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THE EGYPTIAN NATIONAL SYSTEM FOR SCIENTIFIC AND TECHNICAL INFORMATION: DESIGN STUDY

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EXECUTIVE SUMMARY

The decade of 1980 challenges Egypt to build a healthy foundation for the long-term evolution of a new economic sector, the information sector. The past two decades have provided evidence that the production and use of knowledge are related to factors such as productivity and employment, and hence indirectly to the national standard of living. It is now accepted as axiomatic that intensive use of relevant and up-to-date data and information in problem solving and decision making is a sine qua non of accelerated human and national development. In industrialized as well as in developing countries, the intensified use of data and information is bringing about a rapid evolution and growth of national information industries. It is essential for Egypt to participate in and stay abreast of this global phenomenon.

This study proposes the establishment in Egypt of a public utility for the management and use of problem solving knowledge (termed "scientific and technical information," or STI). The key raison d'etre of this "national STI system" is to support Egypt's socioeconomic development. It has three primary objectives: 1) to raise the public awareness of STI as a problem solving resource, so as to increase its use in Egypt; 2) to organize public STI resources in Egypt, particularly those generated by Egypt; and 3) to provide for efficient access to, and delivery of, data and information located within the country and abroad.

The study makes explicit the relationship and functions of three autonomous groups comprising the national STI system: users, information services, and document repositories. Technically, the national STI system is an undirected ("ring") network: given suitable telecommunications it allows the eligible user to communicate directly with any of its information services and document repositories.

User Clientele

A distinct design characteristic of the proposed national STI system is its attempt to diffuse information-interacting activities into Egyptian problem solving communities, so as to force the integration of these activities with human problem solving and decision making processes.

The user communities to be given priority attention are, initially, those of Egyptian managers (policy, business and government decision makers), professional practitioners in the public and service sectors, and knowledge transfer agents (researchers and educators). A major effort is deemed essential to appraise these communities of the utility of data and information as a problem solving resource; toward this objective, the study identifies a series of strategies, the more critical ones of which relate to Egyptian education in problem solving. Concurrent with this longterm effort, intensive marketing of the newly developed information services, mediated through "information liaison" personnel in large enterprises and institutions, is advocated.

Information Services

The study recommends that Egypt establish a distributed, open-ended network of information services. Highest initial priority is attached to services supportive of problem solvers in the following sectors: agriculture, energy, human settlements, industry, medicine and health care, science and engineering, and transportation and communication. Each information service node is to be managed and operated by an autonomous organization belonging to the respective sector.

The main responsibilities of each information service node are: 1) the development of its user clientele and markets; 2) compilation of electronic databases of indigenous information of high utility to its user clientele; and 3) the location and provision, from foreign and domestic sources (databanks, libraries, human experts), of data and information requested by Egyptian problem solvers.

The study strongly recommends the wide use in the proposed national STI system of state-of-the-art technology: microcomputers, user-operable software, and telecommunications. A standard information processing facility is described and recommended for each of the information service nodes, having the capabilities of online creating and querying bilingual databases, camera-ready page composition of database contents, and electronic messaging. The facility is intended to operate in a programmer-free environment and be locally maintainable.

The earliest possible introduction to Egypt of an X.25 digital communication network is advocated, to allow online access from each information service node (and eventually from end user facilities) to the hundreds of databases now extant in industrialized countries. The importance of access to "source" databases by management users is emphasized. Meanwhile, the study recommends that the method temporarily used by Egypt to access public U.S. databases -- transmitting queries via telex to a U.S.-based intermediary and having digital search output delivered by courier to Egypt -- be introduced into all information service nodes.

Document Repositories

The study substantiates Egypt's need to acquire and maintain on its soil a non-trivial portion of the world's high quality scientific and technical literature (journals, reference works, and specialized documents such as patents and technical reports). This goal can be attained only if major Egyptian academic and special libraries subscribe to the principle of resource sharing. An embryonic consortium of such libraries is proposed under the auspices of the national STI system; initially its members only consent to provide, upon request and against remuneration, copies of documents from their holdings. A complementary program for supplementing the holdings of

this document repository network is outlined. The program provides a starting point of, as well as incentives for, a voluntary cooperative development and management of STI resources by Egyptian libraries, and it facilitates access by patrons of these libraries to the information services of the national STI system.

