
- GOGCWS and GOSSD
- GOGCWS and GOSSD (Cairo)
- AWGA and GOSSD (Alexandria)
- GOGCWS, AWGA and GOSSD
- GOGCWS, AWGA, GOSSD and SCA

It has been assumed for GOSSD (Cairo) and GOSSD (Alexandria) that the data volumes are proportional to the staffing levels; 82% in Cairo and 18% in Alexandria. The error in this estimate is likely to be large, depending on the funds which are finally made available to operate the organizations, and the related cost estimates would be unreliable. They would also be small in

comparison with the costs for GOGCWS and AWGA. In order to maintain reliable and comparable cost levels in the tables and analyses the estimates for two computing facilities in Cairo and Alexandria servicing GOGCWS and GOSSD (Cairo), and AWGA and GOSSD (Alexandria), are shown in total and have not been subdivided by authority.

#### 5.4.6 Costs and Staffing Requirements

The detailed results of an analysis of equipment costs, capacity and staffing requirements are shown in Appendix 5, and a cost summary is given in Exhibit 5.5.

Data preparation work would be carried out at the main office of each authority. The costs would cover rental and maintenance of special equipment and also the costs of personnel for key punching and controlling the data. The total annual costs of the data preparation work at current volumes would be approximately as shown in Table 5.6.

TABLE 5.6

#### ANNUAL DATA PREPARATION COSTS - CURRENT VOLUMES

Authority	Annual Cost (LE)
GOGCWS	40,700
AWGA	31,050
GOSSD	24,800

These costs would be incurred regardless of the manner in which the computer processing service was provided.

The annual costs of computer processing will vary considerably depending on the size of equipment used. The total cost of using three small computers for GOGCWS, AWGA and GOSSD is almost double that of using a single larger computer to service all three authorities. This is shown in Table 5.7 below, which summarizes total annual costs of rental and maintenance of computers, and salaries of operations staff:

TABLE 5.7

TOTAL ANNUAL PROCESSING COSTS

Computing Arrangements	Present Organizations			Proposed Organizations for Cairo and Alexandria	
	GOGCWS	GOSSD	AWGA	GOGCWS and GOSSD (Cairo)	AWGA and GOSSD (Alexandria)
Computer at each authority or proposed location	61,750	43,250	54,750	75,830	64,330
Shared computer for GOGCWS and GOSSD. Separate computer for AWGA	75,830		54,750	Not Applicable	
Single computer servicing all authorities	83,886			83,886	

Note: The processing costs will be the same for the current and the 1987 volume.

The computer processing costs attributable to the authorities, based on the use made of facilities, show significant reductions as the equipment used becomes larger and as the staff requirements are reduced. The costs incurred by the authorities are shown in Table 5.8 on the following page.

These data show that authorities would make substantial savings by carrying out processing on shared facilities.

If the present organization is to be retained it may be concluded that:

- GOSSD cannot reasonably justify the use of a computer at the main office because of the high processing costs which would be incurred.
- The use of two separate computers, one in Alexandria and one in Cairo, would increase costs above the level for a single central computer by almost LE 47,000 per year:

AWGA	27,906
GOGCWS	12,878
GOSSD	5,910
Total	<u>LE 46,694 per year</u>

It would be most economical for all authorities to use a single central computer for their data processing work.

If the proposed organizations for Cairo and Alexandria are introduced the use of two computer locations would increase costs above the level for a single central computer by over LE 56,000 per year:

Cairo	22,703
Alexandria	33,571
Total	<u>LE 56,274 per year</u>

It would again be more economical for both authorities to use a single central computer.

TABLE 5.8  
ANNUAL PROCESSING COSTS (LE)

Computing Arrangements	Present Organizations				Proposed Organizations for Cairo and Alexandria		
	GOGCWS	AWGA	GOSSD	TOTAL	GOGCWS and GOSSD (Cairo)	AWGA and GOSSD (Alexandria)	TOTAL
Computer at each Authority or proposed location	61,750	54,750	43,250	159,750	75,830	64,330	140,160
Shared computer for GOGCWS and GOSSD. Separate computer for AWGA	52,304	54,750	23,526	130,580	Not Applicable		-
Single computer servicing all authorities	39,426	26,844	17,616	83,886	53,127	30,759	83,886

Note: The processing costs will be the same for the current and the 1987 volumes.

#### 5.4.7 Conclusions on Facilities

In any strategy study such as this it is necessary to take a broad and long-term view. The judgments on various alternatives have been made with this aim in mind, and are based on experience in computing and knowledge of existing conditions in Egypt.

A detailed analysis has been made of the features involved in providing a reliable computing service under both the present and the proposed organizational arrangements. It is concluded that with suitable highly-skilled staff and arrangements for control by authorities either an internal or a shared service could be used, though internal services would be more costly. Each method has advantages and disadvantages and either choice could be backed up by a logical argument.

A computer is an expensive machine, required to be attended by expensive specialized personnel, and it is to a great extent immaterial whether the machine is owned by an authority or merely used by an authority. What is important is that the authority obtain the necessary information from the machine accurately, quickly, punctually and economically in order to be able to conduct the more important business of providing the public with water or sewerage services.

The two basic problems for the authorities are those of obtaining and keeping highly-skilled staff and ensuring that adequate control is applied to maintain a high quality service. It may be thought that an in-house service enables good control to be achieved, but this control will prove to be completely

ineffective if it is expected to operate through personnel inexperienced in computing disciplines. On the other hand a shared computer facility will permit of less control by each authority, but with skilled and reliable staff should still be able to provide a satisfactory service.

Under the present organizational arrangements shared facilities can be provided in one of two ways:

- A central computer in Cairo serving GOGCWS, AWGA and GOSSD. This would preferably be jointly owned, but in any case GOGCWS, AWGA and GOSSD would be strongly represented on the governing body. Staffing would be by public sector employees, skilled in computing, with special payment arrangements or else by some form of facilities management contract with a reputable external company. The facilities management company would be expected to manage the computer operations and also to train public sector staff to operate the installation. The service would be provided economically.
- GOGCWS and AWGA would each have its own computing facility. GOSSD would use the GOGCWS facility under a contractual agreement. Staffing of each of the facilities would be under a facilities management contract with a reputable external company until such time as payment arrangements enable skilled public sector employees to be attracted to the installation. The cost of the services would be higher than those incurred using a central computer facility.

Under the proposed organizational arrangements, with GOSSD split between new authorities in Cairo and Alexandria, two alternatives are possible. The first would use a single computer facility in Cairo in the same manner as suggested under the present organizational arrangements. The second would use separate computers in Cairo and Alexandria to serve the new authorities. The staffing and management arrangements would be the same as proposed under the present organizational arrangements.

The authorities would have to place a great deal of reliance on computer specialists. The technical problems of the computer would be left to those most suited to deal with them, i.e., the computer specialists, and as long as a good service was provided to the water and sewerage authorities then money spent in obtaining this service would not be wasted.

Because of the difficulty of obtaining skilled computer personnel in Egypt, the desirability of maintaining a close liaison between the authorities and the need to ensure continuity of service, it is concluded that a central computer facility would provide the best overall service to the authorities. Only if it is proved that suitable authority control cannot be satisfactorily achieved should attention be directed to the other alternatives, which have many drawbacks.

Data preparation equipment with checking facilities should be provided at the main offices of the authorities. Consideration should also be given to providing this type of equipment for use in SCA offices to eliminate delays in correcting erroneous data.

## 5.5 PROGRAMS AND PROGRAM CHANGES

### 5.5.1 Options

The systems analysis and programming work required when preparing or modifying computer programs can be considered independently from the operation of the computer. Systems and programming personnel operate in a different environment and need different sets of skills. Their relationship to computer operating staff could be considered as that of a car designer to a car driver.

It has been already pointed out in Section 2.0 of this Report, that there is at present only one software supplier in Egypt that can supply a range of independent services and significant growth has been predicted in this area. This is likely to occur because systems analysts and programmers are concerned largely with development work which, when completed, is handed over to the computer operating staff. The analysts and programmer would then start work on other projects, a normal consultancy situation where the customer does not wish to retain expensive personnel with no continuing work to do.

In actual fact the situation is not so clear-cut. In any set of operational computer programs there are normally found to be small modifications or adjustments which are either necessary or desirable. These requirements arise from time to time as conditions change or as the need for improvements is recognized, and it is normal to find systems analysts and programmers spending small amounts of time engaged in such program maintenance. The actual amount of time required would depend on the number of programs in operational use and the quality of the program documentation.

The work of all the water authorities is similar and there are also similarities with the activities of the sewerage authorities. Accordingly it could prove possible to arrange for some standardization of computer programs, which would result in lower program costs and speedier introduction of the computer procedures.

The options in providing systems analysts and programmers for preparing programs and carrying out program changes are the use of:

- Staff supplied by computer manufacturer.
- An external specialized software supplier.
- Trained employees with special payment arrangements.
- Authority staff trained by the manufacturer.

The main benefits and drawbacks of each of these four options are summarized in Exhibits 5.6 and 5.7 for program preparation and for program maintenance work.

#### 5.5.2 Staffing Requirements

Systems design and programming is one of the longest tasks in setting up any computer system, and it is, therefore, desirable to ensure that this task is not unnecessarily delayed. A large amount of skilled effort should be available as required. Once programs are operational there is no further large requirement for the skilled analysts and programmers.

Although special government employees or trained authority staff could provide some assistance, the majority of the work of preparing the programs should be carried out by either the computer manufacturer's staff or a specialized software supplier.

It is most important that program changes should be carried out only by skilled personnel. Computer suppliers are not noted for their enthusiasm for this type of work.

It is recommended that a specialized software supplier should be used for the work of system design and preparing the programs. The same supplier should, if possible, be retained to carry out program changes which prove to be necessary or desirable.

## 5.6 ADVISORY SERVICES

The management of an authority may require computing advice with implications ranging from the very short-term to the very long-term. It is most important that the source of the advice should be both suitably skilled and impartial.

When considering advisory services in the field of data processing three main types of advice can be identified.

These concern:

- Operational problems.
- Programs and computer applications.
- Computing equipment and information system strategy.

### 5.6.1 Operational Problems

For operational problems, which of their nature require a fairly quick response, it is unlikely that external services could be of use to the authorities unless the external services already have a detailed knowledge of the problem area concerned.

The types of problem which could occur would be:

- Minor revisions to output formats.
- Revisions to frequencies of some computer runs.

In general the staff in day-to-day contact with the computer procedures would be best equipped to handle these problems.

#### 5.6.2 Programs and Computer Applications

In the medium-term, up to say two years ahead, decisions may be required on questions such as:

- Extending programs to accommodate new needs.
- Incorporating new business sectors on the computer.

These decisions will involve expenditure on programs and, possibly, add-on computer equipment. Although computer operations staff would have opinions on the procedures to adopt it is most likely that the best advice could be obtained from software firms and equipment manufacturers. They would be in the best position to quote prices and to provide estimates of cost and time required for implementation.

#### 5.6.3 Equipment and Information System Strategy

It would normally be impossible for authority personnel to have a broad knowledge of the data processing marketplace and to be able to make reasoned decisions concerning equipment or system strategies, which would affect the operations of the authority for the next, say, seven years or more.

Specialized software firms and computer manufacturers might be well-equipped to provide technical information but they might not be aware of some of the broader implications of their advice, nor might they be completely impartial in their recommendations. The computer is only one part of an overall management system and they, as computer specialists, might be unaware of additional aspects of the overall problem.

Advice with long-term implications should be given only after a careful evaluation not only of the data processing systems but also of the management systems surrounding them. It could prove desirable and useful to recruit the assistance of specialists with expertise not only in data processing but also in management as a whole.

#### 5.7 RENTAL OF EXCESS COMPUTER TIME

The computer facilities would be under-utilized during 2 1/2 weeks out of every month and it would be possible, in principle, to rent this excess time to other businesses. On the basis of two-shift operations the total number of computer hours which could be made available for rental are:

- Single computer in Cairo - 80 hours per month.
- Computers at Cairo  
and Alexandria:
  - . Cairo - 70-90 hours per month.
  - . Alexandria - 30-40 hours per month.

An investigation has been made of the likely market for computer time. This shows that companies like Al Ahram, which provides a complete computing service, including assistance in programming, is able to sell computer time much more readily than those that provide only the computer facilities. A great deal of computer time is currently available from many companies if clients are willing to provide their own programs and data to be processed.

The prime purpose of the computer facilities is to provide a service to the authorities and the work of the authorities would always take priority over outside work. It would be impossible to provide customers with any absolute guarantee that their work would be carried out at a given time. The level of service provided to these customers will vary, and they may not be able to rely on the facilities to carry out important work, such as the preparation of their payrolls. Consequently, it is most likely that customers would be willing to use the facilities only for work which is of secondary importance in the day-to-day running of their businesses.

It would be possible to generate a small amount of income by making available for outside work the computer facilities and the operating staff during the two-shift periods. It is highly unlikely, however, that more than one or two hours of computer time each month could be sold in this way unless a great deal of effort was made to sell this spare capacity.

It might be possible, if the facilities were operated under a facilities management contract, to arrive at an agreement whereby the management company would be able to use the computer for other clients and to charge the clients accordingly. The computer time which could be sold in this way might be up to 20 hours per month, depending on the facilities management company.

Since only a small outside income could be obtained by selling excess capacity unless direct sales effort is applied, it would be unwise at the present time to consider the sale of computer time as a useful source of income.

This topic could usefully be re-investigated when the authorities' systems are operational, the management of the facilities is established and the precise amount of excess capacity known.

#### 5.8 RENT OR BUY ARRANGEMENTS

If it is considered desirable to obtain a computer then the decision to rent or buy can be extremely important. The three factors involved in the decision are:

- Cash flow.
- Service.
- Flexibility.

### 5.8.1 Cash Flow

By renting a computer the short-term cash flow of the authority is improved, but in the long-term it may prove more expensive, depending on the terms of the contract such as options to purchase and the interest payable on borrowings.

### 5.8.2 Service

One of the main advantages in renting a computer is in the continued interest on the part of the computer manufacturer to provide sufficiently good service to maintain his source of income. A manufacturer that is short-staffed and required to choose between maintenance for a rented computer and maintenance for a purchased computer may, on purely economic grounds, opt for the rented computer to maintain the prospects for cash flow.

### 5.8.3 Flexibility

In a situation where the precise nature of the future equipment requirements is not known then it makes sense to rent equipment rather than buy, because equipment can be substituted, added to or disposed of in the most economical way.

### 5.8.4 Conclusion

Although computer purchase may appear desirable from the accounting viewpoint, for practical reasons rental with an option to purchase is advocated, at least in the initial stages until manufacturer service arrangements have been tested, and future computer load has been determined. Subsequently, a selected mixture of purchased and rented equipment would prove suitable in maintaining flexibility and service and at the same time eliminating unduly high rental charges.

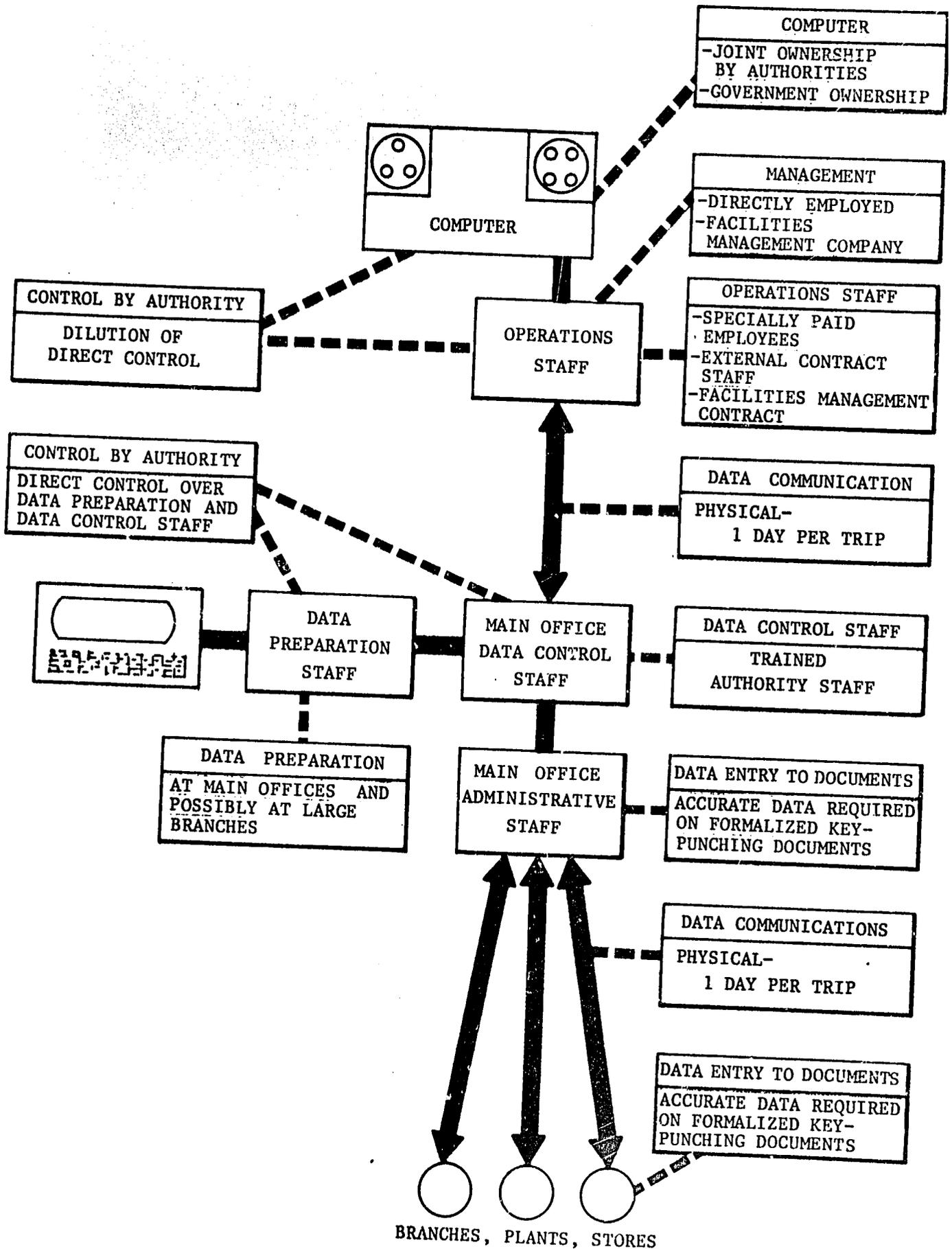
SUMMARY OF FACILITIES OPTIONS,  
PROBLEMS AND BENEFITS

Computing Facilities Features	Basic Options and Comments	Conclusion
<u>Communications</u>	<u>Physical Transportation</u> Relatively slow but quite reliable  <u>Telecommunications</u> Very fast but: - Expensive. - Not very reliable at present.	Use physical transportation.
<u>Computer Processing Location</u>	<u>External Unit Serving Two or More Authorities</u> Cost-effective and economical in staff, but requires back-up arrangements  <u>Unit at Main Office of Each Authority</u> Fairly cost-effective but each main office will require computer staff. Good speed of response.	In principle, each of these locations could be used.
<u>Data Preparation</u>	<u>Punched Cards or Magnetic Media</u> Magnetic media are more cost-effective.  <u>Type of Key punching Equipment</u> Checking facilities provide better effectiveness and reduce delays.  <u>Location of Data Preparation</u> Compromise situation.	Use magnetic media.  Use equipment with checking and printing facilities.  Use main offices and large branches.

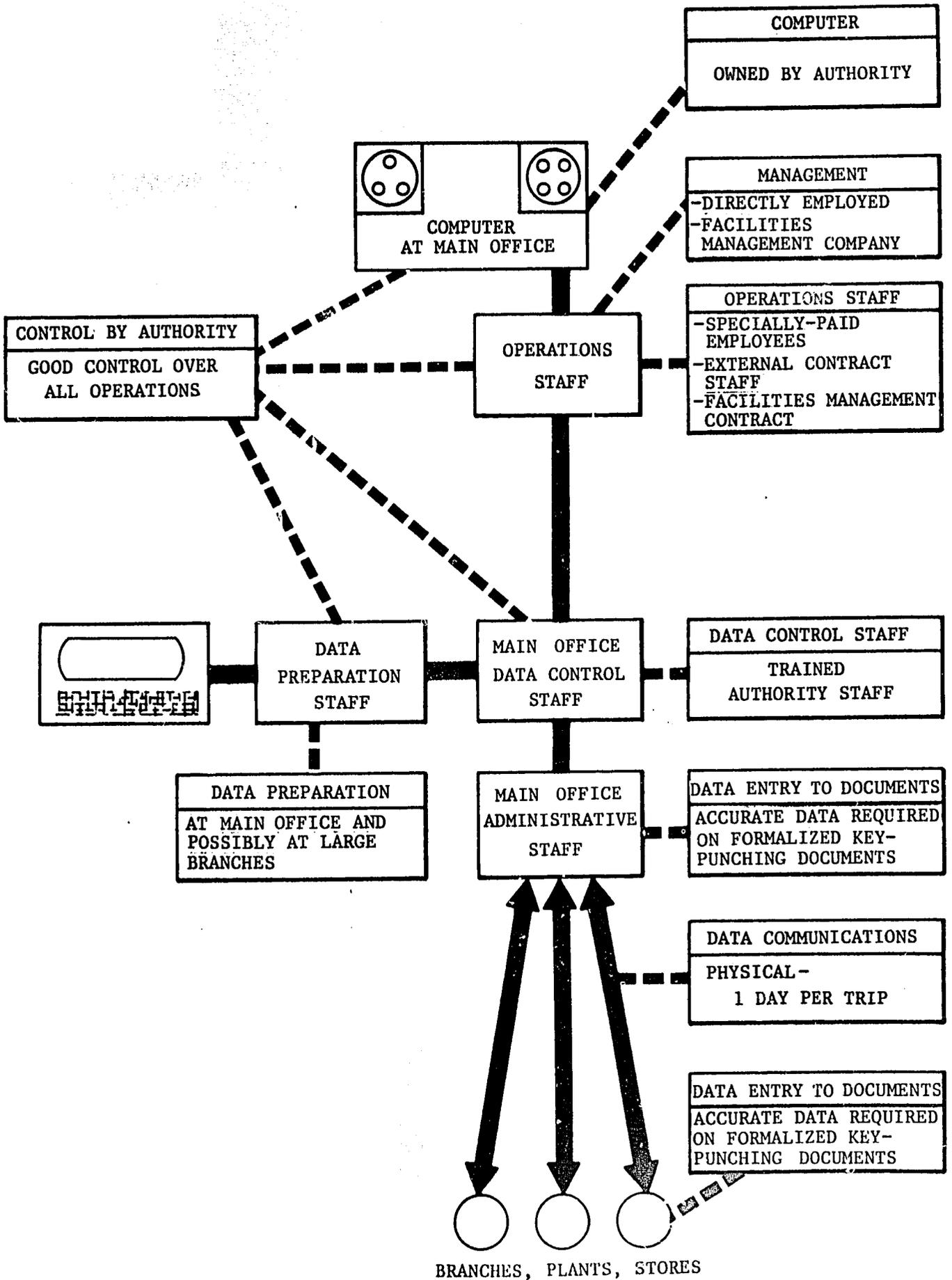
SUMMARY OF FACILITIES OPTIONS,  
PROBLEMS AND BENEFITS

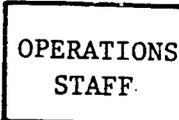
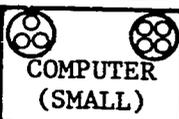
Computing Facilities Features	Basic Options and Comments	Conclusion
<u>Computer Staff</u>	<p><u>Trained Authority Staff</u> Inexpensive, but may be of low quality.</p> <p><u>Employees with Special Pay Arrangements</u> Quality could be high, but fairly expensive.</p> <p><u>External Contract Personnel</u> High quality, but expensive.</p> <p><u>Facilities Management Contract</u> High quality, but expensive.</p>	<p>In principle either use employees with special pay arrangements, external contract personnel or a facilities management contract.</p>
<u>Computer Ownership</u>	<p><u>Private</u> No control available to authorities.</p> <p><u>Government</u> Limited control. Possible technical assistance available.</p> <p><u>Joint Authority Ownership</u> Some control and some communal benefits.</p> <p><u>Authority-Owned</u> Direct control, but possibly lack of some communal benefits.</p>	<p>Preferably joint ownership, though governmental or authority ownership could be satisfactory.</p>
<u>Management of Operations</u>	<p><u>Employee with Special Pay Arrangements</u> Probably lack of broad experience. Good control and inexpensive.</p> <p><u>External Computer Professional</u> Wide experience available. Fair control but quite expensive.</p> <p><u>Facilities Management</u> Wide experience available and reasonable control, but expensive.</p>	<p>Choice depends on skills and reliability of the individuals concerned.</p>

EXTERNAL COMPUTER SERVING TWO OR MORE AUTHORITIES



COMPUTER AT EACH AUTHORITY



		EXTERNAL COMPUTER	COMPUTERS AT MAIN OFFICES OF AUTHORITIES
EXTERNAL FACILITIES		  <b>COMPUTER (SMALL-MEDIUM)</b> OWNED BY -GOVERNMENT -JOINT AUTHORITIES	 <b>OPERATIONS STAFF</b> -SPECIALLY-PAID EMPLOYEES -EXTERNAL CONTRACT STAFF -FACILITIES MANAGEMENT STAFF
MAIN OFFICE FACILITIES		 <b>DATA PREPARATION</b>	 <b>COMPUTER (SMALL)</b> OWNED BY AUTHORITY  <b>OPERATIONS STAFF</b> -SPECIALLY PAID EMPLOYEES -EXTERNAL CONTRACT STAFF -FACILITIES MANAGEMENT STAFF  <b>DATA PREPARATION</b>
ACCURACY		<u>VERY GOOD</u> -USE OF SKILLED AND EXPERIENCED STAFF -DATA PREPARATION WITH CHECKING FACILITIES	<u>VERY GOOD</u> -USE OF SKILLED AND EXPERIENCED STAFF -DATA PREPARATION WITH CHECKING FACILITIES
SPEED OF RESPONSE TO BRANCH DATA		ABOUT 9 DAYS <u>GOOD</u>	ABOUT 7 DAYS <u>VERY GOOD</u>
RELIABILITY OF PROCESSING TIMESCALE	NORMAL OPERATIONS	<u>GOOD</u> -JOINTLY OWNED OR GOVERNMENT COMPUTER -USE OF SKILLED AND EXPERIENCED STAFF -DATA PREPARATION WITH CHECKING FACILITIES	<u>GOOD</u> -USE OF SKILLED AND EXPERIENCED STAFF -DATA PREPARATION WITH CHECKING FACILITIES
	AUTHORITY CONTROL	LEVEL OF CONTROL	<u>VERY GOOD</u> INDIRECT CONTROL AVAILABLE, BUT COMMUNAL CONTROL WITH OTHER AUTHORITIES CAN PROMOTE IMPROVED METHODS AND STANDARDIZATION
EASE OF CONTROL		<u>FAIR</u> TECHNICAL ASSISTANCE WILL BE AVAILABLE	<u>POOR</u> TECHNICAL ASSISTANCE MAY BE AVAILABLE
ECONOMY		<u>EXCELLENT</u> -ONE SMALL OR MEDIUM SIZE COMPUTER REQUIRED -ONE SET OF SKILLED COMPUTER STAFF ONLY -EQUIPMENT AND STAFF WILL BE REASONABLY LOADED AND COST-EFFECTIVE.	<u>FAIR</u> -ONE SMALL COMPUTER PER AUTHORITY -ONE SET OF SKILLED COMPUTER STAFF PER AUTHORITY -EQUIPMENT AND STAFF WILL BE LIGHTLY LOADED AND NOT COST-EFFECTIVE
OVERALL EVALUATION SUMMARY		<u>FOR</u> -GOOD COMPUTING PERFORMANCE -ECONOMICAL IN EQUIPMENT AND STAFF -COMMUNAL CONTROL WOULD PROMOTE IMPROVED METHODS AND STANDARDIZATION <u>AGAINST</u> -RESPONSE TIME MARGINALLY SLOW -DILUTION OF DIRECT CONTROL.	<u>FOR</u> -DIRECT CONTROL AVAILABLE TO AUTHORITIES -RESPONSE TIME GENERALLY GOOD -COMPUTING PERFORMANCE GOOD WITH SKILLED STAFF <u>AGAINST</u> -COSTLY IN EQUIPMENT AND STAFF -EACH AUTHORITY ISOLATED IN PROMOTING IMPROVED METHODS

EVALUATION OF EXTERNAL, COMPUTER VS COMPUTERS AT MAIN OFFICES OF AUTHORITIES

TOTAL ANNUAL COSTS FOR DATA  
PREPARATION AND PROCESSING

Computing Arrangements	Present Organization						Proposed Organizations for Cairo and Alexandria			
	GOGCWS		AWGA		GOSSD		GOGCWS and GOSSD (Cairo)		AWGA and GOSSD (Alexandria)	
	Current	1987	Current	1987	Current	1987	Current	1987	Current	1987
Computer at each authority or proposed location	102,450	114,750	85,800	94,850	68,050	68,650	134,030	143,680	99,230	108,280
Shared computer for GOGCWS and GOSSD. Separate computer for AWGA.	93,004	105,304	85,800	94,850	48,326	48,926	Not Applicable		Not Applicable	
Single computer shared by all authorities	80,126	92,426	57,894	66,944	42,416	43,016	111,327	120,977	65,659	74,709

PROBLEMS AND BENEFITS OF SYSTEMS ANALYSIS AND  
PROGRAMMING OPTIONS - MAIN PROGRAM PREPARATION

Options	Problems	Benefits
Computer Manufacturer's Personnel	<ul style="list-style-type: none"> <li>- Not many manufacturers are willing to prepare special programs.</li> <li>- Could be expensive to prepare programs.</li> </ul>	<ul style="list-style-type: none"> <li>- Programs may be of high quality and reliable.</li> <li>- Documentation may be of adequate quality.</li> <li>- Supplier will wish for good references for future sales.</li> </ul>
External Specialized Software Supplier	<ul style="list-style-type: none"> <li>- Could be expensive to prepare programs.</li> </ul>	<ul style="list-style-type: none"> <li>- Programs could be of high quality and reliable.</li> <li>- Documentation could be of high quality.</li> <li>- Supplier will wish for good references for future sales.</li> </ul>
Employees with Special Payment Arrangements	<ul style="list-style-type: none"> <li>- Could be fairly expensive to prepare programs.</li> <li>- May take slightly longer to prepare programs than specialized external supplier.</li> <li>- Continuation work would have to be provided after main programs have been completed.</li> </ul>	<ul style="list-style-type: none"> <li>- Programs could be of high quality and reliable.</li> <li>- Documentation could be of high quality.</li> </ul>
Trained Authority Staff	<ul style="list-style-type: none"> <li>- Present salary structure will result in lack of experienced staff, poor program design and performance.</li> <li>- Likely poor quality of documentation, leading to difficulty in future program changes.</li> <li>- Continuation work would have to be provided after main programs have been completed.</li> <li>- Standardization with other authorities would be difficult.</li> </ul>	<ul style="list-style-type: none"> <li>- Programs may be inexpensive to prepare.</li> </ul>

PROBLEMS AND BENEFITS OF SYSTEM ANALYSIS AND  
PROGRAMMING OPTIONS - PROGRAM MAINTENANCE

Options	Problems	Benefits
Computer Manufacturer's Personnel	<ul style="list-style-type: none"> <li>- Few manufacturers are willing to undertake program maintenance.</li> <li>- Program changes could be expensive to introduce and will be of secondary importance to the supplier.</li> </ul>	<ul style="list-style-type: none"> <li>- Program changes could be carried out reliably.</li> </ul>
External Specialized Software Supplier	<ul style="list-style-type: none"> <li>- Program changes will be expensive to introduce.</li> </ul>	<ul style="list-style-type: none"> <li>- Program changes could be carried out speedily and reliably.</li> </ul>
Employees with Special Payment Arrangements	<ul style="list-style-type: none"> <li>- Program changes will be fairly expensive to introduce.</li> </ul>	<ul style="list-style-type: none"> <li>- Program changes could be carried out speedily and reliably.</li> </ul>
Trained Authority Staff	<ul style="list-style-type: none"> <li>- Program changes will be difficult to implement with inexperienced staff.</li> </ul>	<ul style="list-style-type: none"> <li>- Program changes may be relatively inexpensive to introduce if skilled career staff do the necessary work.</li> </ul>

## 6.0 COMPUTING STRATEGY TO BE ADOPTED

This Section of the Report reviews the general strategy which should be adopted by GOGCWS, AWGA, SCA and GOSSD and comments on the actions required, the time schedules, and the costs involved. It is reviewed under the following subject headings:

- Facilities Required
- Computer Applications
- Action by the Authorities
- Implementation Schedule
- Equipment Procurement
- Equipment, Staffing and Costs
- Cost Summary
- Cost and Staff Reassignment Summary

### 6.1 FACILITIES REQUIRED

The water supply operations of SCA should for the present time continue to use the services of the SCA computing center in Ismailia.

The computing work of the other authorities should be carried out either in a single computing facility located in Cairo or in two separate computer facilities located in Cairo and Alexandria. In the second case the use of the facilities would depend on the organizational structure selected for the authorities:

- If the present structure is retained the Cairo facility would be used by GOGCWS and GOSSD, and the Alexandria facility by AWGA alone.
- If the proposed sewerage organizations are set up in Cairo and Alexandria then each could share a computer facility with the water authority.

The use of a single computing facility in Cairo is preferable for reasons of financial and staffing economies. It is recommended that this facility should be under the joint control of the authorities but in any case the authorities should be represented on the governing board of the facility.

Computing input data and output reports would be transferred between users and the computer installation by physical transportation.

The authorities should obtain special data preparation equipment to facilitate the accurate preparation of input data. This type of equipment should also be considered for use by SCA. The equipment should be located at the main offices of the authorities and at suitable large branch offices.

The computing facilities will require the use of highly-skilled computer personnel. Special training will be required for data preparation clerks.

Data control departments should be formed at main offices of authorities, to serve as the interface between the users, the Data Preparation Department and the Computer Department. This will assist greatly in ensuring accuracy of input data and hence accuracy of output reports.

Documentation from which computer input data is to be prepared should be reviewed and revised to enable data to be prepared and controlled more reliably.

## 6.2 COMPUTER APPLICATIONS

The commercial computer applications recommended are:

- Water billing and accounting.
- Payroll and time allocations.
- Stock control and accounting.
- General accounting.

GOSSD will not use billing procedures.

The use of a computer for these applications will enable substantially improved management information to be prepared and will make it possible to transfer a large number of clerical staff to more productive work.

## 6.3 ACTION BY THE AUTHORITIES

The successful introduction of computer procedures within a business requires a great deal of planning and cooperation from all personnel concerned. Since personnel within the business have no previous experience in these matters, it is highly desirable that suitable professional advice be obtained from independent specialists who are aware of the problems which are likely to arise.

The general sequence of work to be carried out is shown on the next page.

- Decide on whether a centralized installation is to be used or whether other arrangements are to be made.
- Decide on the type of management, staffing and location of the computer facilities.
- Decide on the sequence in which computer applications are to be introduced.
- Prepare a formal proposal request to be submitted to equipment and software suppliers, and evaluate the responses.
- Prepare a formal proposal request to be submitted to facilities management companies, if this form of management is to be considered, and evaluate the responses.
- Place order for equipment and software.
- Carry out systems design and programming work.
- Obtain specialized staff as necessary.
- Instruct authority staffs in the new procedures to be applied.
- Prepare the sites for computer and data preparation facilities.
- Install computer and data preparation facilities.
- Test and prove systems.
- Implement full computer operations.

During the stage of systems design it is highly likely that problem areas will be encountered, for example it may be desirable to change existing coding systems. It is important that authority personnel can be made available to conduct such investigations as speedily as possible so that all issues can be resolved within an acceptable period of time.

#### 6.4 IMPLEMENTATION SCHEDULE

The chart shown in Table 6.1 on the following page provides an example of the general introductory schedule which could apply in this work. This shows that systems design work is unlikely to start much before nine months from acceptance of this Report. The total duration of the systems and programming effort for all the authorities could be three to four years, depending on the number of personnel involved in the work.

During implementation it would be desirable to minimize the cost of the equipment involved. The configuration of the computer should match as closely as possible the needs of the applications during this implementation period.

If computers are to be installed in Cairo and Alexandria it would be desirable for one of these to take the leading role in implementation. Table 6.2 shows a feasible implementation sequence indicating how a Cairo facility could fulfill such a leading role.

#### 6.5 EQUIPMENT PROCUREMENT

All equipment should initially be rented with an option to purchase until such time as it is proved to operate satisfactorily. This may take about one year. At that time consideration should be given to whether the equipment in question is likely to require replacement by more powerful equipment or whether it is likely to remain for a significant length of time.

TABLE 6.1

EXAMPLE OF INTRODUCTORY TIMESCALE

Action to be Taken	Months																							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Decide on centralized installation or other arrangements.	█	█																						
Decide on type of management, staffing and location.			█																					
Select sequence of introduction of applications.				█																				
Prepare and distribute equipment and software proposal request, and evaluate responses.					█	█	█	█																
Prepare and distribute facilities management proposal request, if required, and evaluate responses.					█	█	█																	
Order equipment and software.									█															
Systems design and programming.										█	█	█	█	█	█	█	█	█	█	█	█	█	█	█
Staff selection and training.																█	█	█	█	█	█	█	█	█
Prepare site and install computer facilities.																█	█							
Program testing and proving initial system.																		█	█	█	█	█	█	█
Implement computer operations.																						█	█	█

TABLE 6.2

EXAMPLE OF IMPLEMENTATION SCHEDULE FOR PROCEDURES  
(Two computers at Cairo and Alexandria)

Procedures	Implementation Schedule			
Installation of Cairo Computer	⊕			
Installation of Alexandria Computer	⊕			
Customer Billing and Accounting	GOGCWS	Cairo Computer		
	AWGA	Cairo Computer	Alexandria Computer	
Payroll and Time Allocation	GOSSD	Cairo Computer		
	GOGCWS	Cairo Computer		
	AWGA	Cairo Computer	Alexandria Computer	
Inventory Control and Accounting	GOGCWS	Cairo Computer		
	AWGA	Cairo Computer	Alexandria Computer	
	GOSSD	Cairo Computer		
General Accounting	GOGCWS	Cairo Computer		
	GOSSD	Cairo Computer		
	AWGA			Alexandria Computer

Any equipment which may be replaced should continue to be rented, whereas for equipment with continuing use consideration should be given to purchasing it, applying financial criteria.

It would be desirable to keep a certain proportion of the equipment continuously rented. This helps ensure that the equipment supplier remains attentive to meeting maintenance requirements.

## 6.6 EQUIPMENT, STAFFING AND COSTS

The main cost and effort in setting up the computing facilities and the associated procedures involve:

- Systems design and programming.
- Data preparation equipment.
- Data preparation staff.
- Data control staff.
- Computer equipment.
- Computer operations staff and management.

### 6.6.1 Systems Design and Programming

Computer systems should be designed and programmed for all authorities except SCA. These computer programs, once prepared or purchased as available, could be used irrespective of the volumes of information to be processed. Since the work of the authorities is similar it is recommended that initially for each application a program should be prepared or purchased to meet the needs of a single authority. Modifications should subsequently be made to the program to meet the needs of other authorities. Program costs would be shared between the authorities.

If the present organizations are retained GOGCWS and AWGA will each be charged about LE 38,000 and GOSSD about LE 26,000. Under the proposed organizational arrangements the Cairo and Alexandria authorities will each be charged about LE 51,000. The estimated costs of preparing these programs are shown in Table 6.3 on the following page.

#### 6.6.2 Data Preparation Equipment

Each authority except SCA will have to obtain data preparation equipment. The initial requirements at current volumes would be for about 16 data preparation units and three small printing units.

During initial operations the computing facilities will be only lightly loaded and time would be available to carry out data listing work. If installations are installed at Alexandria and at Cairo this would mean the authorities may not initially need a small additional printing unit to carry out data listing. For general costing purposes, however, the cost of a printer has been included in Table 6.4.

TABLE 6.3

COSTS FOR SYSTEMS DESIGN AND PROGRAMMING (LE)

Authority	Customer Billing and Accounting	Payroll and Time Allocation	Stock Control and Accounting	General Accounting	Total
<u>Present Organizations</u>					
GOGCWS	11,883	8,202	8,100	9,472	37,657
AWGA	11,883	8,202	8,100	9,472	37,657
GOSSD	-	8,202	8,100	9,472	25,774
<u>Proposed Organizations</u>					
Cairo	11,883	12,303	12,150	14,208	50,544
Alexandria	11,883	12,303	12,150	14,208	50,544

TABLE 6.4

REQUIREMENTS FOR DATA PREPARATION EQUIPMENT

Authority	Current Level		1987	
	Machines	LE per year	Machines	LE per year
<u>Present Organizations</u>				
GOGCWS	7	26,050	10	35,800
AWGA	5	19,550	7	26,050
GOSSD	4	16,300	4	16,300
<u>Proposed Organizations</u>				
Cairo	11	39,050	13	45,550
Alexandria	6	22,800	8	29,300

### 6.6.3 Data Preparation Staff

GOGCWS, AWGA and GOSSD will each require data preparation staff. The requirements at current volumes would be:

- GOGCWS            14 Personnel
- AWGA             10 Personnel
- GOSSD            7 Personnel

These requirements can be met from employees within the authorities

The current and future requirements and costs are shown in Table 6.5 on the following page.

TABLE 6.5

REQUIREMENTS FOR DATA PREPARATION STAFFING

Authority	Current Level			1987		
	Operators	Supervisors	LE per year	Operators	Supervisors	LE per year
<u>Present Organizations</u>						
GOGCWS	14	2	10,000	17	2	11,800
AWGA	10	2	7,600	13	2	9,400
GOSSD	7	2	5,800	8	2	6,400
<u>Proposed Organizations</u>						
Cairo	19	2	13,000	23	2	15,400
Alexandria	11	2	8,200	14	2	10,000

#### 6.6.4 Data Control Staff

Data control staff will be required at all authorities. On the basis of one data control clerk being able to cover the work of three data preparation operators the current requirements would be:

- GOGCWS            5 Personnel
- AWGA             4 Personnel
- GOSSD            3 Personnel

These requirements can be met from employees within the authorities.

The current and future requirements are shown in Table 6.6 below:

TABLE 6.6  
REQUIREMENTS FOR DATA CONTROL STAFFING

Authority	Current Level			1987		
	Clerks	Supervisor	LE per year	Clerks	Supervisor	LE per year
<u>Present Organizations</u>						
GOGCWS	5	1	4,650	6	1	5,400
AWGA	4	1	3,900	5	1	4,650
GOSSD	3	1/2 <sup>(1)</sup>	2,700	3	1/2 <sup>(1)</sup>	2,700
<u>Proposed Organizations</u>						
Cairo	7	1	6,150	8	1	6,900
Alexandria	4	1	3,900	5	1	4,650

Note: (1) A part-time supervisory function should be sufficient at GOSSD.

### 6.6.5 Computer Equipment

Irrespective of whether it is decided to provide a central installation in Cairo or two smaller installations in Cairo and Alexandria, the initial computer configuration should be small and should be rented with an option to purchase. A small configuration will be adequate to accommodate the initial work load, and under a rental agreement this configuration can readily be augmented as necessary to accommodate subsequent increases in the work load.

For all the projected work to be processed on computer facilities, both at the current and the 1987 volumes, equipment rental and maintenance costs will be as shown in Table 6.7 below:

TABLE 6.7

#### COMPUTER EQUIPMENT COSTS

Facilities	LE per year	
Central Facility at Cairo	55-78,000	Say 60,000
At Cairo and Alexandria:		
-GOGCWS and GOSSD (all or Cairo only)	54-70,000	Say 56,000
-AWGA alone	35-45,000	Say 37,500
-AWGA and GOSSD (Alexandria)	42-50,000	Say 44,500

### 6.6.6 Computer Operations Staff and Management

When the computer procedures are first being introduced at either a single central location or at both Alexandria and Cairo, a minimum staffing level is required. Table 6.8 on the following page summarizes the estimates of initial and fully operational staffing levels.

TABLE 6.8

COMPUTER OPERATIONS STAFF AND MANAGEMENT PER FACILITY (1)

Computing Facility	Data Processing Manager	Shift Leader	Computer Operator	Operations Clerk	Ancillary Administrative Staff	Total Salaries	Annual Facilities Management @ 50%	Total Annual Cost
<u>Central Facility</u>								
Initial	1 @ 3,500	1 @ 2,000	2 @ 1,000	1 @ 720	1 @ 600	8,820	4,410	13,230
Operational	1 @ 4,320	2 @ 2,580	3 @ 1,308	1 @ 720	3 @ 600	15,924	7,962	23,886
<u>Two Facilities</u>								
Initial	1 @ 3,500	1 @ 1,800	2 @ 900	1 @ 720	1 @ 600	8,420	4,210	12,630
Operational	1 @ 4,200	2 @ 2,300	2 @ 1,250	1 @ 720	2 @ 600	13,220	6,610	19,830

Note: (1) The operational salary rates are based on assumptions shown in Appendix 5. The initial salary rates allow for increases to be made subsequently.

## 6.7 COST SUMMARY

Table 6.9 on the following page summarizes the external costs which would be incurred by or attributed to the authorities. Additional details are shown in Appendix 5.

The systems and programming charges to GOSSD are less than those to GOGCWS and AWGA because GOSSD would not use computerized customer billing and accounting.

The cost of systems design and programming occurs once only and although it may appear to be a significant amount, it is small in comparison with the annual operational costs.

Under the present organizational arrangements the use of a single computer facility in Cairo would prove to be of most financial benefit to AWGA. The cost of a separate facility in Alexandria would be over 60% of that of a single larger installation and the cost of the Alexandria facility would have to be recovered entirely by AWGA. The difference in cost to AWGA of LE 28,000 per year would more than offset all of AWGA's external data preparation costs at current volumes.

Table 6.10 summarizes the best estimates of the ranges of external costs involved. Additional details are given in Exhibit 6.1 together with comments on the accuracy of the estimates.

TABLE 6.9

EXTERNAL COSTS INCURRED BY AUTHORITIES (LE)<sup>(1)</sup>  
(CURRENT VOLUMES)

External Costs	Present Organizations			Proposed Organizations for Cairo and Alexandria	
	GOGCWS	AWGA	GOSSD	GOGCWS AND GOSSD (Cairo)	AWGA and GOSSD (Alexandria)
<u>Once-Only Costs</u> Systems Design and Programming	38,000	38,000	26,000	51,000	51,000
<u>Annual Costs</u> Data Preparation Equipment Rental and Maintenance	26,000	20,000	17,000	39,000	23,000
Computer Rental, Maintenance, Staffing and Management					
- Computer at each authority or proposed location	62,000	55,000	44,000	76,000	55,000
- Computer shared by GOGCWS and GOSSD. Separate computer for AWGA	53,000	55,000	24,000	Not Applicable	Not Applicable
- Single computer shared by all authorities	40,000	27,000	18,000	54,000	31,000

Note: (1) All costs have been rounded to LE 1,000.

TABLE 6.10  
ESTIMATED RANGE OF EXTERNAL COSTS

Types of Cost	COSTS (LE)		
	Low	Estimated	High
Systems Design and Programming	87,000	102,000	128,000
Data Preparation Equipment (Current Volumes)	57,000/year	63,000/year	70,000/year
Processing Equipment and Staffing:			
. Single Facility	79,000/year	84,000/year	105,000/year
. Two Facilities	124,000/year	132,000/year	164,000/year

#### 6.8 COST AND STAFF REASSIGNMENT SUMMARY

The benefits of applying well-planned computer systems to the work of the authorities would be large. The main benefit is that greatly improved information would be available. Additionally at each authority a substantial number of clerical personnel could be reassigned to other more useful duties.

Table 6.11 on the following page summarizes the situation using a single computer center in Cairo. Additional details are provided in Exhibit 6.2.

TABLE 6.11

COST AND STAFF REASSIGNMENT SUMMARY<sup>(1)</sup>  
(Single Computer Facility)

Cost and Staffing Features	Present Organizations			Proposed Organizations for Cairo and Alexandria	
	GOGCWS	AWGA	GOSSD	GOGCWS and GOSSD (Cairo)	AWGA and GOSSD (Alexandria)
<u>Once-Only Costs (LE)</u>					
Systems Design and Programming	38,000	38,000	26,000	51,000	51,000
<u>Annual Costs (LE)</u>					
Increase in Annual External Payments	39,000	(6,000)	34,000	66,000	1,000
Staff Available for Reassignment	195	192	167	328	221

Note: (1) All costs rounded to LE 1,000.