Governance

The various nodes of the Egyptian national STI system (user organizations, information services, document repositories) are autonomous organizations belonging to the government, the public or the private sector. The design of the national STI system is predicated on the willingness and ability of these autonomous institutions to collaborate. A method of participatory governance of the national system is proposed in the form of a public, non-governmental agency (Council on Information Services and Resources). The Presidential or Parliamentary mandate of the Council is to plan, coordinate, contract for, financially support, and monitor -- but not operate -- the activities of the national STI system. Included in the latter are systemwide functions such as the formulation of policy, design of common networking protocols and standards, manpower development, and certain national and international activities. The proposed governance provides for direct representation on the Council of the organizations comprising the national STI system.

Budget

The study examines and documents costs of the various functions of the national STI system, including some alternatives. In terms of 1981 dollars, the annual operating budget of the proposed system is approximately equivalent to US$1.3 million, or about 2.5 percent of the Egyptian R&D budget. This compares favorably with the 5 percent figure usually quoted as being the annual expenditure for established systems in developing countries. Four categories of funding sources are identified (income from services, partial operations support by parent organizations of the information system nodes, government subsidy, and grants and donations); and a tentative formula is suggested to generate the annual operating budget.

Related Reports

An accompanying document (Slamecka, V., THE NATIONAL STI SYSTEM OF EGYPT: IMPLEMENTATION, November 1981) describes a three-year program of activities, schedules, and costs necessary to implement the above design. A forthcoming document (Slamecka, V., THE NATIONAL STI SYSTEM OF EGYPT: MANPOWER DEVELOPMENT, 1982) analyzes Egypt's professional manpower needs in information work, and presents recommendations for, and an implementation plan of, a national effort in this area.

PREFACE

The design and implementation of an Egyptian system of scientific and technical information services, intended to support the country's socioeconomic development, is part of an Applied Science and Technology Program under a Project Grant Agreement between the Egyptian Academy for Scientific Research and Technology and the U.S. Agency for International Development. Phase I of the project (November 1979-December 1981) consists of a system analysis and design study.

The project is a collaborative effort of Egyptian and U.S. organizations. The Egyptian Academy of Scientific Research and Technology, with its National Information and Documentation Centre, is the Egyptian executive agency. Egypt-based activities are guided by an Executive Committee comprised of senior Egyptian experts and headed by the President of the ASRT. Technical assistance in Phase I is supplied by a team of U.S. consultants under a National Science Foundation contract (INT-7924187) to the Georgia Institute of Technology. Planning and project management assistance is provided by the U.S. National Science Foundation under a U.S. Agency for International Development Participating Agency Service Agreement.

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Prof. Dr. Hassan Ismail, the former President of the Academy, and Prof. Badran were instrumental in attracting to the project, as its Executive Committee, a group of Egyptian leaders whose stature and commitment have provided it with enviable guidance: Prof. Dr. Ali El-Salmy, member of President Sadat's Advisory Council; Prof. Dr. Aziz El-Kholy, Director of the National Center for Health Statistics; Prof. Dr. Ahmad Gad, Director of the National Information and Documentation Centre; General A.M. Hallouda, Director of the Central Agency for Public Mobilization and Statistics; Prof. Dr. Aziz Kamal, Dean of Engineering, Cairo University; and Dr. Mohamed A.K. Madkour, Director-General, Al-Ahram Microfilming and Organization Center. Prof. Dr. Ossama El-Kholy, advisor to Professor Badran, has provided the project with invaluable cultural and organizational insights.

Dr. Mohamed A.K. Madkour, the Egyptian Project Manager, has made major conceptual contributions to the design study. His technical prowess, able management, and indefatigable energies account for our ability to keep the project on schedule.

The project's technical and consulting staff consisted of some 20 Egyptian experts and U.S. consultants. I am deeply indebted to all of them for their expert and positive contributions to this study. At my institution, Miss Ann Lewis deserves credit for having shaped a manuscript into a finished product.