ESTIMATED COST RANGES - EXTERNAL COSTS

COST ELEMENT	COST ESTIMATES (LE)		
	Low	Estimated	High
<u>Once-Only Costs</u>			
System Design and Programming	(-15%) 87,000	102,000	(+25%) 128,000
<u>Annual Costs</u>			
Data Preparation Equipment, Rental and Maintenance (Current Volumes)	(-10%) 57,000	63,000	(+10%) 70,000
<u>Single Computing Facility:</u>			
- Computer Equipment	(-5%) 57,000	60,000	(+30%)(1) 78,000
- Operations Staff and Management	(-10%) 22,000	24,000	(+10%) 27,000
Total	79,000	84,000	105,000
<u>Computers at Alexandria and Cairo:</u>			
- Computer Equipment	(-5%) 89,000	94,000	(+30%)(1) 122,000
- Operations Staff and Management	(-10%) 35,000	38,000	(+10%) 42,000
Total	124,000	132,000	164,000

Note: (1) The maximum cost of computer equipment is significantly higher than the cost which is expected to carry out the work.

ESTIMATED COST RANGES - EXTERNAL COSTS

It must be stressed that the estimates used to generate cost information should be used only as a general guideline and should not be considered to be a definitive cost statement because:

- The system which has been used as a preliminary model to generate these estimates is in conceptual form only and during system design the requirements will be subject to change. This would cause changes in the cost of the system design and programming itself and also in the types and volumes of information to be processed.
- Some of the estimates of current volumes of information have been vague and assumptions have knowingly been made which can only be checked when additional large-scale investigations are carried out during the stage of system design.
- Computer equipment suppliers are reluctant to provide anything approaching a price list for their products without first having had the opportunity to prepare a proposal for the prospective client. Copies of recent proposals and discussions with IBM, ICL and NCR provide the basis for estimates of equipment costs.
- The costs of computer equipment, personnel and software in Egypt will probably increase with time. All estimates are based on the current situation and do not forecast how costs of individual equipment or personnel will change in the future.

COST AND STAFF REASSIGNMENT SUMMARY  
(Single Computer Facility)

Cost and Staffing Features	Present Organizations			Proposed Organizations for Cairo and Alexandria	
	GOGCWS	AWGA	GOSSD	GOGCWS and GOSSD (Cairo)	AWGA and GOSSD (Alexandria)
<u>Once-Only Costs (LE)</u> Systems Design and Programming	37,657	37,657	25,774	50,544	50,544
<u>Annual External Payments (LE)</u> Data Preparation Equipment Rental and Maintenance	26,050	19,550	16,300	39,050	22,800
Data Processing Equipment Rental and Maintenance	28,200	19,200	12,600	38,000	22,000
Operations Staff and Management	11,226	7,644	5,016	15,127	8,759
	<u>65,476</u>	<u>46,394</u>	<u>33,916</u>	<u>92,177</u>	<u>53,559</u>
Present External Payments to be Eliminated	26,400	52,700	-	26,400	52,700
Increase in Annual Costs	<u>39,076</u>	<u>(6,306)</u>	<u>33,916</u>	<u>65,777</u>	<u>859</u>

COST AND STAFF REASSIGNMENT SUMMARY  
(Single Computer Facility)

Cost and Staffing Features	Present Organizations			Proposed Organizations for Cairo and Alexandria	
	GOGCWS	AWGA	GOSSD	GOGCWS and GOSSD (Cairo)	AWGA and GOSSD (Alexandria)
<u>Internal Staffing (Persons)</u>					
<u>Present Staffing</u>					
Data Preparation and Processing	33	82	-	33	82
Clerical	184	127	180	324	157
Subtotal	<u>217</u>	<u>209</u>	<u>180</u>	<u>357</u>	<u>239</u>
<u>Proposed Staffing</u>					
Data Preparation	16	12	9	21	13
Data Control	6	5	4	8	5
Subtotal	<u>22</u>	<u>17</u>	<u>13</u>	<u>29</u>	<u>18</u>
Net Staff Available for Reassignment	195	192	167	328	221

## 7.0 RECOMMENDED SHORT-TERM IMPROVEMENTS

The recommendations for short-term improvements should not be allowed to influence the long-term strategy to be adopted. There are no significant problems in this respect.

The short-term improvements should be introduced as soon as possible and should be maintained until revised procedures make them no longer necessary.

The water authorities all carry out procedures which are, in principle, similar but in which the problems arising tend to be different because of the different methods of processing which are applied. One type of problem is, nevertheless, common to all the data processing work and results in a great deal of delay and wasted human effort. This is the problem of inaccuracy of output.

At GOGCWS, SCA and to a lesser extent at AWGA, a great deal of time and effort is applied in checking manually all the output from the data processing equipment. If the data output were correct and if the equipment were known to be operating correctly then it would clearly not be necessary to carry out these checks. In practice, however, it is not possible to be absolutely certain that input data are correct, nor that equipment is working properly, but it is certainly possible to minimize the effort required to check these two factors.

Accuracy of output information is the end-result of good control of data, for all aspects of control from entering data on documents through to the actual printing of the final information. The procedures of all the water authorities are deficient in this respect, and speedy improvements in accuracy and reduction of checking can be obtained if a relatively small amount of effort is devoted to this aspect of the work. Data control will also be necessary when computer procedures are introduced.

Each authority also has its own particular problems, and these have been commented on individually. Since the SCA computer serves also the navigation interests of the authority no consideration has been given to any detailed improvements which could be made in the areas of payroll, stock accounting and costing. At the present time water billing and accounting procedures are meeting the basic needs, but some small improvements could be made.

This Section is divided into the following subject headings:

- Data Control at the authorities.
- Other Recommendations - GOGCWS.
- Other Recommendations - AWGA.
- Other Recommendations - SCA.

## 7.1 DATA CONTROL AT THE AUTHORITIES

Data control is a term which has a wide range of implications, but the work of controlling data can be carried out in a single location. It is becoming commonly accepted practice in Europe and the USA to employ personnel to carry out this function in a data control department.

This subject is discussed under three subject headings:

- Methods of Data Control
- Data Control Department
- Presentation of Prime Information

### 7.1.1 Methods of Data Control

Much closer checks are required on data at all stages of processing in order to eliminate errors in the final output.

This implies that:

- A simple and speedy method of inspection and control of data should be available.
- When errors are known to be present it should be possible to isolate and correct them rapidly.

This involves maintaining close control over information files, input data, calculations carried out and the printing of output information.

Three major steps should be taken in order to obtain the required control:

- For all information files used in processing, listings should be prepared at regular intervals and submitted to user departments so that the accuracy of these files may be checked.

- For all input information:

- . All data to be processed should be presented in small batches, for ease of isolating and correcting errors.
  - . Each batch of data should be accompanied by a set of independently-prepared information, defining significant line and column totals for the batch. These are termed control totals and would be used to check the consistency of the batch information through all the stages of processing by comparing the specified batch totals with the calculated batch totals.
  - . In data processing each batch of input data should be printed and the control totals checked before any processing is allowed to take place.
  - . Each batch should be processed independently and the batch identities should be maintained until it is known that all data has been processed correctly.
- For selected output documents, such as water bills, a pre-printed numbering system should be applied to reduce the possibility of fraud.

If, at any stage during processing, the checks show that errors have occurred then the source of the error must immediately be traced. The complete batch containing errors should be re-processed.

This type of control procedure is standard practice in most data processing installations. It requires a certain amount of clerical effort on the part of the user departments in preparing the control totals, and on the part of the Data Control Department in carrying out the checks, but experience has shown that this procedure is highly reliable if carried out properly.

In order to implement these recommendations it is necessary to carry out several detailed steps:

7.1.1.1 Data listing. Specify, prepare and test a set of programs which will enable information files and input batches to be listed, and calculated batch totals to be presented for checking.

7.1.1.2 Data batching. Define an appropriate size of input batch for each type of input. This would depend on the frequency of data errors, but would normally be about 50 records per batch. A high incidence of data errors requires the use of a small batch size if errors are to be isolated and corrected speedily.

Define the significant totals to be provided with each type of input batch, and:

- Prepare appropriate stationery.
- Train personnel to prepare this control total information.

Train Data Control personnel in the work involved in checking batch totals and the correction procedures to be adopted.

7.1.1.3 Special output control. Define the output documents for which special protection against fraud is desirable.

Define the pre-printed numbering systems to be applied and the formats to be used.

Modify the programs for the use of pre-numbered output documents.

Define the data control procedures to be applied in dealing with the pre-numbered documents.

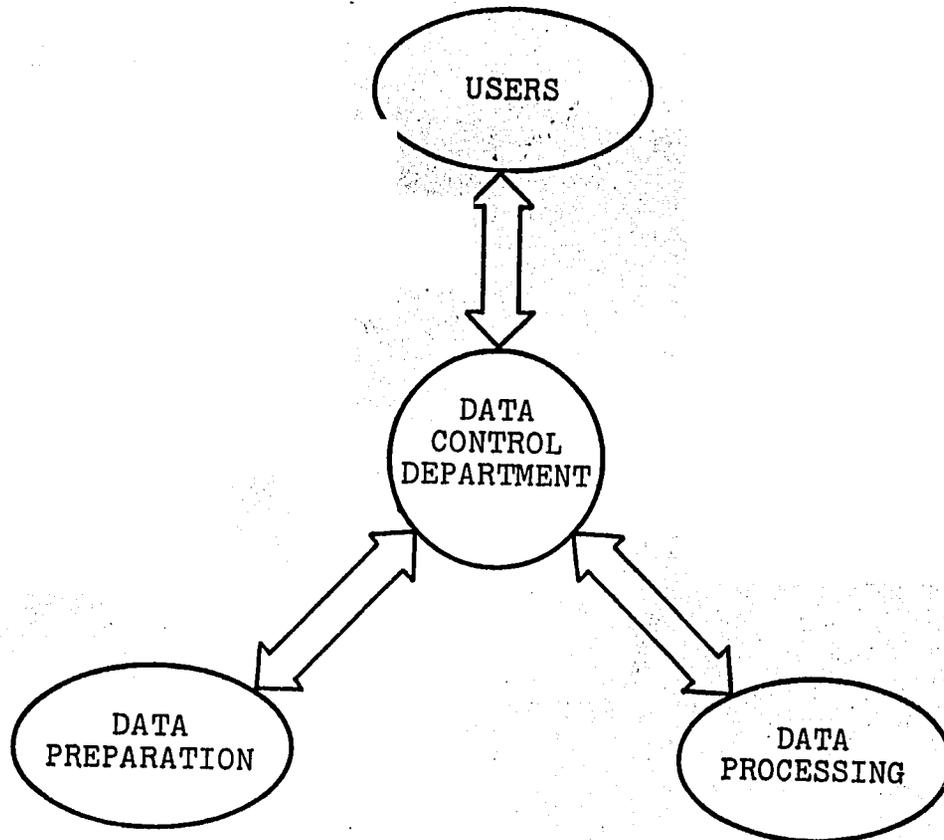
### 7.1.2 Data Control Department

Data control departments should be set up at GOGCWS, AWGA and SCA. The heads of these departments would report directly to the data processing managers. It is in the interests of the Data Processing Manager to ensure that all data supplied for processing is in the correct format and that data preparation errors have not been overlooked. The concept of service to user departments must be promoted effectively and data control checks will enhance this.

The main responsibilities of the Data Control Department would be to:

- Control the flow of all data and information within the whole area of data processing.
- Ensure that information received from user departments for processing is:
  - . Legible.
  - . In a suitable format for quick and accurate data preparation.
  - . Accompanied by all necessary control information enabling the accuracy of subsequent processing to be verified readily.
- Request and monitor data preparation and processing as required:
  - . All data preparation and processing work would be issued through the Data Control Department, and the results of the work would be returned to the Data Control Department.
  - . Records showing the dates of issue and receipt would be maintained, together with details of all errors found.
- Carry out checks at appropriate stages during the processing, to ensure that accuracy is being maintained. The Data Control Department would be authorized to demand re-punching or re-processing of data as they consider necessary.
- Carry out special investigations as necessary regarding data problems.

In essence the Data Control Department would act as the main link between users and the Data Preparation and Data, as Processing Departments, as shown below:



### 7.1.3 Presentation of Prime Information

The prime information supplied by user departments is not in a format which permits speedy and reliable data preparation.

7.1.3.1 Problems. Among the main problems which have been noted are:

Meter reading data is currently provided in book form, with about one hundred pages per book:

- . At GOGCWS and SCA punch operators may miss readings.
- . Control total information is difficult to prepare.
- . It is undesirable to use batches of data containing such a large number of records.

- Payroll data is provided on sheets designed for manual payroll preparation.
- The data written on the input document may not be in the same format as that in which it should be punched.
- The key-punching positions to be used are not specified on the input documents.
- Space is not currently available for inserting control totals on documents.

7.1.3.2 Recommendations. The four main recommendations are:

- All input documents supplied to the Data Preparation Department should be in the form of individual sheets. This implies that meter reading data should be either directly written on these sheets or transcribed from the meter reading books.
- Each input document should contain formalized spaces for the insertion of control totals.
- The input documents should define:
  - . The keypunching positions for each element of data.
  - . The control totals to be applied.
- Standard information should be pre-printed on the input form.

In order to implement these recommendations it is necessary to carry out the following actions:

- All main input documentation should be revised to provide details of:
  - . Key-punching position to be used.
  - . Data formats.
  - . Control totals.
  - . Standard information to be punched.
- Procedures should be defined for inserting meter reading data on these sheets, while maintaining the use of the meter reading books as a source of speedy reference when customer inquiries arise.

## 7.2. OTHER RECOMMENDATIONS - GOGCWS

The main short-term recommendations made specifically concerning GOGCWS are in regard to:

- Management of data preparation operations.
- Lack of written data formats and procedures.
- Unreliability of present equipment.
- Maintenance of detailed records of processing work.

### 7.2.1 Management of Data Preparation Operations

A formalized system should be introduced in the Data Preparation Department to record and control the performance of work.

For each batch of work received, records should be maintained concerning its performance, detailing:

- Type of work.
- Batch number.
- Date of receipt of batch.
- Number of records in batch.
- Name of punch/verifier operator.
- Number of punching errors found.
- Date of completion of batch preparation.
- Date of submission for processing.

A loose-leaf system should be perfectly adequate for this type of record and will enable good control to be maintained without a great deal of effort.

At the end of each week the Data Preparation Supervisor should prepare a report for the Data Processing Manager that summarizes details of the work done during the week and showing a weekly performance index which relates the work actually achieved to the man days of effort used.

#### 7.2.2 Lack of Written Data Formats and Procedures

A set of manuals should be prepared, specifying all details of files, data input, data output, processing and schedules involved. A separate manual should be prepared for each application.

As an initial step, one of the two punchroom supervisors should define the data preparation procedures, and one of the machine room supervisors should do likewise for the machine operations.

#### 7.2.3 Unreliability of Present Equipment

Investigations should start immediately to correct the equipment problems that undermine the whole concept of reliable data processing.

The steps which should be taken are:

- Maintain a detailed log of all equipment failures.
- Analyze the failure log to ascertain which items of equipment are prone to failure and the specific types of failure occurring.
- Contact the equipment supplier and request immediate action to be taken to eliminate these faults.
- If immediate action is not forthcoming contact a reputable computer service bureau and ascertain whether computer facilities can be applied to those processing operations affected most by the present equipment failures. In a punched card installation the major procedures involved are generally carried out by three separate pieces of equipment for sorting, calculating and tabulating. It may be possible to utilize external services to carry out specific elements of processing to reduce the load on one or more of these pieces of equipment, e.g., cards prepared in the installation could be printed on equipment at an external computer bureau.

#### 7.2.4 Maintenance of Detailed Records Of Processing Work

A log should be maintained for each item of processing equipment, enabling each element of processing work to be recorded and subsequently analyzed.

The equipment log should record, for each job carried out:

- Type of equipment.
- Date.
- Job type, or reason for idle time.
- Time started.
- Time finished.
- Problems occurring, if any.
- Operator's signature.

At the end of each week and each month a report should be prepared for the Data Processing Manager covering each item of equipment.

#### 7.3 OTHER RECOMMENDATIONS - AWGA

The main short-term recommendations specifically concerning AWGA are in regard to:

- The present high unit costs of processing using the new NCR 399 and 499 machines.
- The necessity for ensuring that the payroll and stock accounting procedures remain operational despite the increase in the breakdown rate of the NCR 500 machine.
- Providing selected AWGA personnel with training in the operations and capabilities of the NCR 399 and 499 machines.

### 7.3.1 Present High Processing Costs

The high unit costs of processing arise because the equipment is:

- Expensive, and is incurring high maintenance costs.
- Not ideally suited for fast handling of large amounts of data.
- Being applied as if it were a batch-processing computer.
- Not working to full capacity because of a lack of operators.

Three sets of actions should be taken, namely:

- Enter into discussions with NCR with the objective of re-negotiating price levels, if possible.
- Carry out detailed investigations, with the assistance of NCR and external experts if available, to improve the processing speed of the billing operation. This could involve:
  - . Modifying the processing strategy applied.
  - . Doing some operations simultaneously instead of consecutively.
  - . Increasing the speed at which individual operations are done.
  - . Eliminating wasted processing time when power failures occur during the printing operations.
- . Make certain that the machines operate at their full capacity and are loaded with additional work by:
  - . Applying additional staff as machine operators.
  - . Ensuring that all operators work effectively.

### 7.3.2 Payroll and Stock Accounting Operations

It is of prime importance that the payroll procedures should be reliable at all times, and the deficiencies of the NCR 500 must not be allowed to interfere with this requirement.

Three sets of actions should be taken, namely:

- If possible, obtain a commitment from NCR that a continuing high level of maintenance support will be available in the future. Detailed records of all failures should be maintained by AWGA to support any requests which may be necessary to improve the quality of the service.
- Determine the feasibility of transferring payroll work to one of the NCR 399 or 499 machines once additional capacity has been made available. It is most important that the systems analyst who prepared the payroll programs for the NCR 500 should be involved in this study.
- Contact any other NCR 500 users in the area and enter into a mutual back-up agreement.

### 7.3.3 Develop NCR 399 and 499 Expertise Within AWGA

The present lack of knowledge within AWGA concerning the NCR 399 and 499 equipment is restrictive and causes concern. NCR should be approached to provide training and appropriate documentation so that AWGA employees are able to prepare and run programs on these machines.

7.4 OTHER RECOMMENDATIONS -  
SCA

Since the computer department of SCA provides services in all areas of the Authority the recommendations are restricted to those considered desirable for water billing and accounting.

The Computer Department should hold discussions with the users of the water billing and accounting output so that any additional user needs can be determined. It is possible to provide additional statistical information and thereby eliminate some clerical effort currently expended.

Consideration should also be given to remote preparation of data at Port Said and Suez, using data preparation equipment with checking facilities. This will greatly improve the accuracy of data preparation and reduce the delays which currently occur before users obtain accurate output.

PROCESSING ANALYSES FOR NCR 399  
AND 499 MACHINES AT AWGA

In view of the high unit costs of bill preparation using the NCR 399 and 499 machines, an analysis for this activity has been made. Details of processing speeds for the various types of runs involved are shown in Table A1.1.

TABLE A1.1

CURRENT PROCESSING RATES (NCR 399 AND 499)  
FOR AUTOMATED MAIN OFFICE CUSTOMER ACCOUNTING

Processing Runs	NCR 399		NCR 499	
	Number of Records Per Hour	Minutes Per Record	Number of Records Per Hour	Minutes per Record
Entry of Meter Reading Data	300	0.20	400	0.15
Printing Bills and Collection Lists	110	0.55	170	0.35
Entry of Collectors' Payment Data	450	0.13	600	0.10
Entry of Cashiers' Payment Data	200	0.30	300	0.20
Updating Customer Ledger Cards	250	0.24	350	0.17
Additions, Deletions and Changes	300	0.20	300	0.20

Source: Processing Supervisor

On the basis of this information an estimate has been made of the minimum number of machines required to carry out this work for Moharem Bey accounts, at two-month intervals, and for both Moharem Bey and El Gomrok accounts, at one-month intervals. These estimates are shown in Tables A1.2 and A1.3, and indicate that although the present work load (Moharem Bey at two-month) can be accommodated comfortably, the four-fold increase of work involved in adding the El Gomrok accounts and providing bills at monthly intervals will almost create an overload situation.

TABLE A1.2

CURRENT MONTHLY BILLING LOAD ON NCR 399 AND 499 MACHINES  
(Moharem Bey At Two-Month Intervals)

Activity	Percent of Records	Number of Records	NCR 399		NCR 499	
			Minutes Per Record	Machine Hours Required Per Month	Minutes Per Record	Machine Hours Required Per Month
Entry of Meter Reading Data	100%	22,500	0.2	75	0.15	57
Printing Bills and Lists	100	22,500	0.55	206	0.35	131
Entry of Collectors' Payment Data	85	19,125	0.13	42	0.1	32
Entry of Cashiers' Payment Data	15	3,375	0.3	17	0.2	12
Updating Customer Ledger Cards	100	22,500	0.24	90	0.17	64
Additions, Deletions and Changes	2	500	0.2	2	0.2	2
Total				432		298
Total Basic Machine Hours				432		298
Allowance for Operator Breaks and Other - 20%				86		60
				<hr/> 518		<hr/> 358
Allowance for Breakdowns - 10%				52		36
Total				570		394
Number of Fully-Staffed Machines Required, at 300 Available Hours/Month (Two Shifts)				1.90		1.31
Average Time Per Meter Reading				1.52 Min. 1 min., 31 sec.		1.05 min. = 1 min., -3-sec.

PROCESSING ANALYSES FOR NCR 399  
AND 499 MACHINES AT AWGA

TABLE A1.2  
CURRENT MONTHLY BILLING LOAD ON NCR 399 AND 499 MACHINES  
(Morarem Bey And El Gomrok At One-Month Intervals)

Activity	Percent of Records	Number of Records	NCR 399		NCR 499	
			Minutes Per Record	Machine Hours Required Per Month	Minutes Per Record	Machine Hours Required Per Month
Entry of Meter Reading Data	100%	90,000	0.2	300	0.15	228
Printing Bills and Lists	100	90,000	0.55	825	0.35	525
Entry of Collectors' Payment Data	85	76,500	0.13	166	0.1	128
Entry of Cashiers' Payment Data	15	13,500	0.3	68	0.2	48
Updating Customer Ledger Cards	100	90,000	0.24	360	0.17	256
Additions, Deletions and Changes	2	2,000	0.2	8	0.2	8
Total				1,727		1,193
Total Basic Machine Hours				1,727		1,193
Allowance for Operator Breaks and other - 20%				346		239
				2,073		1,432
Allowance for Breakdowns - 10%				207		143
Total				2,280		1,575
Number of Fully-Staffed Machines Required, at 300 Available Hours/Month (Two Shifts)				7.60		5.25
Average Time Per Meter Reading				1.52 min. = 1 min., 31 sec.		1.05 min. = 1 min., 3 sec.

PROCESSING ANALYSES FOR NCR 399 AND 499 MACHINES AT AWGA

CONCEPTUAL OUTLINES OF COMPUTER PROCEDURES

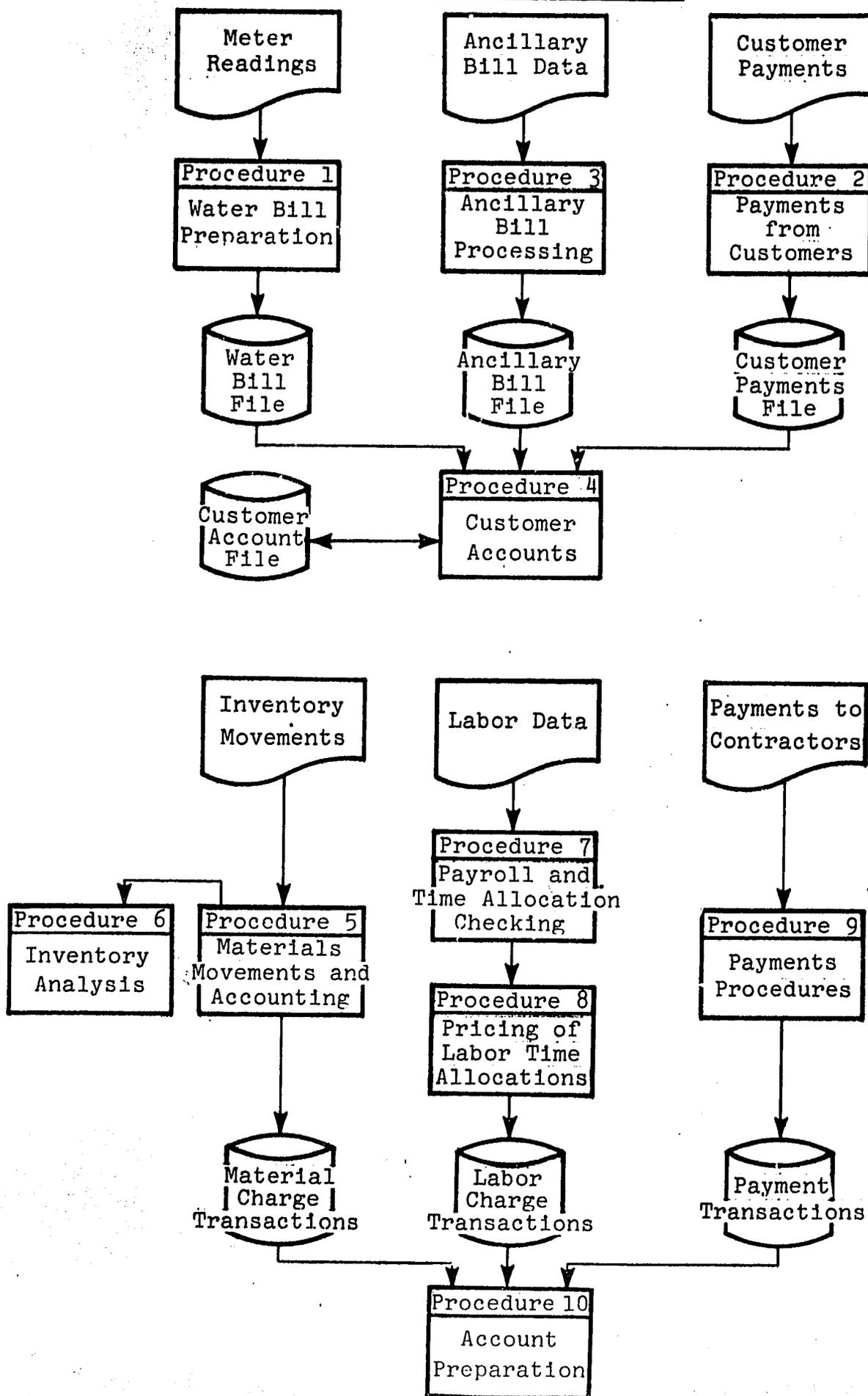
These outlines of computer procedures are conceptual in nature and are intended to enable the general size of the equipment required to be determined. They should not be considered as a definitive design for the systems.

They are presented under the following subject headings:

- Flowchart of Procedures
- Processing Frequencies for Conceptual Systems
- Outline Process Diagrams
- Summary of Current Data Volumes

CONCEPTUAL OUTLINES OF COMPUTER PROCEDURES

Flowchart of Procedures



PROCESSING FREQUENCIES FOR CONCEPTUAL SYSTEMS

Procedure	Processing Frequency					
	As Necessary	Weekly	Two Weeks	Monthly	Six Months	Annually
1. Water Bill Preparation and Statistics	-Check input data against files.  -Print details of data errors to be corrected.	-Check input data against files.  -Print details of data errors to be corrected.	-Print: . Bills. . Collection lists. . Consumption statistics.			-Print analyses and reports.
2. Payments from Customers	-Check input data against files.  -Print details of data errors to be corrected.	-Check input data against files.  -Print details of data errors to be corrected.	-Print details of payments received and payment statistics.			-Print analyses and reports.
3. Ancillary Bills	-Check input data against files.  -Print details of data errors to be corrected.	-Check input data against files.  -Print details of data errors to be corrected.	-Print details of valid billing data.			-Print analyses and reports.
4. Customer Accounts and Statistics			-Update customer accounts.  -Print account reports and statistics.			-Print analyses and reports.

PROCESSING FREQUENCIES FOR CONCEPTUAL SYSTEMS (Cont'd)

Procedure	Processing Frequency					
	As Necessary	Weekly	Two Weeks	Monthly	Six Months	Annually
5. Materials Movements and Accounting	<ul style="list-style-type: none"> <li>-Check input data against files.</li> <li>-Print details of data errors to be corrected.</li> </ul>	<ul style="list-style-type: none"> <li>-Check input data against files.</li> <li>-Print details of data errors to be corrected.</li> <li>-Update inventory file.</li> <li>-Print movement reports.</li> </ul>		<ul style="list-style-type: none"> <li>-Inventory checking procedures and reports.</li> </ul>		<ul style="list-style-type: none"> <li>-Print analyses and reports.</li> </ul>
6. Inventory Analyses and Statistics				<ul style="list-style-type: none"> <li>-Prepare item lists for inventory checks.</li> </ul>	<ul style="list-style-type: none"> <li>-Prepare inventory analyses reports and statistics.</li> </ul>	<ul style="list-style-type: none"> <li>-Prepare inventory valuation and usage report.</li> </ul>
7. Payroll and Time Allocation Checking	<ul style="list-style-type: none"> <li>-Check input data against files.</li> <li>-Print details of data errors to be corrected.</li> </ul>	<ul style="list-style-type: none"> <li>-Check input data against files.</li> <li>-Print details of data errors to be corrected.</li> </ul>		<ul style="list-style-type: none"> <li>-Calculate payroll.</li> <li>-Update files.</li> <li>-Print payroll documentation and analyses.</li> </ul>		<ul style="list-style-type: none"> <li>-Print end-of-year analyses and reports.</li> </ul>

PROCESSING FREQUENCIES FOR CONCEPTUAL SYSTEMS (Cont'd)

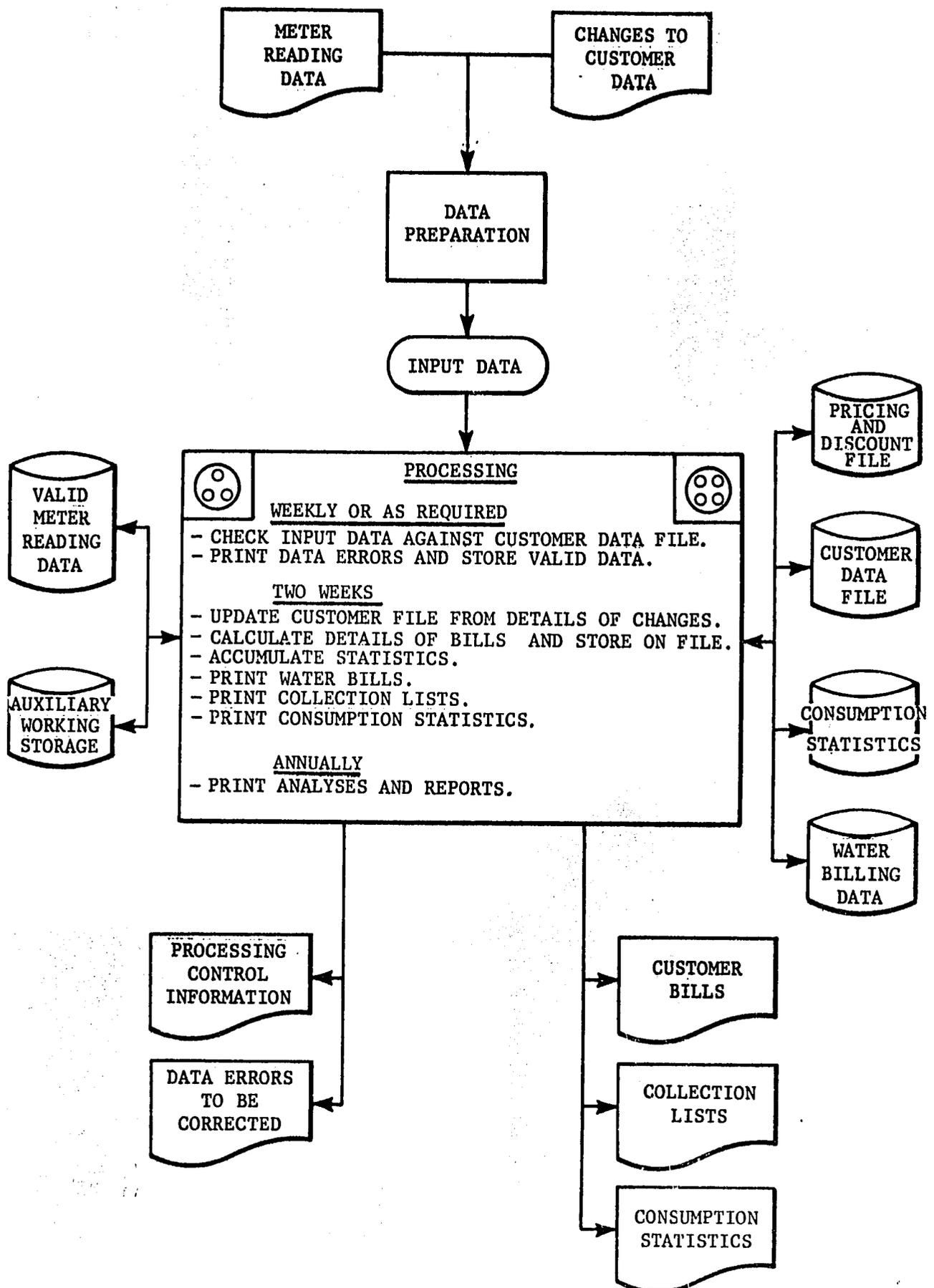
Procedure	Processing Frequency					
	As Necessary	Weekly	Two Weeks	Monthly	Six Months	Annually
8. Pricing of Labor Time Allocations				-Allocate payroll costs to accounts.  -Print cost collection details.		
9. Payments		-Check input data against files.  -Print details of data errors to be corrected.		-Update payment files.  -Print contractor and account listings.		-Print analyses and reports.
10. Preparation of Accounts				-Update account files.  -Print monthly accounting reports.		-Print annual accounting reports.

CONCEPTUAL OUTLINES OF COMPUTER PROCEDURES

Outline Process Diagrams

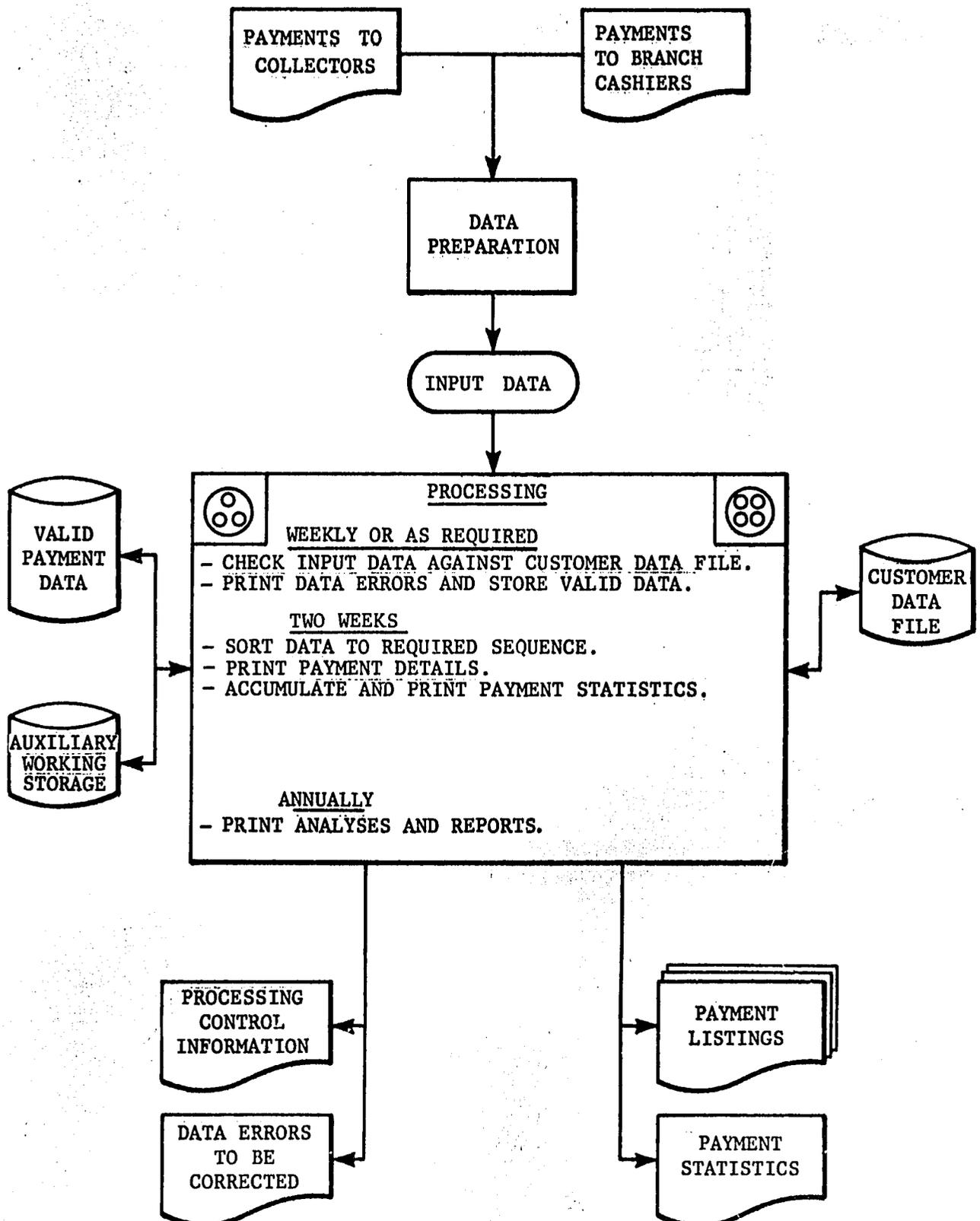
- Water Bill Preparation and Statistics
- Payments from Customers and Statistics
- Customer Ancillary Bill Processing
- Customer Accounts and Statistics
- Materials Movements and Accounting
- Inventory Analysis and Statistics
- Payroll and Time Allocation Checking
- Pricing of Labor Time Allocations
- Payments to Contractors
- Account Preparation

CONCEPTUAL OUTLINES OF COMPUTER PROCEDURES  
Outline Process Diagram-Water Bill Preparation and Statistics

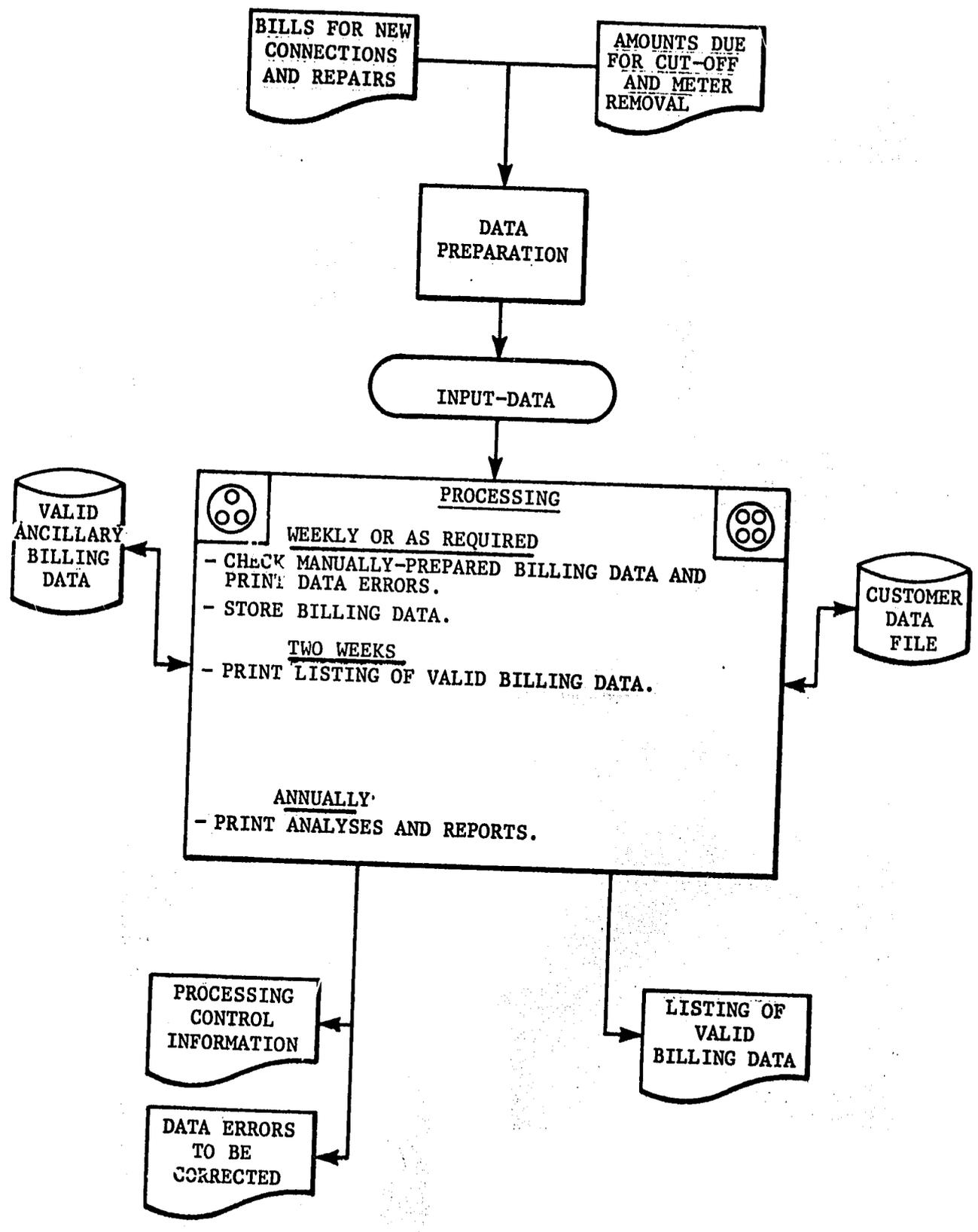


CONCEPTUAL OUTLINES OF COMPUTER PROCEDURES

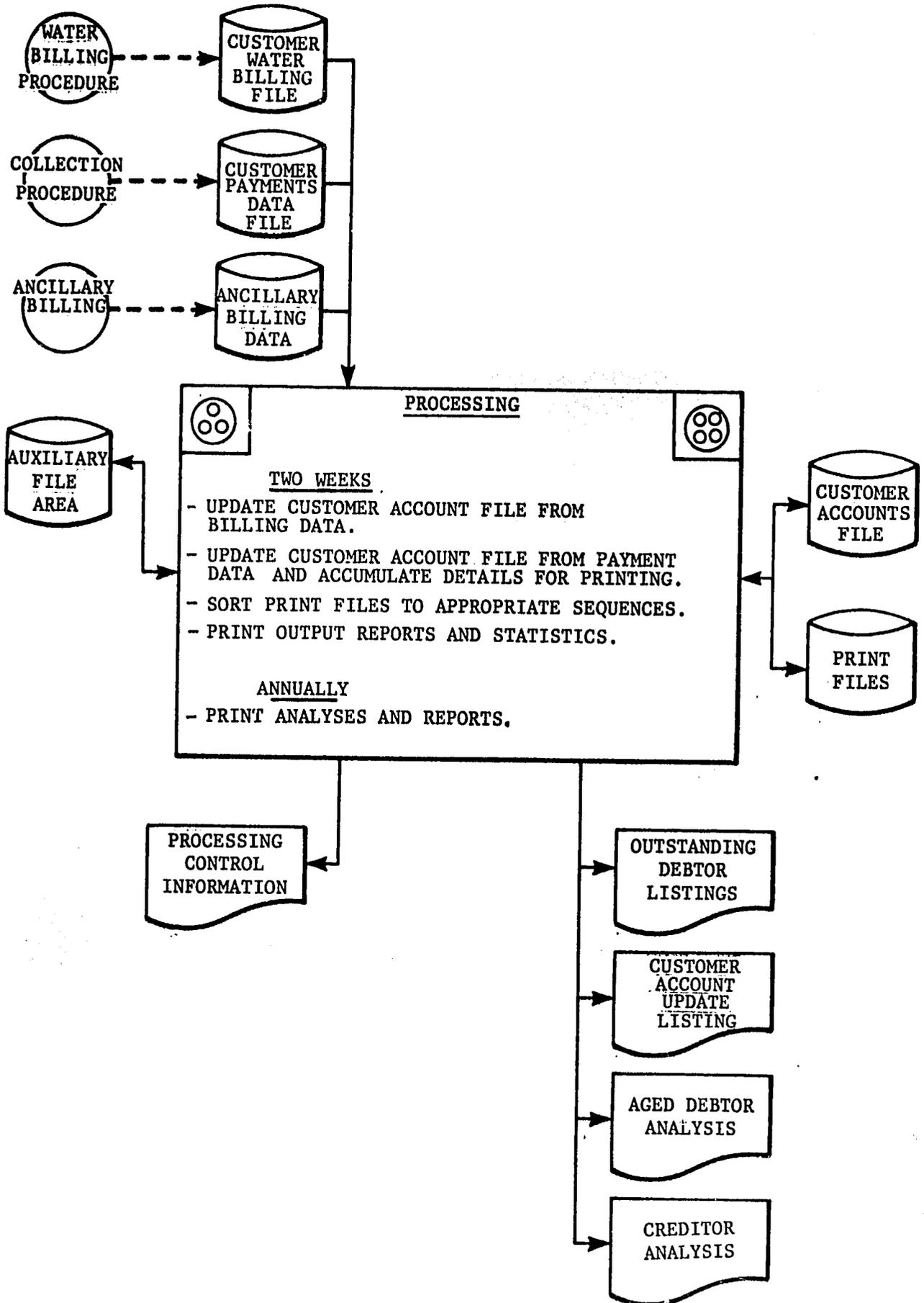
Outline Process Diagram- Payments From Customers and Statistics



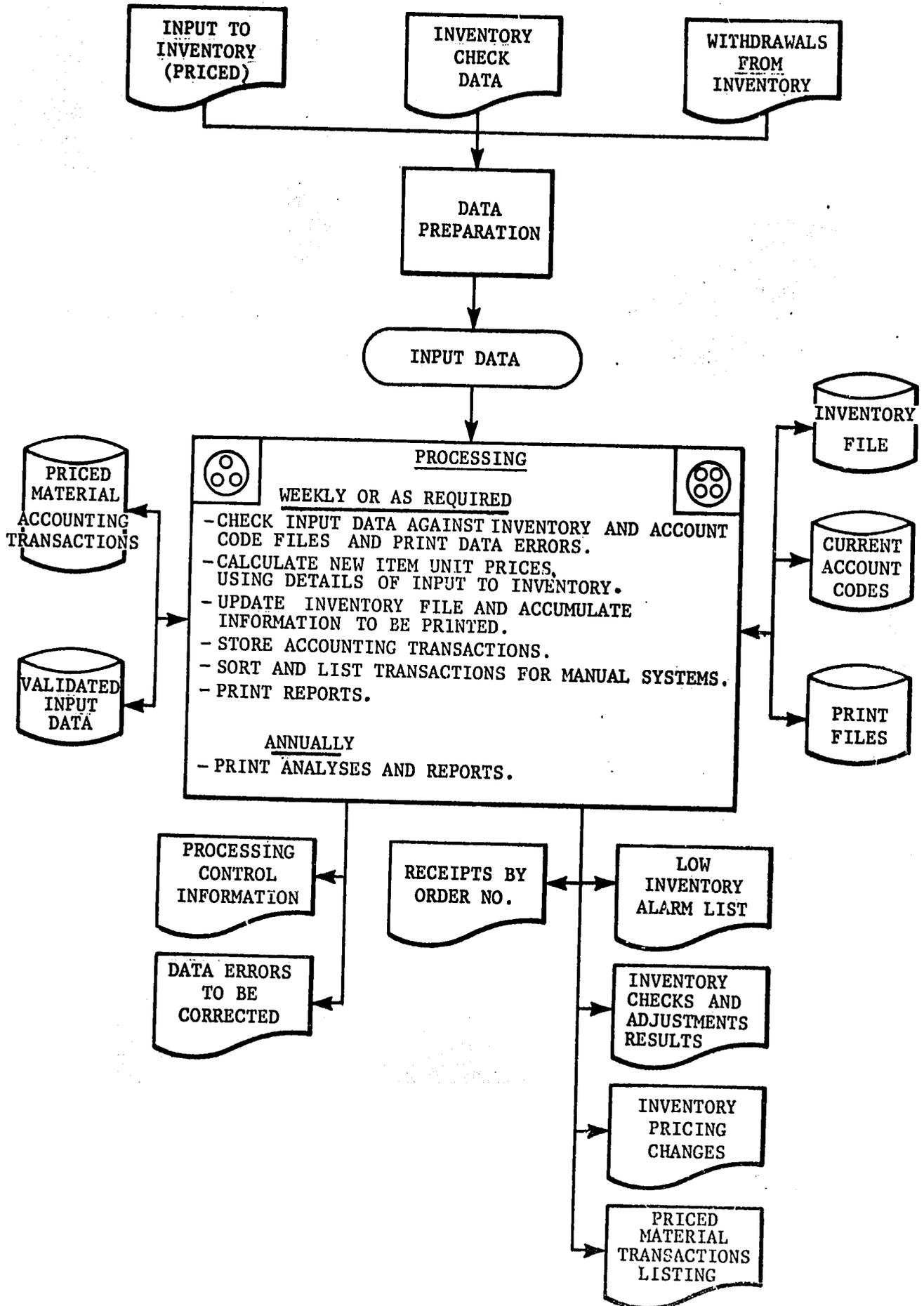
CONCEPTUAL OUTLINES OF COMPUTER PROCEDURES  
Outline Process Diagram- Customer Ancillary Bill Processing



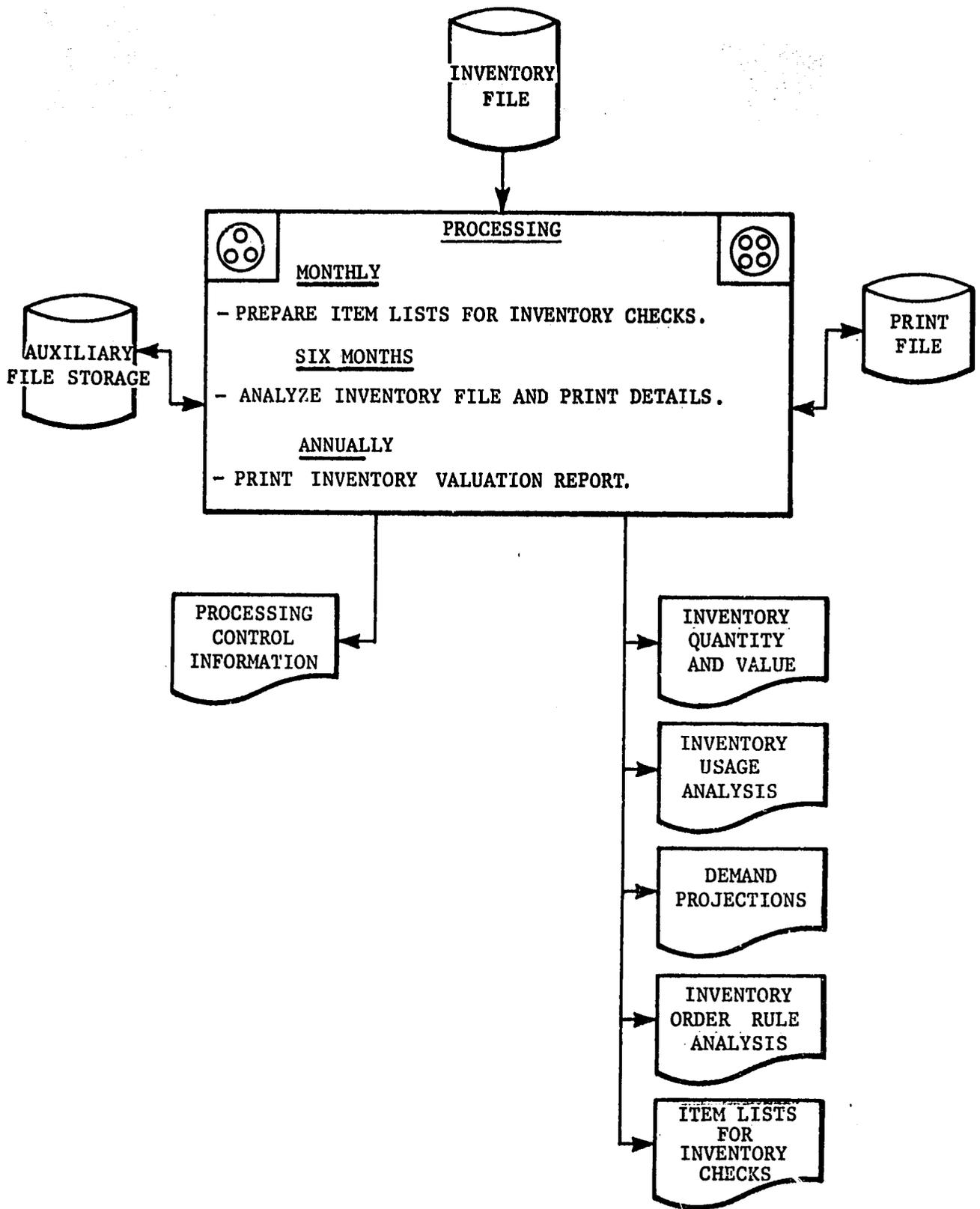
CONCEPTUAL OUTLINES OF COMPUTER PROCEDURES  
Outline Process Diagram- Customer Accounts and Statistics



CONCEPTUAL OUTLINES OF COMPUTER PROCEDURES  
Outline Process Diagram- Materials Movement and Accounting

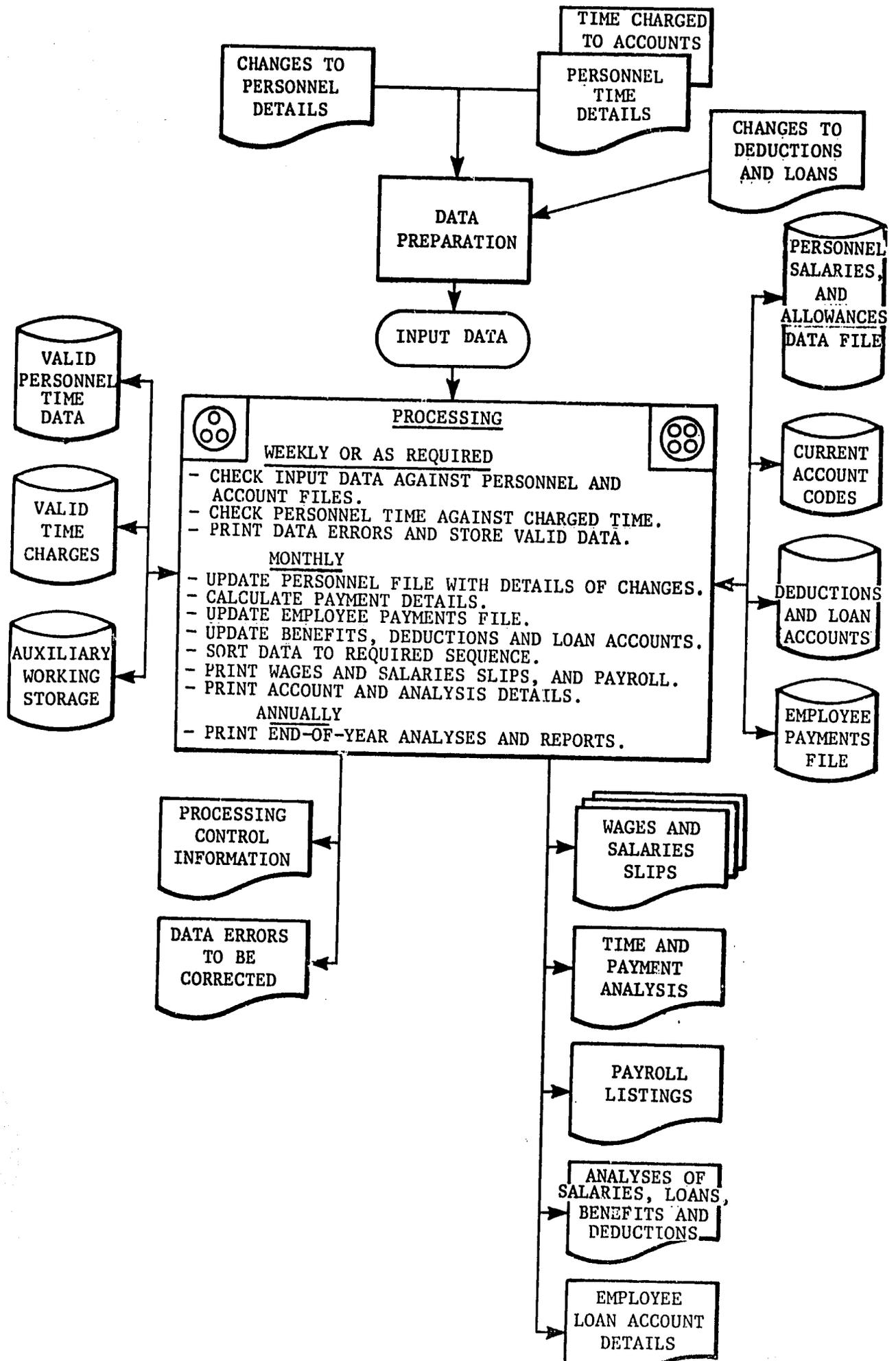


CONCEPTUAL OUTLINES OF COMPUTER PROCEDURES  
Outline Process Diagram- Inventory Analysis and Statistics

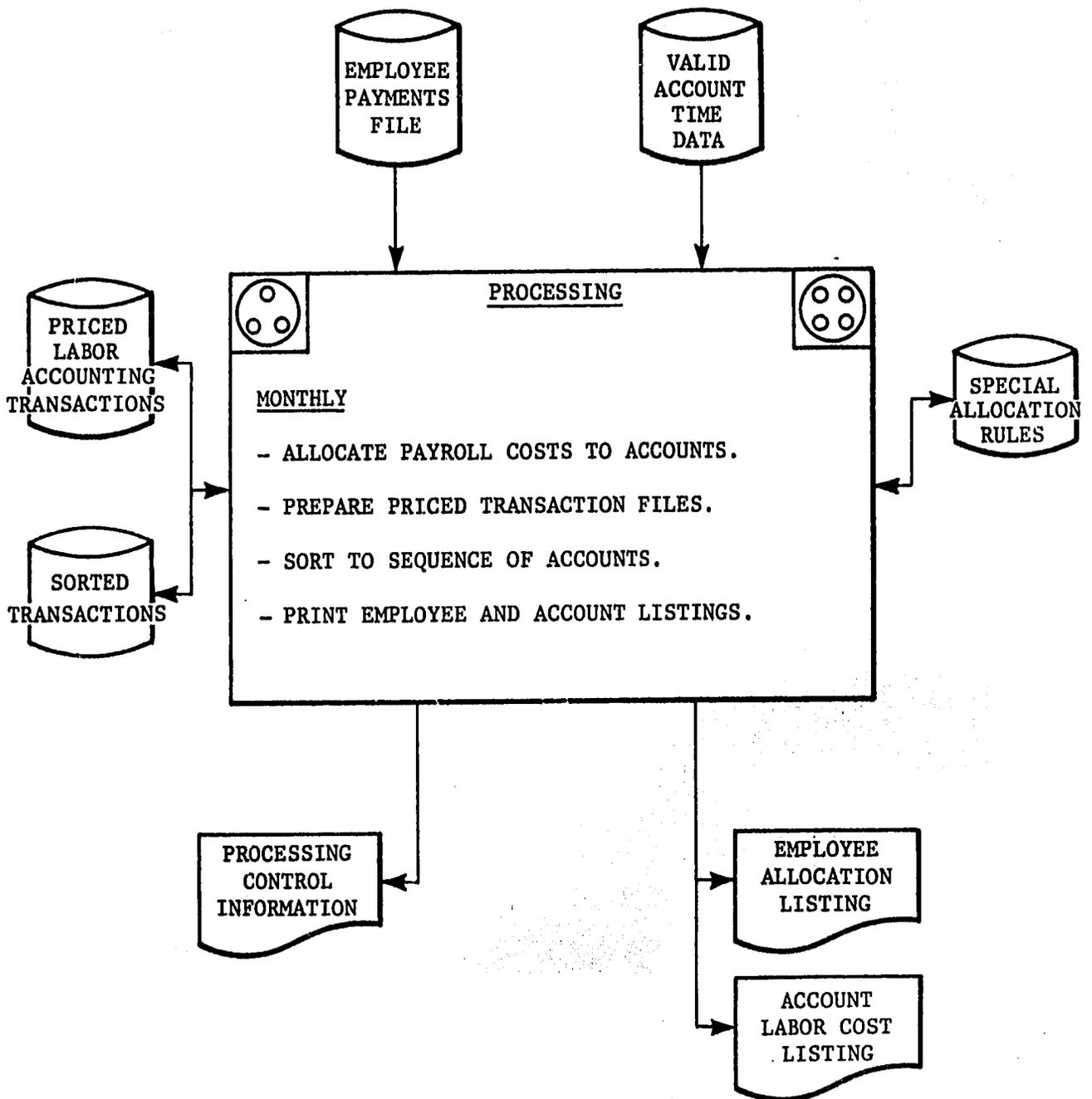


CONCEPTUAL OUTLINES OF COMPUTER PROCEDURES

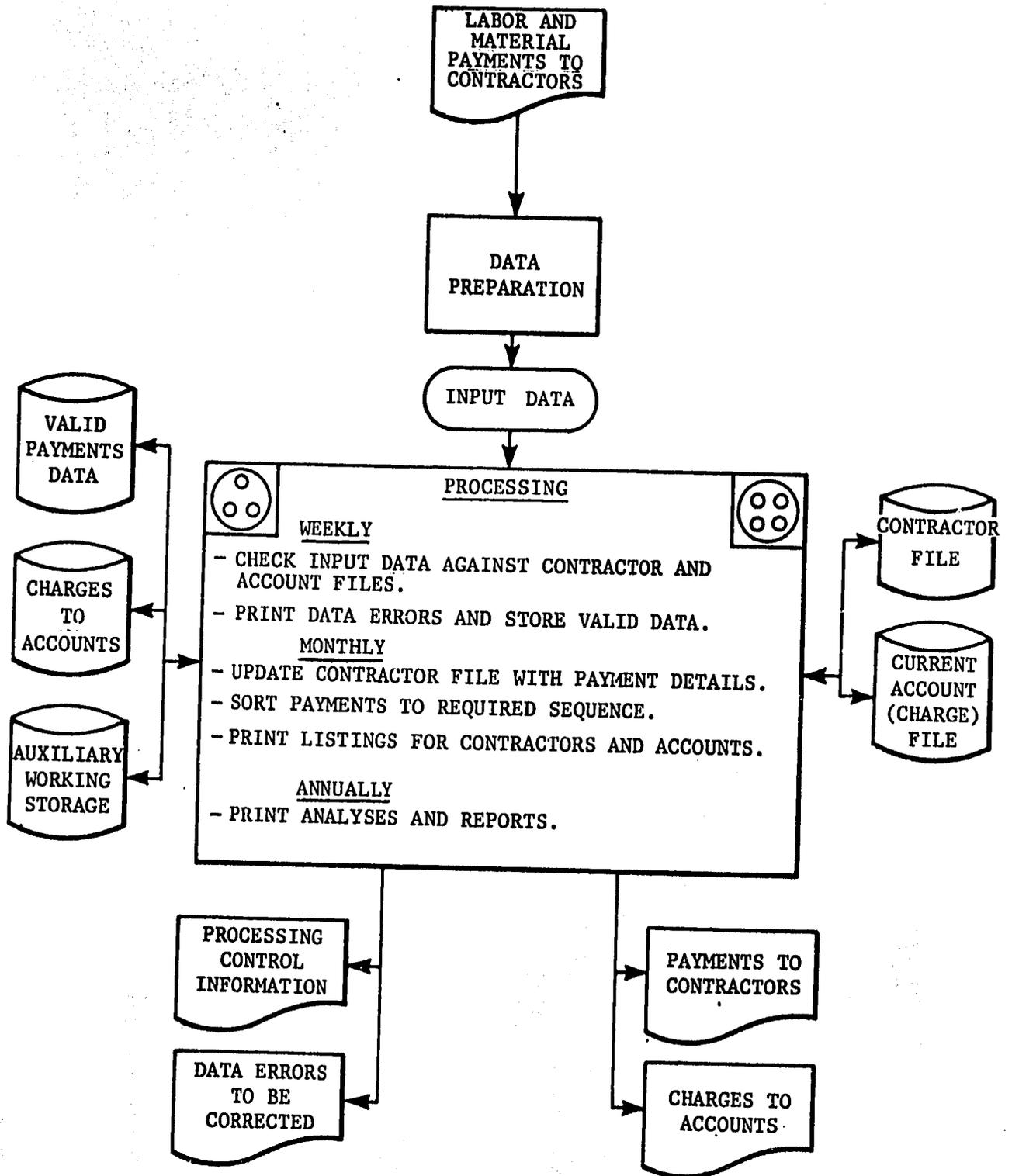
Outline Process Diagram- Payroll and Time Allocation Checking



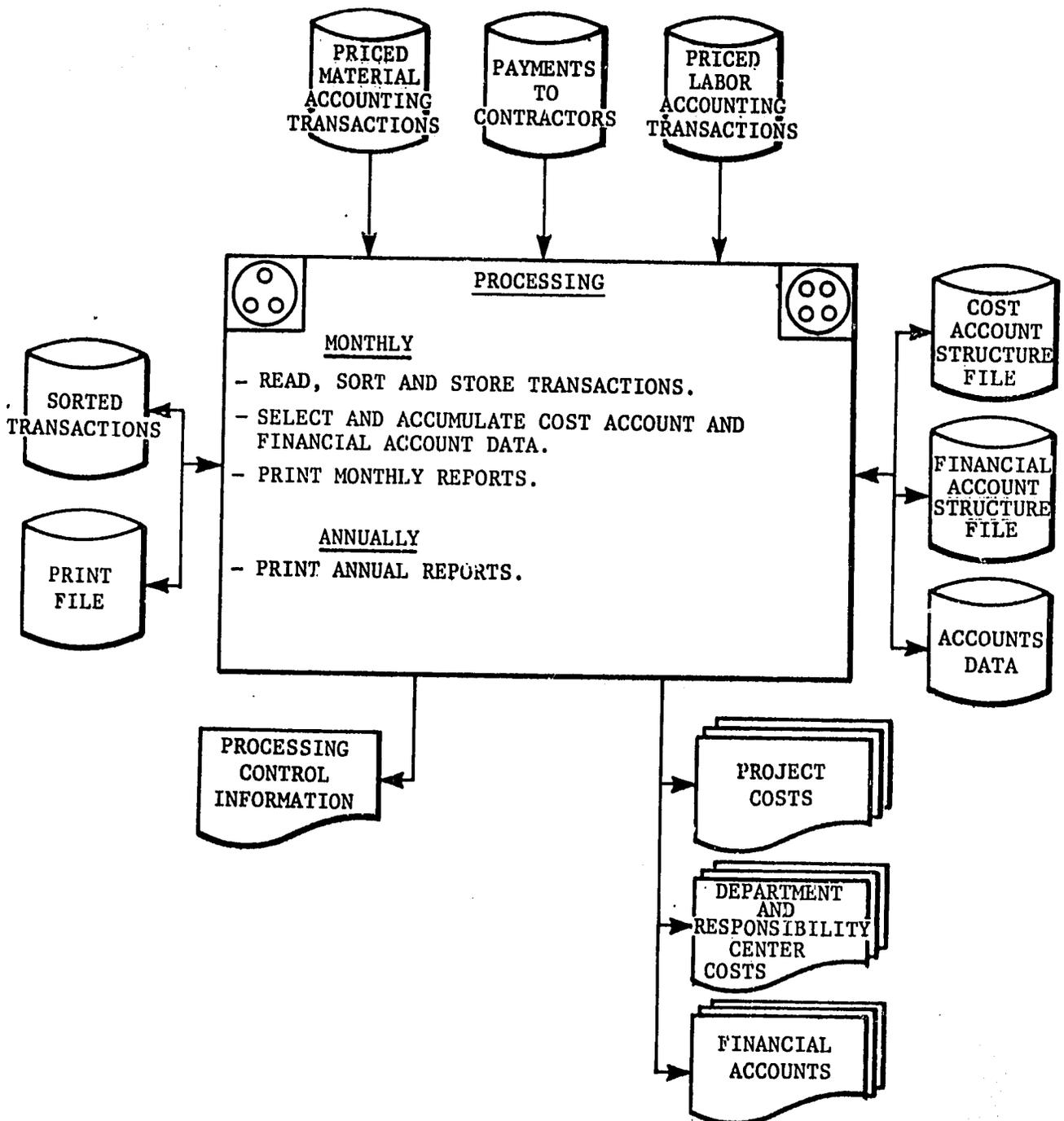
CONCEPTUAL OUTLINES OF COMPUTER PROCEDURES  
Outline Process Diagram- Pricing of Labor Time Allocations



CONCEPTUAL OUTLINES OF COMPUTER PROCEDURES  
Outline Process Diagram- Payments to Contractors



CONCEPTUAL OUTLINES OF COMPUTER PROCEDURES  
Outline Process Diagram-Account Preparation



SUMMARY OF CURRENT DATA VOLUMES

INPUT AND OUTPUT (Millions of Characters and Lines)

FREQUENCY	GOGCWS		AWGA		SCA		GOSSD	
	Input Characters	Output Lines of Print						
Weekly	2.6	.1	1.9	.08	.44	.02	1.3	.04
Two-Weekly	—	.47	—	.47	—	.28	—	—
Monthly	.2	.45	.08	.20	.08	.13	.08	.46
Six-Monthly	—	.17	—	.06	—	.06	—	.06
Annually	—	.18	—	.08	—	.06	—	.13

MAIN FILE SIZES

Description of File	Main File Size - Millions of Characters			
	GOGCWS	AWGA	SCA	GOSSD
Water Billing File	25.6	25.3	2.2	—
Water Accounts File	14.7	14.4	1.4	—
Inventory File	7.3	2.7	2.7	2.7
Payroll File	3.9	1.6	0.8	4.1

STAFF AVAILABLE FOR REASSIGNMENT

Staff could be made available for reassignment by introduction of the proposed computer procedures. Analyses have been carried out at GOGCWS, AWGA and GOSSD which show that over 600 staff could be made available in this way for other work as shown in Tables A3.1 - A3.4 below and on the following page.

TABLE A3.1  
STAFF FOR REASSIGNMENT-GOGCWS

<u>Type of Work</u>	<u>Current Staff</u>	<u>Proposed Staff</u>	<u>Staff for Reassignment</u>
Data Preparation	20	- (1)	20
Data Processing (Punched Cards)	13	- (1)	13
Water Billing and Accounting			
- Private Water	121	69	52
- Private New Connections and Repairs	31	26	5
- Private Payments and Accounts	106	76	30
- Governmental	33	19	14
Subtotal	291	190	101
Payroll			
- Preparation	72	51	21
- Audit	16	7	9
Subtotal	88	58	30
Inventory Accounting	39	16	23
Inventory Control	46	40	6
General Accounting	143	119	24
Total	640	423	217

Note: (1) To be drawn from the 217 staff for reassignment.

TABLE A3.2

STAFF FOR REASSIGNMENT-AWGA

<u>Type of Equipment or Activity</u>	<u>Number of Direct Staff</u>	<u>Number of Ancillary Staff</u>	<u>Proposed Staff</u>	<u>Total Staff for Reassignment</u>
<u>Data Preparation and Processing</u>				
NCR 399 and 499	17	8	-	25
NCR 500	7	14	-	21
<u>Payroll and NCR 32</u>				
- Head Office	9	19	-	28
- Branches	28	59	-	87
<u>Addressograph</u>				
- Head Office	7	-	-	7
- Branches	14	-	-	14
Subtotal	82	100	- (1)	182
<u>General Accounting</u>				
- Costing Department	7	-	3	4
- Accounts Department	24	-	6	18
- Budgeting Department	7	-	2	5
Subtotal	38	-	11	27
Total	120	100	11	209

Note: (1) To be drawn from the 209 staff for reassignment.

TABLE A3.3

STAFF FOR REASSIGNMENT-GOSSD

Type of Work	Current Staff			Proposed Staff			Staff for Reassignment
	Central	Cairo	Alexandria	Central	Cairo	Alexandria	
<u>Payroll</u>							
- Payroll Preparation (except Central Department)	-	93	15	-	47	8	53
- Central Payroll Preparation and Administration Audit	28	-	-	7	-	-	21
- Payroll Audit (Finance Department)	15	-	5	4	-	2	14
- Pension Preparation and Analysis	10	-	9	2	-	2	15
- Personnel Leave Records	5	24	3	2	6	1	23
Subtotal	58	117	32	15	53	13	126
<u>Inventory Control and Accounting</u>	34	-	17	17	-	9	25
<u>General Accounting</u>	22	-	18	6	-	5	29
Total	114	117	67	38	53	27	180(1)

Note: (i) Includes staff that would be assigned to operating the new computer procedures.

STAFF AVAILABLE FOR REASSIGNMENT

STAFF AVAILABLE FOR REASSIGNMENT

TABLE A3.4

SUMMARY OF STAFF FOR REASSIGNMENT

<u>Type of Work</u>	<u>GOGCWS</u>	<u>AWGA</u>	<u>GOSSD</u>
Current Data Preparation	20	82	-
Current Data Processing	13		-
Water Billing and Accounting	101	100	-
Payroll and Time Allocation	30		126
Inventory Control and Accounting	29		25
General Accounting	24	27	29
Total	<u>217 (1)</u>	<u>209 (1)</u>	<u>180 (1)</u>

Note: (1) Includes staff that would be assigned to operating the new computer procedures.

STAFF AVAILABLE FOR REASSIGNMENT

The new procedures will require staff for operation. The personnel required could be drawn from the staff to be reassigned if their educational qualifications and experience are suitable. The staff required to prepare data at the authorities and to operate a centralized installation in Cairo required for the needs of GOGCWS, AWGA and GOSSD are shown in Table A3.5 below.

TABLE A3.5  
NEW STAFF REQUIREMENTS

<u>Staff Required</u>	<u>GOGCWS</u>	<u>AWGA</u>	<u>GOSSD</u>	<u>Total</u>
<u>At Main Offices of Authorities</u>				
Data Preparation Staff	14	10	7	31
Data Control Staff	5	4	3	12
	19	14	10	43
At Central Computer Location				10
Total Requirement				53

EVALUATION OF FEATURES  
FOR COMPUTING FACILITIES

This Appendix includes an evaluation of the following features for computing facilities:

- Communications.
- Computer locations.
- Data preparation.
  - . Media and equipment.
  - . Locations.
- Computer operations staff.
- Ownership of the computer facilities.
- Control and management of computing operations.
- Use of other equipment at branches.

Communications

Options. In any information system it is necessary to decide how information should be transmitted between points in the system. Data is collected at various locations, transmitted for processing and then the processed information is transmitted to the locations at which it will be used. The two basic methods of communication which can be considered are:

- Physical transportation
- Telecommunications.

Physical transportation of data depends for its speed and reliability on the method of carriage involved.

EVALUATION OF FEATURES  
FOR COMPUTING FACILITIES

Telecommunications required that the data be encoded at the transmitting locations into a machine-readable form, and that transmitting devices, receiving devices and reliable telecommunication links, normally telephone lines, are available.

The main problems and benefits of these options are shown in Exhibit A4.1.

Conclusions. The procedures proposed for use by the authorities are generally closely related to the accounting functions and a high speed of communication between the user and the computer is not very important. Transmission of data once per week or at the most, twice per week should be perfectly adequate and if the output was returned punctually within, say, one to three weeks depending on the type of output, then users would be satisfied.

At the present time telecommunications are unlikely to provide a reliable form of communication medium and also have other significant drawbacks. Physical transportation is slow by comparison, but has virtues of simplicity and reliability and the journey times are short in comparison with the total delay acceptable to the users.

Since telecommunications provide no useable benefits, and physical transportation provides an adequate service, the telecommunications option has been excluded in the analyses which follow. The use of physical transportation has been assumed to apply in all cases.

EVALUATION OF FEATURES  
FOR COMPUTING FACILITIES

Computer Locations

Options. Two main options have been considered:

- An external location from which data processing equipment will serve the needs of two or more authorities
- Equipment at the main office of each authority

An external data processing unit able to meet the needs of two or more authorities would consist of a medium-sized computer system. Each authority would collect and collate, from its branches, stores and plants, all information to be processed together with information from the head office, and would send this to the data processing unit. The data would be processed and the resulting output would be sent back to the main office of the authority to be checked and distributed.

A data processing unit at each authority main office would consist of a small-sized computer system. Data from each authority's branches, stores and plants would be sent to its main office, processed and the processed results would then be checked and distributed.

The main problems and benefits of each of these options is shown in Exhibit A4.2.

Conclusions. An external processing unit provides good equipment utilization and reduces the overall number of skilled computer personnel required. There may be problems of back-up and data may have to travel significant distances to be processed. One day per trip should be allowed.

EVALUATION OF FEATURES  
FOR COMPUTING FACILITIES

A computer at the main office of each authority would not provide very good value in comparison with a central computer and would require staff equally highly skilled to operate it. The main advantage would be slightly shorter delay in providing output.

Unless fast response is considered absolutely vital, then serious consideration should be given to the benefits which could be obtained using an external processing unit.

Data Preparation -  
Media and Equipment

Options. Computer input data must be encoded to a computer-readable form. The media considered are punched cards, and magnetic tape or discs. The equipment itself can be:

- Simple encoding equipment.
- Simple encoding equipment and printing facility.
- Encoding equipment with simple checking facility, and printing facility.
- Encoding equipment linked to mini-computer facilities.

Media. Of the three types of media considered the punched card is the one which has been in use longest. Magnetic tape reels, cassettes and diskettes have emerged as powerful contenders, however.

EVALUATION OF FEATURES  
FOR COMPUTING FACILITIES

In Egypt punched cards cost LE 3.30 per thousand, or about 1/3 piaster each. It is highly likely that this price will increase in the future. A card can be used only once. Although magnetic media are slightly more expensive in initial cost, each can store the equivalent data content of up to 4,000 punched cards, and they can be used at least one hundred times. Consequently they are much less expensive in the longer term. For example, a magnetic tape cartridge for an ICL data preparation machine has sufficient capacity for 900 records of 128 characters each, i.e. 115,200 characters. It costs about LE 5 and can be used at least one hundred times. This volume of data could be stored on 1440 punched cards, which would cost about LE 4.75 and can only be used once.

The main problems and benefits of each of these media options are shown in Exhibit A4.3.

Equipment. Data preparation equipment can be obtained with various levels of sophistication, each additional level being designed to improve the reliability of the data preparation process. The characteristics of the four options considered are shown in the diagram of Exhibit A4.4. It is normally not possible to obtain sophisticated equipment which uses punched cards. The problems and benefits of each of these options are shown in Exhibit A4.5.

The major factor to be considered is the time which may elapse between information becoming available for data preparation and the availability of accurate processed information from the computer.

EVALUATION OF FEATURES  
FOR COMPUTING FACILITIES

The use of checking facilities would eliminate a large proportion of the input errors which could occur and assists greatly in ensuring that delay in providing accurate processed output is minimized. Among the types of checks which could be carried out are:

- Check digit checks on codes for customers, employees, inventory items and other.
- Column total checks, to ensure that all data is controlled.

Where the computer is nearby it is of less importance to carry out comprehensive checks at the time of data preparation since computer time can normally be made available readily to check the data. If the data has to be transferred to another location for processing, however, the delays involved in eliminating data errors may become substantial.

Conclusions. In order to eliminate delays and unnecessary waste of valuable computer time, encoding equipment should be provided with checking and printing facilities. Data should be entered to magnetic media.

Data Preparation-  
Locations

Options. The locations considered are:

- At branches of authorities.
- At authority main offices.
- At an external processing location.

EVALUATION OF FEATURES  
FOR COMPUTING FACILITIES

The three options are logical selections based on the work of the authorities and represent data preparation at various stages of the data collection processes. External data preparation could usefully be carried out only if an external processing location is applied.

The main benefits and problems for the three options are shown in Exhibit A4.6.

Conclusions. Although branches are very near the source of data and hence errors can be readily corrected, problems of equipment, staffing, maintenance and expense may prove to outweigh the benefits of error correction at source. The converse applies to data preparation at a central location, where expense would be relatively small and reliability good, but where the delays in error correction could prove too great to operate effectively.

A good compromise appears to be to locate the data preparation equipment at the main office of each authority. It may prove possible for large branches to have their own data preparation facility

EVALUATION OF FEATURES  
FOR COMPUTING FACILITIES

Computer Operations  
Staff

Options. The options which are available for computer staff are:

- Training existing personnel of authorities.
- Using employees with special payment arrangements.
- Using external personnel on a contract basis.
- Using an external facilities management company.

At the present time the salary structure of the authorities is not attractive to skilled computer staff. The only authority with a number of trained computer staff is SCA, where the more generous conditions of employment have enabled them to retain some skilled personnel. Even there, however, it is not always possible to attract ready-trained staff because of the low starting grades, and consequently the low salaries, which would apply. Although there are methods of providing increased salaries for trained personnel joining a government organization, the rates paid for computer staff in the private sector are still generally more attractive.

It would be possible, using special arrangements, to enable employees engaged in computer work to obtain salaries comparable with those in the private sector. This would involve either the payment of generous allowances, or the ability to sell the services to external private companies and to pay bonuses to the staff from the proceeds.

EVALUATION OF FEATURES  
FOR COMPUTING FACILITIES

A third option would be to engage highly-trained external computer personnel on a long-term contract basis. The fourth alternative considered is the use of a private company specializing in the management of computer facilities. This is normally carried out on a contractual basis whereby the facilities management company provides a data processing manager, and other staff if required, and takes responsibility for the smooth operation of the client's computer facility.

The main problems and benefits of these options are shown in Exhibit A4.7.

Conclusions. The efficiency and reliability of a computer installation is dependent on the quality and experience of the computer operating staff.

High quality and experienced computer staff can be obtained only if special salary arrangements can be made for employees engaged on this type of work, or external contract personnel can be engaged, or a reputable computer facilities management company can be engaged. It is very unlikely that authority employees could be utilized reliably and consistently at the payment rates currently prevailing because of the high personnel turnover rates which will apply after employees have been trained.

EVALUATION OF FEATURES  
FOR COMPUTING FACILITIES

Ownership of the  
Computer Facilities

Options. Four alternative types of ownership are considered:

- Private service bureau
- Governmental - external facility
- Jointly by authorities - external facility
- Authority - facilities at each authority.

The features of interest here are the administrative effort, control available and availability of help when required.

The main problems and benefits of these options are summarized in Exhibit A4.8.

Conclusions. Unless some degree of control is available to each authority with regard to the speed and reliability of processing then it is unlikely that a good service will be provided. It is therefore necessary to ignore private service bureaus, where economic considerations usually prevail, and to confine attention to the remaining three options.

Real control can be exerted only through executive power. Unless some board representation can be arranged it is therefore unlikely that a government-owned facility will be suitable. On the other hand it is not fully desirable that an authority inexperienced in using computers should feel itself isolated from any assistance which may be available.

It may be concluded that apart from private ownership, the other three options could prove viable in appropriate circumstances. Of the three the jointly-owned option would provide a good blend of control and communal benefits.

Management Of  
Computing Operations

Options. In considering the managerial options the main factors of importance are:

- The reliability with which the data processing requirements can be met
- The ability to take appropriate action when problems arise
- The ability to administer high-quality staff.

The necessary quality of computer staff can be obtained either externally, under contract or from a facilities management company, or else using employees with special payment arrangements. The quality of the manager is of great importance in gaining the respect and confidence of this staff and he must be skilled not only in administration but also in computer processing.

The options for managing the computer center are:

- Using an employee with special payment arrangements
- Hiring an experienced external professional, on a contract basis
- Entering into a facilities management contract with a reputable external company skilled in computing

The main problems and benefits of these options are shown in Exhibit A4.9.

Conclusions. Each alternative relies for its effectiveness on the quality of the Computer Manager. In one option an employee is used, whereas the other two options use external specialists. The choice to be made depends essentially on skill and reliability. Both of these qualities should be present in the person selected but in the long-term reliability must be considered of greater importance.

Use of Other  
Equipment At Branches

Options. If it is desired to decentralize work it would be possible to have water bills and customer payments prepared and controlled at branches, and to carry out some recording of accounting transactions at the branch level. The volume of data to be processed at each branch would be relatively small and could readily be accommodated by a very small computer or equivalent electromechanical or manual equipment. The main office would receive consolidated revenue information and also data concerning payroll, inventories and other pertinent items. These would be processed at the main office and results would be distributed appropriately.

The main problems and benefits of this option are summarized in Exhibit A4.10.

Conclusions. A mini-computer would not be viable at branches.

If a computer is available to the authority then the only real advantage of branch processing is a marginally-improved speed of response in the billing area. In all other features there are more problems than benefits. The use of branch equipment would not be worthwhile if full computer facilities are available elsewhere.

OPTIONS, PROBLEMS AND  
BENEFITS FOR COMMUNICATIONS

Option	Problems	Benefits
Physical Transportation- Allow one day per trip.	<ul style="list-style-type: none"> <li>- Relatively slow speed of transmission.</li> </ul>	<ul style="list-style-type: none"> <li>- Simple. No special equipment or training required.</li> <li>- Reliable and inexpensive.</li> </ul>
Telecommunications.	<ul style="list-style-type: none"> <li>- Present difficulty of obtaining reliable telephone links.</li> <li>- Need for special equipment, which would have to be imported.</li> <li>- Skilled staff required at remote location.</li> <li>- Back-up system is required, using physical transportation</li> <li>- Special supplies required at remote locations.</li> <li>- Reliable maintenance facilities required at remote location.</li> </ul>	<ul style="list-style-type: none"> <li>- High speed of transmission.</li> </ul>

OPTIONS, PROBLEMS AND BENEFITS  
FOR COMPUTER LOCATIONS

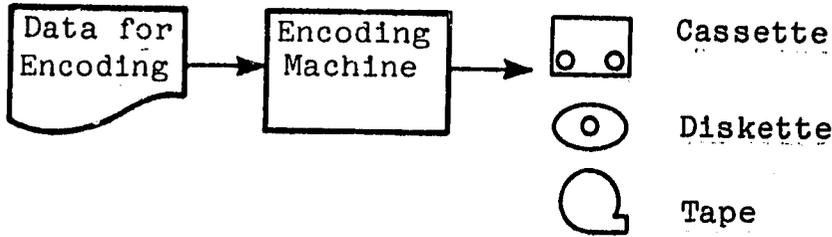
Option	Problems	Benefits
One External Processing Unit For Two or More Authorities.	<ul style="list-style-type: none"> <li>- Back-up facilities must be available for a major breakdown.</li> <li>- Some data may have to travel large distances to the processing unit.</li> </ul>	<ul style="list-style-type: none"> <li>- One set of highly skilled computer staff can serve two or more authorities.</li> <li>- Large data volumes promote good utilization of equipment.</li> <li>- Larger machines are more cost-effective (better value for money).</li> </ul>
Data Processing Unit at Main Office of Each Authority	<ul style="list-style-type: none"> <li>- One set of highly skilled computer staff required at each main office</li> <li>- Not very good value for money.</li> </ul>	<ul style="list-style-type: none"> <li>- Authorities may be able to provide communal back-up.</li> <li>- Slightly faster response.</li> </ul>

OPTIONS, PROBLEMS AND BENEFITS  
FOR DATA PREPARATION MEDIA

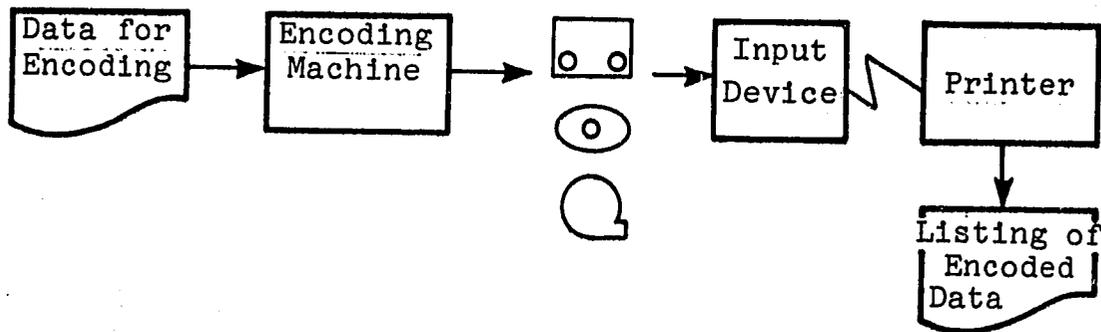
Option	Problems	Benefits
Punched Cards.	<ul style="list-style-type: none"> <li>- Individual cards may be lost or misplaced.</li> <li>- Sequence of cards may be lost if the pack is dropped.</li> <li>- Cards are a bulky form of data storage.</li> <li>- Card costs are relatively high because a card can be used only once.</li> <li>- Most sophisticated data preparation equipment does not accept this medium.</li> </ul>	<ul style="list-style-type: none"> <li>- Individual cards containing errors can be replaced readily.</li> </ul>
Magnetic Tape Reels and Cassettes/ Diskettes.	<ul style="list-style-type: none"> <li>- Can be used many times.</li> <li>- Errors in records require the use of special correction procedures.</li> </ul>	<ul style="list-style-type: none"> <li>- Sequence of input is maintained.</li> <li>- Compact. Small space required.</li> </ul>

CHARACTERISTICS OF DATA PREPARATION EQUIPMENT OPTIONS

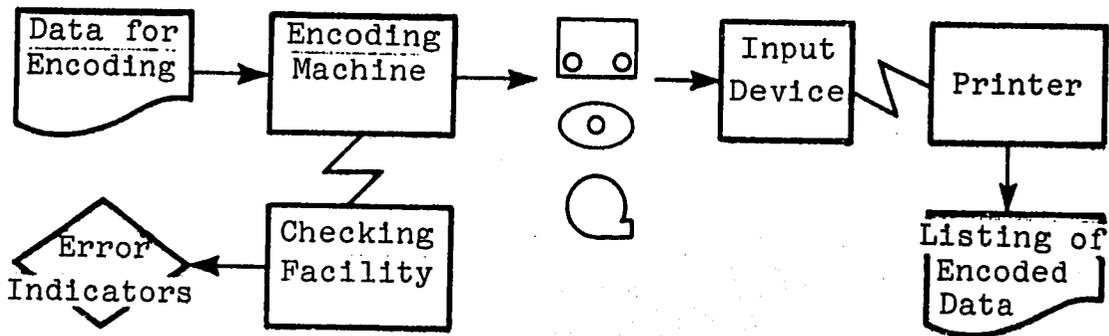
1. Simple Encoding Equipment



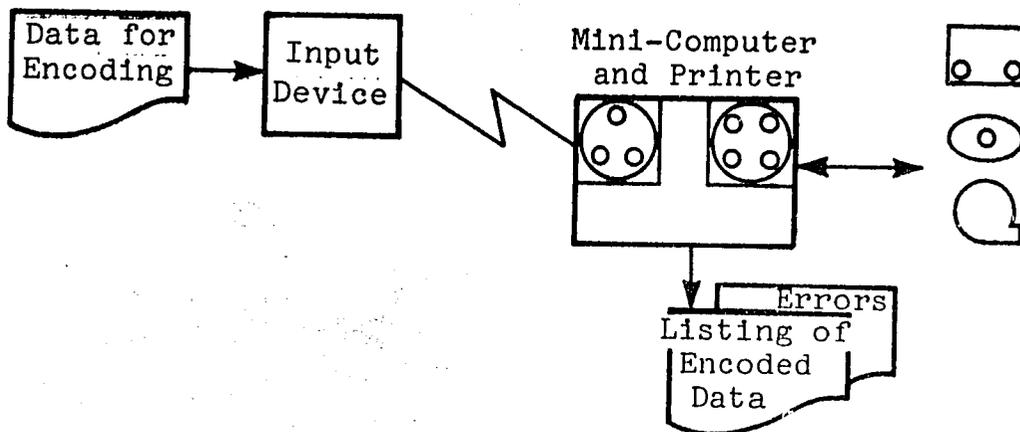
2. Simple Encoding Equipment and Printing Facility



3. Encoding Equipment with Checking Facilities and Printing Facility



4. Encoding Equipment Linked to Mini-Computer Facilities



OPTIONS, PROBLEMS AND BENEFITS  
FOR DATA PREPARATION EQUIPMENT

Option	Problems	Benefits
1. Simple Encoding Equipment.	<ul style="list-style-type: none"><li>- Punching errors may elude punching and verifying process and may not be recognized until data is input to computer.</li><li>- Control total errors may not be recognized until data is input to computer.</li><li>- Possible waste of computer time.</li></ul>	<ul style="list-style-type: none"><li>- Inexpensive.</li><li>- Simple to operate.</li></ul>
2. Simple Encoding Equipment and Printing Facility.	<ul style="list-style-type: none"><li>- Data input device and printer represent an increase in cost over Option 1.</li><li>- Minor punching errors may elude punching and verifying process and may not be recognized until data is input to the computer.</li><li>- Control total errors may not be recognized until data is input to computer.</li><li>- Some waste of computer time.</li></ul>	<ul style="list-style-type: none"><li>- A printer can serve several encoding units.</li><li>- Major punching errors may be recognized easily from the listing.</li><li>- Clerical checks can be carried out manually on the listing provided.</li></ul>

OPTIONS, PROBLEMS AND BENEFITS  
FOR DATA PREPARATION EQUIPMENT

Option	Problems	Benefits
3. Encoding Equipment with Checking Facility and Printing Facility.	- Checking facility represents an increase in cost over Option 2.	- Some punching errors can be recognized and corrected immediately after they are made.  - Control total checks can be carried out on batches as they are prepared.  - Significantly higher reliability of input data to computer and low waste of computer time.
4. Encoding Equipment Linked to Mini-Computer Facilities.	- Additional cost. - Possible complexity in operations depending on the applications.	- Some capabilities for expansion of in-house processing in the future.

OPTIONS, PROBLEMS AND BENEFITS  
FOR DATA PREPARATION LOCATIONS

Option	Problems	Benefits
Data Preparation At Branches.	<ul style="list-style-type: none"> <li>- Small volumes causes poor utilization of equipment.</li> <li>- Large number of data preparation units required, involving substantial expenditure.</li> <li>- Branch staff must be of high enough quality and skill to handle the equipment.</li> <li>- Data control facilities must be available at branches.</li> <li>- Remote branches may receive poor maintenance service.</li> </ul>	<ul style="list-style-type: none"> <li>- Very close to source of data. Speedy correction of errors if detected at the time of data preparation.</li> </ul>
Data Preparation At Authority Main Office.	<ul style="list-style-type: none"> <li>- Data must be physically sent from branches to main office.</li> <li>- Some delay in correcting errors may be incurred.</li> </ul>	<ul style="list-style-type: none"> <li>- Smaller number of units required than at branches.</li> <li>- Communal back-up facilities available.</li> </ul>
Data Preparation At External Processing Location, If External Processing Service Is Used.	<ul style="list-style-type: none"> <li>- Data must be physically sent to external location.</li> <li>- If data errors occur then long delays may be incurred before corrections can be made.</li> </ul>	<ul style="list-style-type: none"> <li>- Smallest number of units required.</li> </ul>

OPTIONS, PROBLEMS AND BENEFITS  
FOR COMPUTER OPERATIONS STAFF

Option	Problems	Benefits
Training Existing Personnel of Authorities.	<ul style="list-style-type: none"> <li>- Difficulty of retaining good personnel under present salary structures in the authorities.</li> <li>- Need to train all replacements for leaving personnel.</li> <li>- Quality of trained staff will tend to be low.</li> <li>- Staff will lack broad experience.</li> <li>- The efficiency and reliability of the computer installation is likely to be low.</li> </ul>	<ul style="list-style-type: none"> <li>- Low operating costs.</li> </ul>
Employees With Special Payment Arrangements	<ul style="list-style-type: none"> <li>- Setting up special salary arrangements for staff.</li> <li>- Ensuring selection of high-quality staff.</li> </ul>	<ul style="list-style-type: none"> <li>- Quality of applicants can be high if special salary arrangements can be made.</li> <li>- Lower operating costs if private sector work can offset normal costs.</li> </ul>
External Personnel	<ul style="list-style-type: none"> <li>- Relatively high operating costs.</li> <li>- Individual arrangements have to be made with personnel by authority.</li> <li>- Potential problems if individuals break their contracts.</li> </ul>	<ul style="list-style-type: none"> <li>- Quality of applicants can be high.</li> <li>- Lower operating costs if private sector work can offset normal costs.</li> </ul>
	<p>Ensuring selection of high-quality staff.</p>	

OPTIONS, PROBLEMS AND BENEFITS  
FOR COMPUTER OPERATIONS STAFF

Option	Problems	Benefits
Computer Facilities Management Company.	<ul style="list-style-type: none"><li>- High operating costs.</li><li>- Periodic re-negotiation of management contract.</li></ul>	<ul style="list-style-type: none"><li>- Quality of staff can be high.</li><li>- Lower operating costs if private sector work can offset normal costs.</li><li>- Day-to-day administration is carried out by management company.</li><li>- Efficiency and reliability likely to be high within period of contract.</li></ul>

OPTIONS, PROBLEMS AND  
BENEFITS FOR COMPUTER OWNERSHIP

Option	Problems	Benefits
Private Service Bureau,	<ul style="list-style-type: none"> <li>- No real control over the speed and reliability of processing.</li> </ul>	<ul style="list-style-type: none"> <li>- Authority need not be concerned with day-to-day administration of the computer unit.</li> <li>- Technical assistance may be available.</li> </ul>
Government Owned - External Facility.	<ul style="list-style-type: none"> <li>- Limited control over the speed and reliability of processing.</li> </ul>	<ul style="list-style-type: none"> <li>- Authority need not be concerned with day-to-day administration of the computer unit.</li> <li>- Technical assistance may be available.</li> </ul>
Jointly Owned By Authorities - External Facility.	<ul style="list-style-type: none"> <li>- Some concern with day-to-day administration of the computer unit.</li> <li>- Limited control over speed and reliability of processing.</li> </ul>	<ul style="list-style-type: none"> <li>- Ability to obtain communal benefits and system improvements through liaison with joint owners.</li> </ul>
Authority Owned - Facility At Each Authority.	<ul style="list-style-type: none"> <li>- Authority is directly concerned with day-to-day administration of the computer unit.</li> <li>- Authority may be isolated from useful technical expertise.</li> </ul>	<ul style="list-style-type: none"> <li>- Direct control over the processing of work.</li> </ul>

OPTIONS, PROBLEMS AND BENEFITS FOR  
COMPUTING OPERATIONS MANAGEMENT

Option	Problems	Benefits
Employee with Special Payment Arrangements.	<ul style="list-style-type: none"> <li>- Lack of experience in computer work may lead to poor operational performance.</li> </ul>	<ul style="list-style-type: none"> <li>- Inexpensive management.</li> </ul>
External Professional On A Contract Basis.	<ul style="list-style-type: none"> <li>- Possibility of lack of continuity.</li> <li>- Higher management costs because of external contract.</li> </ul>	<ul style="list-style-type: none"> <li>- Personnel with proven skills and experience can be obtained.</li> </ul>
Facilities Management Contract.	<ul style="list-style-type: none"> <li>- Some possibility of lack of continuity.</li> <li>- Higher management costs because of external contract.</li> </ul>	<ul style="list-style-type: none"> <li>- Personnel with proven skills and experience can be obtained.</li> <li>- Additional assistance can be provided as required by the facilities management company.</li> </ul>

OPTIONS, PROBLEMS AND BENEFITS FOR  
USE OF OTHER EQUIPMENT AT BRANCHES

Option	Problems	Benefits
Mini-Computer.	<ul style="list-style-type: none"> <li>- Skilled staff must be available at remote branches.</li> <li>- Maintenance problems at remote branches.</li> <li>- Poor equipment utilization.</li> <li>- Small machines are less cost-effective (poor value for money).</li> </ul>	<ul style="list-style-type: none"> <li>- Branches may be able to provide communal backup.</li> <li>- Speed of preparation of bills and statistics.</li> </ul>
Manual or Electro-Mechanical Equipment.	<ul style="list-style-type: none"> <li>- Billing statistics would still be prepared largely manually.</li> <li>- Not as accurate as if prepared using computer methods.</li> <li>- Totally dependent on availability of staff.</li> </ul>	<ul style="list-style-type: none"> <li>- Bills could be prepared speedily.</li> </ul>

EQUIPMENT AND APPLICATION COSTING

It is possible to prepare estimates of the costs of introducing and operating the computer systems using:

- Details of the application volumes from Section 4.0.
- Computing methods which could be applied from Section 5.0.

In this Appendix consideration is given to:

- Systems design and programming.
- Data preparation staff.
- Data preparation equipment.
- Data control staff.
- Computer equipment.
- Computer staff and management.

A summary is provided showing, for each authority, the total costs involved.

SYSTEMS DESIGN AND  
PROGRAMMING

One Authority

Using the outline design given in Appendix 2 estimates have been made of the time and effort required to design the necessary procedures and to prepare a set of computer programs for a single authority.

EQUIPMENT AND APPLICATION COSTING

The estimates are based on the time it would take an experienced systems designer or programmer to carry out the work. It has been assumed that the salaries paid to these personnel would be at the average rate in the private sector, as already given in Section 2.0 of this Report, and that two analysts and four programmers would be used for the basic program preparation. During the system testing we have assumed that one analyst and two programmers would be present and have been charged for accordingly.

Using these assumptions, the overall costs of preparing a single set of programs for the four applications would be between LE 50,000 and LE 65,000. Details are shown in Exhibit A5.1, showing how the costs are incurred for each of the four applications.

In developing the implementation schedule shown in Exhibit A5.2 for the introduction of this single set of programs it has been assumed that it is desirable and possible to introduce the systems consecutively. This shows that once design work has started:

- Customer Billing and Accounting could be operational after about 14 months.
- Payroll could be operational after about 15 months.
- Inventory control could be operational after about 21 months.
- General accounting could be operational after about 27 months.

EQUIPMENT AND APPLICATION COSTING

All Authorities

The computing procedures to be applied at each authority would be similar but not identical. It would be possible and economical to prepare programs for a single application at an authority and to carry out modifications as required to meet any special requirements of the other authorities. Ultimately each authority would have its own separate set of application programs.

It is not possible, at this stage, to make an accurate estimate of the extent of the modifications which would be required for each authority. It would not be unreasonable, however, to assume that the work of modifying an existing set of programs could amount to 20% - 25% of the basic program preparation effort, if carried out by the same personnel who were involved with the original programs.

In addition to making the modifications it would still be necessary to undertake comprehensive system testing for each modified set of programs. The overall cost considerations are shown in Exhibits A5.3 and A5.4. These show that even if SCA does not wish to obtain new programs the charges for the other three authorities will not be greatly affected. GOGCWS, AWGA and SCA would incur costs of about LE 34-38,000 each. For GOSSD the cost would be LE 24-26,000 which, under the proposed organizational arrangements, could be divided equally between the Cairo and Alexandria operations.

EQUIPMENT AND APPLICATION COSTING

The time required for the authorities to introduce modified programs will depend on the speed with which decisions can be made regarding the modifications which are required, the extent of the modifications and the number of systems personnel available to carry out the modifications. It is unlikely that all the authorities will be using all the computer procedures within three to four years from the start of systems design work, though all authorities could be using at least one set of computer procedures within two years from start of systems design.

DATA PREPARATION  
STAFF

Estimates have been made of the number of data preparation operators required based on the volumes already defined in Appendix 2 of this Report. In addition to these operators it would be necessary to have Data Preparation Supervisors at each authority. We have assumed for costing purposes that an operator would receive about LE 50 per month and a supervisor about LE 70 per month.

The total number and costs of data preparation staff required, working in two shifts, would be as shown in Exhibit A5.5.

EQUIPMENT AND APPLICATION COSTING

DATA PREPARATION  
EQUIPMENT

A survey has been made of the data preparation equipment which could be applied in the procedures.

The scope of this survey was restricted to IBM, ICL and NCR, since they are the companies best able to provide a reliable maintenance service. Each of these companies is able to provide equipment with basic checking and printing facilities.

On the small individual sets of equipment the magnetic media on which data is stored are all of different types:

- ICL - Special cartridge
- NCR - Cassette
- IBM - Diskette.

In making any specific selection it is necessary to take into account means of ensuring compatibility with the input media used in the computer system.

For general costing purposes the current costs of the equipment available has been considered. Data preparation units would each cost about LE 8,000 and a maintenance charge of about LE 660 would be incurred. The annual rental and maintenance cost, using a rental pay-back period of three years, will amount to about LE 3,250 for each data preparation unit. The annual costs for a small printer will be about LE 3,300.

A single printer will probably be adequate at each authority, but the number of data preparation units required will vary.

EQUIPMENT AND APPLICATION COSTING

On the assumption that the equipment can be operated on a two-shift basis the estimated number and costs of data preparation units required for each authority are shown in Tables A5.1 and A5.2:

TABLE A5.1  
DATA PREPARATION UNIT REQUIREMENTS

Data Preparation Units Required	Present Organizations				Proposed Organizations for Cairo and Alexandria	
	GOGCWS	AWGA	SCA	GOSSD	GOGCWS and GOSSD (Cairo)	AWGA and GOSSD (Alexandria)
- Current	7	5	2	4	11(1)	6
- 1987	10(1)	7	2	4	13(1)	8(1)

Note: (1) An extra unit has been allowed for standby in a high usage situation.

TABLE A5.2  
ANNUAL COSTS FOR DATA PREPARATION EQUIPMENT

Annual Equipment Rental and Maintenance Costs	Present Organizations				Proposed Organizations for Cairo and Alexandria	
	GOGCWS	AWGA	SCA	GOSSD	GOGCWS and GOSSD (Cairo)	AWGA and GOSSD (Alexandria)
Preparation Units @ LE3250						
- Current	22,750	16,250	6,500	13,000	35,750	19,500
- 1987	32,500	22,750	6,500	13,000	42,250	26,000
Printers @ LE 3300						
- Current	3,300	3,300	3,300	3,300	3,300	3,300
- 1987	3,300	3,300	3,300	3,300	3,300	3,300
Total Costs						
- Current	26,050	19,550	9,800	16,300	39,050	22,800
- 1987	35,800	26,050	9,800	16,300	45,550	29,300

EQUIPMENT AND APPLICATION COSTING

DATA CONTROL STAFF

It is not possible to provide a detailed estimate of the projected work load of the data control staff. On the basis of experience an initial working estimate which could be applied is that one data control clerk can handle the work of three data preparation operators. Since the duties of data control are crucial to the success of the data preparation operation, the data control clerks should be paid slightly more than the preparation operators, and the data control supervisor correspondingly more.

Estimates for each authority are given in Table A5.3 below:

TABLE A5.3

DATA CONTROL STAFF AND COSTS

Personnel and Costs	Present Organizations				Proposed Organizations for Cairo and Alexandria	
	GOGCWS	AWGA	SCA	GOSSD	GOGCWS and GOSSD (Cairo)	AWGA and GOSSD (Alexandria)
Clerks						
- Current	5	4	1	3	7	4
- 1987	6	5	2	3	8	5
Supervisors						
- Current	1	1	- (1)	1/2(1)	1	1
- 1987	1	1	1/2(1)	1/2(1)	1	1
Total Costs <sup>(2)</sup>						
- Current	4,650	3,900	750	2,700	6,150	3,900
- 1987	5,400	4,650	1,950	2,700	6,900	4,650

Note: (1) A part-time supervisory function should be sufficient at SCA and GOSSD.

(2) Clerks @ LE 750 per year, supervisors @ LE 900 per year.

EQUIPMENT AND APPLICATION COSTING

COMPUTER EQUIPMENT

Consideration has been given to:

- A single computer at a central location.
- Computers at main offices of existing authorities.
- A computer to serve the needs of GOGCWS and GOSSD.
- Computers to serve the needs of the proposed new authorities at Cairo and Alexandria.

In outlining the general nature and size of the equipment which could be used the following factors have been taken into account:

- The ability to sort large volumes of information speedily. This can be achieved best by using a disc-based storage system.
- The need for processing simplicity. Serial updating methods can be utilized readily in these procedures.

Time Required

A computer installation would normally require more than one shift operation per day if it is to be economically viable. If an installation would use two shifts it is possible to make some preliminary estimates to evaluate the size of equipment which would be required:

Total maximum time per week, @ 6 days, 2 shifts/day, 6 hours/shift	72 hours
Non-operational time	
-Routine maintenance, say 1 shift/week =6 hours	
-Breakdowns on critical runs, say 1 shift/week = 6 hours	<u>12 hours</u>
Total weekly time available for computer use	60 hours

EQUIPMENT AND APPLICATION COSTING

Method of Approach

The determination of equipment requirements has involved:

- Making estimates of the processing times which would be required to carry out work not involving printing, such as sorting and the development of print files.
- Determining the weekly, two-week, monthly, six-month and annual peak loadings for printing requirements.
- Estimating the amount of work load smoothing which could be allowed in order to minimize the computing power required while still providing an acceptable service to the authorities.
- Calculating the work load fluctuations which would occur during a month.
- Making estimates of the allowances to be applied to rated printer speeds in order to meet the operational work load.
- Estimating the printer speeds required.
- Estimating the disc storage capacity required.
- Estimating the CPU size required.

Estimates of processing times. Estimates have been made of the main run times required to process each application for each authority, ignoring those runs for which the duration is dependent on the speed of the printer. Run sequences have been assumed which prepare print files for subsequent printing.

EQUIPMENT AND APPLICATION COSTING

In preparing these estimates speeds of disc data access have been assumed in line with those available on small and medium-sized discs, with allowances for run set-up times.

The results of these estimates are shown in Table A5.4 below:

TABLE A5.4

PROCESSING TIME NOT INVOLVING PRINTING (1987 Volumes)

Processing Frequency	Hours of Processing			
	GOGCWS	AWGA	SCA	GOSSD
Weekly	10	8.1	4.9	5.4
Two Weeks	3.25	3.25	0.7	-
Monthly	7	3.6	2.3	6.2

Estimates of print loads. From the details of data volumes the print loads have been calculated which would be required at various intervals for the different applications. These are summarized in Table A5.5 below:

TABLE A5.5

PRINT LOADS (1987 Volumes)

Processing Frequency	Lines of Print (All Applications)			
	GOGCWS	AWGA	SCA	GOSSD
Weekly	131,000	110,000	24,000	39,000
Two Weeks	655,000	627,000	43,000	-
Monthly	497,000	225,000	144,000	506,000
Six Months	172,000	63,000	63,000	63,000
Annual	192,000	83,000	63,000	140,000

EQUIPMENT AND APPLICATION COSTING

Work load smoothing allowances. In order to arrive at a realistic balance between equipment capability and service to authorities it has been assumed that:

- The two-week peak, composed largely of billing, can be spread over a two-week period.
- The monthly peak, largely made up of payroll work, can be spread over 1 1/2 weeks.
- The six-month and annual peaks can be spread over four weeks.

Work load fluctuations. The smoothing allowances shown above have been applied to the processing and printing work loads which would be incurred under various computing arrangements. Table A5.6 summarizes the maximum weekly volumes of processing and printing work to be carried out under various computing arrangements.

TABLE A5.6  
WORK LOAD ANALYSES - 1987 VOLUMES

Computing Arrangement	Weekly Maximum Volumes	
	Hours of Non-Printing Work	Lines of Print
<u>Individual Computers for:</u>		
GOGCWS	16.3	880,800
AWGA	12.1	610,000
SCA	6.75	174,000
GOSSD (All areas)	9.5	427,000
GOSSD (Cairo only)	7.4	332,100
GOSSD (Alexandria only)	2.1	94,900
<u>Computer For:</u>		
GOGCWS and GOSSD	25.8	1,307,800
GOGCWS and GOSSD (Cairo)	23.7	1,212,900
AWGA and GOSSD (Alexandria)	14.2	704,900
GOGCWS, GOSSD, AWGA	37.9	1,917,800
All Authorities	44.65	2,091,800

EQUIPMENT AND APPLICATION COSTING

The ratio of the normal weekly print load and the peak weekly print load has been calculated assuming that the billing load, which accounts for the two week nominal peak, can in fact be smoothed out completely in the allowed two week spread and is therefore part of the normal weekly load. The results are shown in Table A5.7 below:

TABLE A5.7  
MAXIMUM AND NORMAL WEEKLY PRINT LOADS - 1987 VOLUMES

Computing Arrangement	Weekly Print Load (Lines)		Ratio of Maximum to Normal Load
	Normal <sup>(1)</sup> Load	Maximum Load	
<u>Individual computers for:</u>			
GOGCWS	458,500	880,800	1.9
AWGA	423,500	610,000	1.4
SCA	45,500	174,000	3.8
GOSSD (All areas)	39,000	427,000	10.9
<u>Computer for:</u>			
GOGCWS and GOSSD (All areas)	497,500	1,307,800	2.6
GOGCWS and GOSSD (Cairo)	488,800	1,212,900	2.5
AWGA and GOSSD (Alexandria)	432,200	704,900	1.6
GOGCWS, AWGA and GOSSD (All areas)	921,000	1,917,800	2.1
All authorities	966,500	2,091,800	2.2

Note: (1) This includes the meter billing loads for GOGCWS, AWGA and SCA, which it is assumed can be spread evenly.

This shows that only in the case of AWGA is the computer work load fairly well balanced during a month. In all other cases the load is very uneven.

EQUIPMENT AND APPLICATION COSTING

Printer allowances. For printing work certain factors reduce the effective speed of the printer to below the rated speed:

- Paper changes - Allow 5 mins per 15 mins elapsed.
- Non-optimal printer speed - Allow a speed reduction of 25% when the printer is operating.

Total speed allowance required is 100%. (A factor of 2 has be be allowed). On this basis a printer rated at 600 lines per minute will, in fact, produce only 300 actual lines of print per minute over an extended period of printing.

It is necessary, in addition, to take into account the fact that when a printer breakdown occurs the time lost must be recovered. If a breakdown lasts 1 day it is desirable to recover in a short period of time, normally within two days. This is to say an additional allowance of 100% would normally be made unless this is clearly unreasonable or impractical.

If an extreme imbalance is present in the maximum and normal weekly loads then it is unnecessary and uneconomical to make significant additional allowances to permit recovery of time, since the required printer speed will be based on the maximum weekly loading, and recovery can take place readily during the normal lightly loaded conditions.

EQUIPMENT AND APPLICATION COSTING

The factors shown in Table A5.8 below are to be applied to the printer loads in order to estimate the most suitable printer speed:

TABLE A5.8  
PRINTER SPEED FACTORS APPLIED

Computer Arrangement	Ratio of Maximum to Normal Print Load	Printer Speed Factor Applied
<u>Individual computers for:</u>		
GOGCWS	1.9	2.5
AWGA	1.4	3.0
SCA	3.8	2.0
GOSSD (All areas)	10.9	2.0
<u>Computers for:</u>		
GOGCWS and GOSSD (All areas)	2.6	2.0
GOGCWS and GOSSD (Cairo)	2.5	2.0
AWGA and GOSSD (Alexandria)	1.6	2.8
GOGCWS, AWGA and GOSSD (All areas)	2.1	2.0
All authorities	2.2	2.0

For example, if the required printing capability for GOGCWS during the available time is 100 lines per minute then a 250 line per minute printer should be provided.

EQUIPMENT AND APPLICATION COSTING

Estimate of printer speeds. The printer speed calculations are based on the maximum weekly print load, the computer time available for carrying out printing and the printer speed factor to be applied. These calculations are shown in Table A5.9.

TABLE A5.9

RATED PRINTER SPEED ANALYSIS - 1987 VOLUMES  
(60 WORKING HOURS PER WEEK)

Computing Arrangements	Maximum Weekly Print Lines	(1) Hours Per Week for Printing	Actual Speed Required (Lines/Minute)	Printer Speed Factor	Speed Required (Lines/Minute)
<u>Individual Computers for:</u>					
GOGCWS	880,800	43.7	336	2.5	840
AWGA	610,000	47.9	212	3.0	636
SCA	174,000	53.24	55	2.0	110
GOSSD (All areas)	427,000	50.5	141	2.0	282
<u>Computers for:</u>					
GOGCWS and GOSSD (All areas)	1,307,800	34.2	637	2.0	1,275
GOGCWS and GOSSD (Cairo)	1,212,900	36.3	557	2.0	1,114
AWGA and GOSSD (Alexandria)	704,900	45.8	257	2.8	720
GOGCWS, AWGA and GOSSD (All areas)	1,917,800	22.1	1,446	2.0	2,892 (2)
All authorities	2,091,800	15.3	2,279	2.0	4,557 (2)

Note: (1) Sixty hours minus maximum non-printing work hours. (Table A5.6)

(2) This situation is because of the small time available for printing and it is necessary to apply multi-processing, or spooling techniques. This will enable the printer to be working while the computer is carrying out other work. Using this facility a printer of about 1,200 - 1,500 lines per minute should be suitable.

EQUIPMENT AND APPLICATION COSTING

Configurations for individual authorities. The computing capability required for each individual authority is small. The calculating power required is minimal and the on-line storage required is not large by normal standards. The major capability required is that of printing, though the volumes in themselves are not exceptionally large. For a computer located at the main office of an authority the following configuration would be appropriate:

- 1 Central processing unit - 16K Words/64K Bytes
- 1 Slow input device. - Cards/Cartridge/Cassette/Diskette
- 2 Exchangeable disc drives - At least 3 million characters each.
- 1 Console input and logging device, for use by operators.
- 1 Printer - The rated lines per minute required would be about:
  - . GOGCWS 800-900
  - . AWGA 600-700
  - . SCA 100-150
  - . GOSSD 250-300

The current annual rental and maintenance costs of such configurations are likely to be:

- GOGCWS LE 43-46,000
- AWGA LE 35-40,000
- SCA LE 29-32,000
- GOSSD LE 30-33,000

EQUIPMENT AND APPLICATION COSTING

Configuration for centralized service. The computing capability required for a centralized service for three or more authorities would be the total of the needs of the individual authorities. The main differences in the configuration would be:

- A significant increase in the printing capability, which could probably be achieved most reliably by having two printers available.
- Increased disc drive capacity, to decrease the number of disc changes required when handling the files, thus decreasing the overall processing times.
- An increase in capacity of the central processing unit, to provide rather greater overall processing speed.

The following configuration would be appropriate:

- |  |  |
|--|--|
| 1 Central processing unit with multi-processing facility | - 24K Words/96K Bytes                                  |
| 1 Slow input device                                      | - Cards/Cartridge/Cassette/Diskette                    |
| 3 Exchangeable disc drives                               | - 10m characters each                                  |
| 1 Console input and logging device for use by operators  |  |
| 1 or 2 printers  | - About 1250 rated lines per minute would be required. |

A configuration of this type would currently cost about LE 55-78,000 per year in rental and maintenance depending on the manufacturer selected.

EQUIPMENT AND APPLICATION COSTING

Configuration for GOGCWS and GOSSD.(All areas or Cairo alone). The configuration would be similar to that of the centralized service. The only difference is likely to be that two disc drives could be acceptable and that multi-programming would not be an important a facility.

The reduction in price below that of the centralized service configuration would be small, and the price would be about LE 54-70,000 per year for rental and maintenance, depending on the manufacturer selected.

Configuration for AWGA and GOSSD (Alexandria). The configuration would be similar to that for AWGA alone, except that a faster printer would be required. This would raise the price to the same general level as that of a computer for GOGCWS, that is LE 42-50,000 per year for rental and maintenance.

COMPUTER STAFF AND  
MANAGEMENT

The minimum staff required to operate a small computer installation that processes several types of work are:

- A data processing manager.
- A shift leader, or chief operator.
- A junior computer operator.

If the installation is to work on a two-shift basis then an additional shift leader and one or more additional operators will be required.

EQUIPMENT AND APPLICATION COSTING

If the installation is processing a large volume of information it is necessary to have formal control over data flowing into and out of the installation, and for this purpose one or more clerks would be utilized.

It is necessary to have administrative services for purchasing supplies, typing letters and other. These facilities have to be made available either through a parent organization or by having a staff.

Data Processing  
Manager

Any computer installation requires a Data Processing Manager. His work would consist of:

- Day-to-day administration of the computer staff.
- Ensuring that work was processed in accordance with the required schedule.
- Maintaining contact with the computer world in general and with the equipment supplier in particular, to ensure that the equipment used and methods applied continue to be the most suitable and effective.
- Maintaining contact with managers of user departments, to ensure that any problems arising from the computer work may be resolved speedily and to promote the efficient use of computer procedures in additional areas as the needs arise.

The Data Processing Manager's job is a vital one for maintaining and improving efficiency and this is reflected in the private sector salaries which are paid. For costing purposes it has been assumed that the manager of a computer serving three or more authorities would receive the average private sector

EQUIPMENT AND APPLICATION COSTING

salary of LE 360 per month, or LE 4,320 per year. For a computer serving two authorities the salary would be LE 4,200 per year. For the individual authorities reduced rates have been assumed because of the smaller volumes of work involved.

- GOGCWS - LE 4,000 per year
- AWGA - LE 4,000 " "
- SCA - LE 2,250 " "
- GOSSD - LE 3,000 " "

Shift Leader, or  
Chief Operator

Each working shift in a computer installation requires the presence of a shift leader. He would have full responsibility for the computer processing during his shift and consequently requires a detailed knowledge of all the processing work to be carried out. In addition he would be responsible for discipline within the computer room and for the security of the installation.

A good shift leader would be a very experienced computer operator and his salary would be in the same range as that of a programmer. For costing purposes it has been assumed that a shift leader for a computer installation serving three or more authorities would receive the top private sector salary of a computer operator, namely LE 215 per month or LE 2,580 per year. For an installation serving two authorities the salary would be

EQUIPMENT AND APPLICATION COSTING

LE 2,300 per year. For the individual authorities slightly reduced rates have been used:

- GOGCWS - LE 2,250 per year
- AWGA - LE 2,250 " "
- SCA - LE 1,500 " "
- GOSSD - LE 2,000 " "

At GOGCWS and AWGA, because of the two-shift working which would be necessary if the authorities have their own computer, allowances have been made for two shift leaders.

Computer Operators

Each installation would require one or more computer operators to work under the guidance of the shift leader. These operators would be responsible for loading tapes and discs, setting up the printers, labelling files and output, and carrying out simple operating procedures.

It has been assumed that the computer operators in a central installation would receive the average private sector salary of LE 109 per month, or LE 1,308 per year. For an installation serving two authorities the salary would be LE 1,250 per year. Slightly lower rates at individual authorities have been assumed:

- GOGCWS - LE 1,200 per year
- AWGA - LE 1,200 " "
- SCA - LE 850 " "
- GOSSD - LE 1,000 " "

EQUIPMENT AND APPLICATION COSTING

In a central installation, working two shifts, it is likely that a total of three operators would be required. At GOGCWS and AWGA, working two shifts, one operator per shift would be sufficient.

Operations Clerks

At GOGCWS and AWGA it would be desirable to have a clerk available to record the movement of work into and out of the computer installation. For a central installation this would be necessary. At the individual authorities a salary rate of LE 50 per month or LE 600 per year has been assumed, and at an installation serving more than one authority LE 60 per month or LE 720 per year.

Ancillary  
Administrative Staff

In a computer installation serving more than one authority extra staff would be required for routine clerical and administrative work. Two or three clerks should be available, at an average monthly salary of LE 50, or LE 600 per year.

Facilities Management

If a facilities management contract is used, to ease the work load of an authority in administering the computer facility, additional costs will be incurred. Many alternative methods can be adopted, but for costing purposes we have assumed that the facilities management company will require that private sector

EQUIPMENT AND APPLICATION COSTING

salaries be paid to computer staff, as already discussed, and will make a charge equivalent to 50% of the salary cost of the staff at the installation.

Summary of Staffing  
and Costs

Exhibits A5.6 and A5.7 summarize the potential staffing and costs for installations at main offices and at a central location.

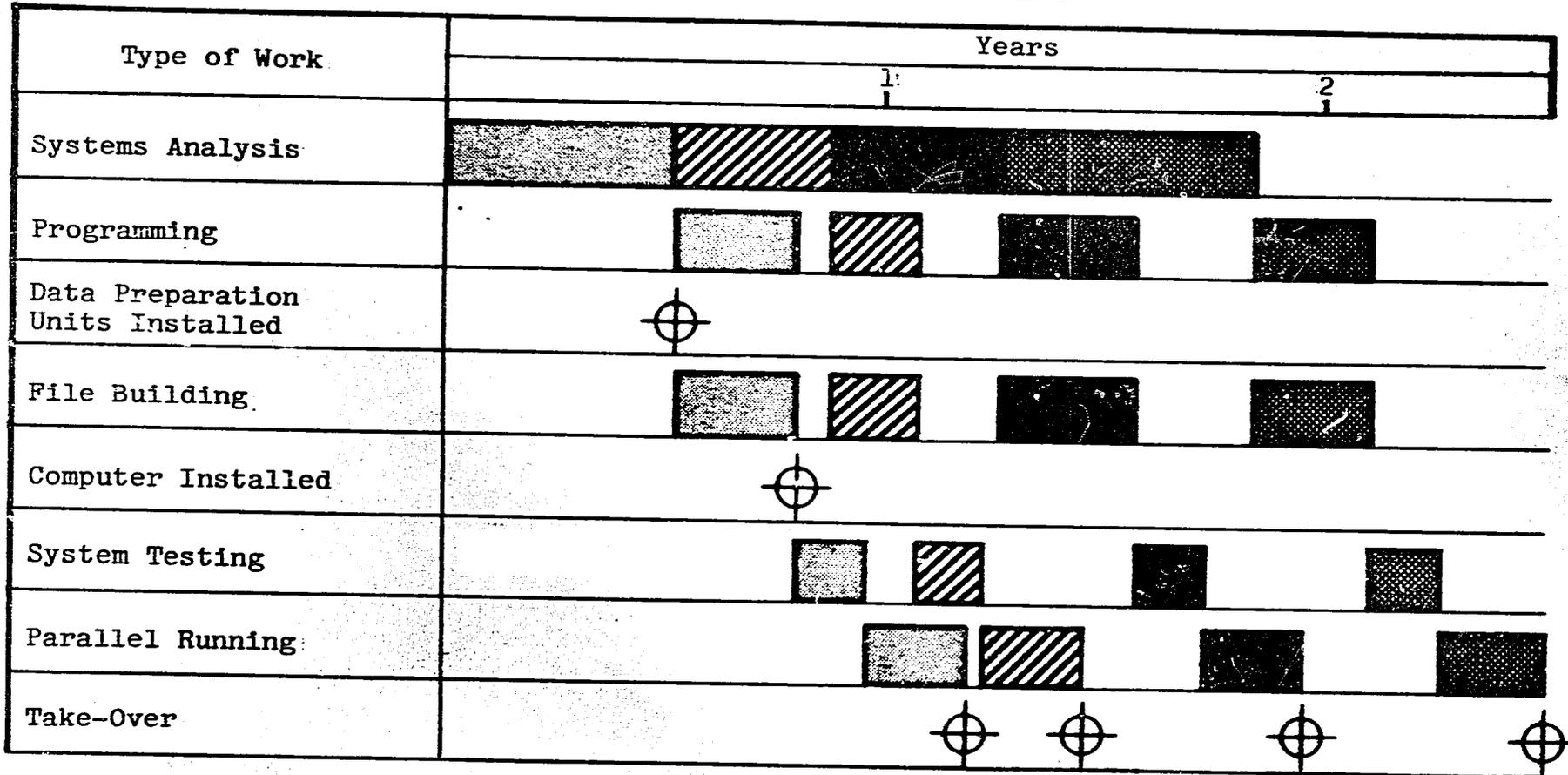
The total cost of staffing installations at individual authorities would be slightly more than twice the cost of the staff at a single central installation.

An overall cost summary is provided at Exhibit A5.8 showing the levels of cost which would be incurred using different computing arrangements for each type of organization. Exhibit A5.9 shows the costs assuming that SCA (water) is included in the computing proposals.

SYSTEMS DESIGN, PROGRAMMING  
EFFORT AND COSTS

	Billing and Accounting	Payroll And Time Allocation	Inventory Control and Accounting	General Accounting
<u>SYSTEMS DESIGN</u>				
<u>Basic Program Preparation</u>				
- Man Days of Effort	192	129	138	180
- Salary Cost @ LE 12/Day	LE 2,394	LE 1,548	LE 1,656	LE 2,160
- 150% Over-head Charges	LE <u>3,456</u>	LE <u>2,322</u>	LE <u>2,484</u>	LE <u>3,240</u>
Total Cost	LE 5,760	LE 3,870	LE 4,140	LE 5,400
Elapsed Weeks (2 Designers)	24-29	17-21	18-21	25-30
<u>System Testing</u> (During period of 8 weeks)				
Cost - 1 analyst	LE 1,440	LE 1,440	LE 1,440	LE 1,440
<u>PROGRAMMING</u>				
<u>Basic Program Preparation</u>				
- Man Days of Effort	333	237	216	282
- Salary Cost @ LE 9/Day	LE 2,997	LE 2,133	LE 1,944	LE 2,538
- 150% Over-head Charges	LE <u>4,496</u>	LE <u>3,200</u>	LE <u>2,916</u>	LE <u>3,807</u>
Total Cost	LE 7,493	LE 5,333	LE 4,860	LE 6,345
Elapsed Weeks (4 Programmers)	13-17	10-12	9-11	12-15
<u>System Testing</u> (During period of 8 weeks)				
Cost - 2 Programmers	LE 2,160	LE 2,160	LE 2,160	LE 2,160
Total Costs	LE 16,853	LE 12,803	LE 12,600	LE 15,345
Combined Cost	LE 57,601, say LE 50,000 - 65,000			

PROGRAM IMPLEMENTATION SCHEDULE



-  Billing and Accounting
-  Payroll and Time Allocation
-  Inventory Control and Accounting
-  General Accounting

COSTS INCURRED IN PROVIDING PROGRAMS  
FOR MORE THAN ONE AUTHORITY

Type of Cost	Billing and Accounting	Payroll And Time Allocation	Inventory Control and Accounting	General Accounting
<u>Basic Program Preparation</u>				
First Set of Programs	5,760	3,870	4,140	5,400
System Design Programming	<u>7,493</u>	<u>5,333</u>	<u>4,860</u>	<u>6,345</u>
	13,253	9,203	9,000	11,745
Subsequent Program @ 25% of original cost	1,440	967	1,035	1,350
System Design Programming	<u>1,873</u>	<u>1,334</u>	<u>1,215</u>	<u>1,586</u>
	3,313	2,301	2,250	2,936
<u>System Testing</u>				
For each original or modified program	1,440	1,440	1,440	1,440
System Design Programming	<u>2,160</u>	<u>2,160</u>	<u>2,160</u>	<u>2,160</u>
	3,600	3,600	3,600	3,600

Programs Required For:	GOGCWS AWGA SCA	GOGCWS AWGA SCA GOSSD	GOGCWS AWGA SCA GOSSD	GOGCWS AWGA SCA GOSSD
	3 Programs	4 Programs	4 Programs	4 Programs
Basic Cost of First Program	13,253	9,203	9,000	11,745
Costs of Subsequent Programs	6,626	6,903	6,750	8,808
Costs of System Testing	10,800	14,400	14,400	14,400
Total Program Costs	30,679	30,506	30,150	34,953

Source: Basic data derived from Exhibit A5.1

ALLOCATION OF PROGRAMMING COSTS TO AUTHORITIESCase I - Programming Charges Assuming  
SCA(Water) Uses New Programs

Type of Program	Number of Programs	Total Program Cost	Cost Per Program	Authorities			
				GOGCWS	AWGA	SCA	GOSSD
Billing and Accounting	3	30,679	10,227	10,227	10,227	10,227	-
Payroll and Time Allocation	4	30,506	7,627	7,627	7,627	7,627	7,627
Inventory Control and Accounting	4	30,150	7,538	7,538	7,538	7,538	7,538
General Accounting	4	34,953	8,738	8,738	8,738	8,738	8,738
Total	15	126,288		34,130	34,130	34,130	23,903

Case II - Programming Charges Assuming SCA(Water).  
Continues to Use Existing Programs

Type of Program	Number of Programs	Total Program Cost	Cost Per Program	Authorities		
				GOGCWS	AWGA	GOSSD
Billing and Accounting	2	23,766	11,883	11,883	11,883	-
Payroll and Time Allocation	3	24,605	8,202	8,202	8,202	8,202
Inventory Control and Accounting	3	24,300	8,100	8,100	8,100	8,100
General Accounting	3	28,417	9,472	9,472	9,472	9,472
Total	11	101,088		37,657	37,657	25,774

DATA PREPARATION EFFORT AND COSTS

Procedure	Number of Operators Required											
	Present Organizations								Proposed Organizations for Cairo and Alexandria			
	GOGCWS		AWGA		SCA		GOSSD		GOGCWS and GOSSD (Cairo)		AWGA and GOSSD (Alexandria)	
	Current	1987	Current	1987	Current	1987	Current	1987	Current	1987	Current	1987
Customer Billing and Accounting	7.2	8.8	6.6	8.5	0.5	0.6	-	-	7.2	8.8	6.6	8.5
Payroll and Time Allocations	4.8	5.8	1.8	2.3	0.9	1.2	5.2	6.0	8.8	10.5	3.0	3.6
Stock Control and Accounting	1.9	2.3	1.1	1.4	1.1	1.4	1.2	1.4	2.8	3.4	1.4	1.7
General Accounting	Negligible		Negligible		Negligible		Negligible		Negligible		Negligible	
Total Operators	14	17	10	13	3	4	7	8	19	23	11	14
Supervisors Required	2	2	2	2	1	1	2	2	2	2	2	2
Annual Costs												
- Operators @ 600/yr	8,400	10,200	6,000	7,800	1,800	2,400	4,200	4,800	11,400	13,800	6,600	8,400
- Supervisors @ 800/yr	1,600	1,600	1,600	1,600	800	800	1,600	1,600	1,600	1,600	1,600	1,600
Total Cost	10,000	11,800	7,600	9,400	2,600	3,200	5,800	6,400	13,000	15,400	8,200	10,000

COMPUTER OPERATIONS STAFFING AND COSTS  
FOR COMPUTERS AT INDIVIDUAL AUTHORITIES (1987 LEVELS)

Personnel	GOGCWS			AWGA			SCA			GOSSD		
	No.	Annual Salary	Cost	No.	Annual Salary	Cost	No.	Annual Salary	Cost	No.	Annual Salary	Cost
Data Processing Manager	1	4,000	4,000	1	4,000	4,000	1	2,250	2,250	1	3,000	3,000
Computer Shift Leader	2	2,250	4,500	2	2,250	4,500	1	1,500	1,500	1½(1)	2,000	3,000
Computer Operator	2	1,200	2,400	2	1,200	2,400	1	850	850	1½(1)	1,000	1,500
Operations Clerk	1	600	600	1	600	600	-	-	-	-	-	-
Ancillary Administrative Staff	-	-	-	-	-	-	-	-	-	-	-	-
Annual Cost			11,500			11,500			4,600			7,500
Facilities Management Charge			5,750			5,750			2,300			3,750
Total Cost			17,250			17,250			6,900			11,250

Note: (1) Using special arrangements for greatly fluctuating work load.

**COMPUTER OPERATIONS STAFFING AND  
COSTS FOR SHARED COMPUTING FACILITIES (1987 LEVELS)**

Personnel	GOGCWS and GOSSD (All Areas)			GOGCWS and GOSSD (Cairo)			AWGA and GOSSD (Alexandria)			GOGCWS, GOSSD and AWGA			All Authorities, Including SCA		
	No.	Annual Salary	Cost	No.	Annual Salary	Cost	No.	Annual Salary	Cost	No.	Annual Salary	Cost	No.	Annual Salary	Cost
Data Processing Manager	1	4,200	4,200	1	4,200	4,200	1	4,200	4,200	1	4,320	4,320	1	4,320	4,320
Computer Shift Leader	2	2,300	4,600	2	2,300	4,600	2	2,300	4,600	2	2,580	5,160	2	2,580	5,160
Computer Operator	2	1,250	2,500	2	1,250	2,500	2	1,250	2,500	3	1,308	3,924	3	1,308	3,924
Operations Clerk	1	720	720	1	720	720	1	720	720	1	720	720	1	720	720
Ancillary Administrative Staff	2	600	1,200	2	600	1,200	2	600	1,200	3	600	1,800	3	600	1,800
Annual Cost	13,220			13,200			13,220			15,924			15,924		
Facilities Management Charge @ 50%	6,610			6,610			6,610			7,962			7,962		
<b>Total Cost</b>	<b>19,830</b>			<b>19,830</b>			<b>19,830</b>			<b>23,886</b>			<b>23,886</b>		

OVERALL COST SUMMARY  
SYSTEMS DESIGN, PROGRAMMING AND DATA PREPARATION

Type of Cost	Present Organizations						Proposed Organizations for Cairo and Alexandria			
	GOGCWS		AWGA		GOSSD		GOGCWS and GOSSD (Cairo)		AWGA and GOSSD (Alexandria)	
	Current	1987	Current	1987	Current	1987	Current	1987	Current	1987
<u>Once-Only Costs</u>										
Systems Design and Programming	37,657	-	37,657	-	25,774	-	50,544 <sup>(1)</sup>	-	50,544 <sup>(1)</sup>	-
<u>Annual Data Preparation Costs</u>										
Equipment Rental and Maintenance	26,050	35,800	19,550	26,050	16,300	16,300	39,050	45,550	22,800	29,300
Data Preparation Staff	10,000	11,800	7,600	9,400	5,800	6,400	13,000	15,400	8,200	10,000
Data Control Staff	4,650	5,400	3,900	4,650	2,700	2,700	6,150	6,900	3,900	4,650
Total	40,700	53,000	31,050	40,100	24,800	25,400	58,200	67,850	34,900	43,950

Note: (1) This assumes that no standardization has taken place and that the GOSSD charges are attributed equally between new Cairo and Alexandria organizations for sewerage.

OVERALL COST SUMMARY -  
DATA PROCESSING (FOR BOTH CURRENT AND 1987 VOLUMES)

Computing Arrangements	Present Organizations			Proposed Organizations for Cairo and Alexandria	
	GOGCWS	AWGA	GOSSD	GOGCWS and GOSSD (Cairo)	AWGA and GOSSD (Alexandria)
1. Computer at each authority or proposed location					
Equipment Rental and Maintenance	44,500	37,500	32,000	56,000	44,500
Operations Staff and Management	17,250	17,250	11,250	19,830	19,830
Total	61,750	54,750	43,250	75,830	64,330
2. Shared computer for GOGCWS and GOSSD <sup>(1)</sup> . Separate computer for AWGA					
Equipment Rental and Maintenance	38,640 <sup>(1)</sup>	37,500	17,360 <sup>(1)</sup>	Not Applicable	Not Applicable
Operations Staff and Management	13,664 <sup>(1)</sup>	17,250	6,166 <sup>(1)</sup>	Not Applicable	Not Applicable
Total	52,304 <sup>(1)</sup>	54,750	23,526 <sup>(1)</sup>	Not Applicable	Not Applicable
3. Single computer shared by all authorities <sup>(2)</sup>					
Equipment Rental and Maintenance	28,200	19,200	12,600	38,000	22,000
Operations Staff and Management	11,226	7,644	5,016	15,127	8,759
Total	39,426	26,844	17,616	53,127	30,759

Notes: (1) Shared system for GOGCWS and GOSSD involves:  
 - Equipment rental and maintenance LE 56,000 per year  
 - Operations staff and management LE 19,830 per year

Costs are divided according to estimated usage  
by maximum output volumes:

- GOGCWS	69%
- GOSSD	31%
	100%

(2) Shared system for all authorities involves:  
 - Equipment rental and maintenance LE 60,000 per year  
 - Operations staff and management LE 23,886 per year

Costs are divided according to estimated usage  
by maximum output volumes:

Present Organization	Proposed Organizations	
- GOGCWS	47%	
- AWGA	32%	
- GOSSD	21%	
	100%	
	- Cairo	63%
	- Alexandria	37%
	100%	

OVERALL COST SUMMARY -  
TOTAL ANNUAL COSTS FOR DATA PREPARATION AND PROCESSING

Computing Arrangements	Present Organizations						Proposed Organizations for Cairo and Alexandria			
	GOGCWS		AWGA		GOSSD		GOGCWS and GOSSD (Cairo)		AWGA and GOSSD (Alexandria)	
	Current	1987	Current	1987	Current	1987	Current	1987	Current	1987
Computer at each authority or proposed location	102,450	114,750	85,800	94,850	68,050	68,650	134,030	143,680	99,230	108,280
Shared computer for GOGCWS and GOSSD. Separate computer for AWGA	93,004	105,304	85,800	94,850	48,326	48,926	Not Applicable		Not Applicable	
Single computer shared by all authorities	80,126	92,426	57,894	66,944	42,416	43,016	111,327	120,977	65,659	74,709

OVERALL COST SUMMARY - INCLUDING SCA  
SYSTEMS DESIGN, PROGRAMMING AND DATA PREPARATION

Type of Cost	Present Organizations								Proposed Organizations for Cairo and Alexandria			
	GOGCWS		AWGA		GOSSD		SCA		GOGCWS and GOSSD (Cairo)		AWGA and GOSSD (Alexandria)	
	Current	1987	Current	1987	Current	1987	Current	1987	Current	1987	Current	1987
Once-Only Costs												
Systems Design and Programming	(2) 34,130	-	(2) 34,130	-	(2) 23,903	-	(1) 34,130	-	(1) 46,082	-	(1) 46,082	-
Annual Data Preparation Costs												
Equipment Rental and Maintenance	26,050	35,800	19,550	26,050	16,300	16,300	9,800	9,800	39,050	45,550	22,800	29,300
Data Preparation Staff	10,000	11,800	7,600	9,400	5,800	6,400	2,600	3,200	13,000	15,400	8,200	10,000
Data Control Staff	4,650	5,400	3,900	4,650	2,700	2,700	750	1,950	6,150	6,900	3,900	4,650
Total	40,700	53,000	31,050	40,100	24,800	25,400	13,150	14,950	58,200	67,850	34,900	43,950

Note: (1) This assumes that no standardization has taken place and that the GOSSD charges are attributed equally between new Cairo and Alexandria organizations for sewerage.

(2) Assuming that SCA programs are derived from programs prepared for the other organizations.

**OVERALL COST SUMMARY - INCLUDING SCA  
TOTAL ANNUAL COSTS FOR DATA PREPARATION AND PROCESSING**

Computing Arrangements	Present Organizations				Proposed Organizations for Cairo and Alexandria	
	GOGCWS	AWGA	GOSSD	SCA	GOGCWS and GOSSD (Cairo)	AWGA and GOSSD (Alexandria)
1. Computer at each authority or proposed location.						
Equipment Rental and Maintenance	44,500	37,500	32,000	31,000	56,000	44,500
Operations Staff and Management	17,250	17,250	11,250	6,900	19,830	19,830
Total	61,750	54,750	43,250	37,900	75,830	64,330
2. Shared computer for GOGCWS and GOSSD <sup>(1)</sup> . Separate computer for AWGA						
Equipment Rental and Maintenance	38,640 <sup>(1)</sup>	37,500	17,360 <sup>(1)</sup>		Not Applicable	
Operations Staff and Management	13,664 <sup>(1)</sup>	17,250	6,166 <sup>(1)</sup>			
Total	52,304 <sup>(1)</sup>	54,750	23,526 <sup>(1)</sup>			
3. Single computer shared by all authorities <sup>(2)</sup>						
Equipment Rental and Maintenance	25,200	17,400	12,000	5,400	38,000	22,000
Operations Staff and Management	10,032	6,927	4,777	2,150	15,127	8,759
Total	35,232	24,327	16,777	7,550	53,127	30,759

Notes: (1) Shared system for GOGCWS and GOSSD involves:  
 - Equipment rental and maintenance LE 56,000 per year  
 - Operations staff and management LE 19,830 per year  
 Costs are divided according to estimated usage by maximum output volumes:

- GOGCWS	69%
- GOSSD	31%
	<u>100%</u>

(2) Shared system for all authorities involves:  
 - Equipment rental and maintenance LE 60,000 per year  
 - Operations staff and management LE 23,886 per year  
 Costs are divided according to estimated usage by maximum output volumes:

Present Organization	Proposed Organizations
- GOGCWS 42%	- Cairo 63%
- AWGA 29%	- Alexandria 37%
- GOSSD 20%	
- SCA 9%	
	<u>100%</u>
	<u>100%</u>

OVERALL COST SUMMARY - INCLUDING SCA  
DATA PROCESSING (FOR BOTH CURRENT AND 1987 VOLUMES)

Computing Arrangements	Present Organizations								Proposed Organizations for Cairo and Alexandria			
	GOGCWS		AWGA		GOSSD		SCA		GOGCWS and GOSSD (Cairo)		AWGA and GOSSD (Alexandria)	
	Current	1987	Current	1987	Current	1987	Current	1987	Current	1987	Current	1987
Computer at each authority or proposed location	102,450	114,750	85,800	94,850	68,050	68,650	51,050	52,850	134,030	143,680	99,230	108,280
Shared computer for GOGCWS and GOSSD. Separate computer for AWGA	93,004	105,304	85,800	94,850	48,326	48,926	Not Applicable		Not Applicable		Not Applicable	
Single computer shared by all authorities	80,126	92,426	57,894	66,944	42,416	43,016	20,700	22,500	111,327	120,977	65,659	74,709