The U.S. contracting agencies have been extremely helpful throughout the duration of the project. Mr. James Riley and Ms. Janice Weber, of the U.S. Agency for International Development (Cairo), offered invaluable assistance on all-too-frequent and always urgent occassions. As the contract officer, Mr. Eugene Pronko, of the National Science Foundation (Washington, D.C.), has given the project a rare degree of professional and personal commitment, one that comes from having been associated with the project's conception in 1976, and having husbanded it since.

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Previous Page Blank

TABLE OF CONTENTS

	Page
Executive Summary	i
Preface	v
Acknowledgements	vii
Table of Contents	ix
List of Figures	xi
List of Tables	xi
List of Appendices	xiii
I. INTRODUCTION	1
II. OVERALL DESIGN OF THE NATIONAL STI SYSTEM OF EGYPT	5
1. Design Options and Rationale	6
2. Objectives and Functions	7
3. Structure	8
a) The Services Subsystem	10
b) The User Subsystem	11
c) The Document Repository Subsystem	15
III. INFORMATION SERVICES OF THE NATIONAL STI SYSTEM	19
1. Clientele Development	20
a) Clientele Development through Information Services	21
b) Clientele Development through the National Governance System	22
2. Database Development	23
a) Referral Databases	25
b) Bibliographic Databases	25
3. Access to Foreign Databases	29
a) Relevance of Foreign Databases	31
b) Options for Accessing Foreign Databases	31
c) Options for Search Output	36
d) Total Costs of Database Searching	39
e) Recommendations	46
4. Document Delivery	48
5. Referral Service	50
6. Publication	52
a) STI Awareness Bulletin	53
b) Monographs	53
c) Cost Estimate	55
7. Information Technology	55
a) Functional Specifications	56
b) Software	57
c) Hardware	61
d) Estimated Costs	65

Previous Page Blank

IV. STRENGTHENING EGYPT'S INFORMATION RESOURCES 67
1. Local Document Availability 67
a) Selection of Repository Libraries 69
b) Union List of STI Holdings 72
2. Supplementation of Holdings 73
a) Selection 73
b) Technical Services 73
c) Other Equipment 77
d) Estimated Costs 77
V. GOVERNANCE OF THE NATIONAL STI SYSTEM 79
1. Council for Information Resources and Services 80
a) Functions 80
b) Organization 83
2. Funding 85
a) Income from Services 86
b) Funding Formula 86
3. Budget of the National STI System 87
VI. REFERENCES 89
APPENDICES
A. Information Flow Nodes 97
B. Process Flow Charts 103
C. Administrative Files 115
D. Management Reports 129

LIST OF FIGURES

		Page
1.	The Egyptian National STI System	9
2.	Priority Sectors	12
3.	Information Service: Typical Floor Plan	14
4.	Comparison of Annual Costs for Copying 2,600 Search Outputs (@ 100 Abstracts)	41
5.	Egyptian STI Awareness Bulletin	54
6.	The Egyptian National STI System as a "Ring" Network	58
7.	Information Service Node Computer System	66
8.	Subscription Decision Algorithm	71
9.	The Integrated Library System Software	75
10.	Council on Information Services and Resources	81
11.	Council on Information Services and Resources: Organization Chart	84

LIST OF TABLES

1.	Initial Staff of an Information Service	13
2.	Information Service Agents	16
3.	Large Database Creation: Distribution of Costs	28
4.	Growth of Bibliographic Databases, 1975-1979	30
5.	Alternate Communication Costs of Online Access to U.S. Databases from Egypt	35
6.	Digital Transmission Times for 1,000 Abstracts	37
7.	Comparison of Methods of Transmitting Daily Search Outputs to Egypt	38
8.	Online Search and Digital Output Transmission Cost Comparisons	40
9.	Comparative Annual Costs for Storing Search Output	42
10.	Annual Costs of Reproducing 2,600 Search Outputs	43
11.	Comparative Cost Estimates for Different Method of Single Reference Database Search	44
12.	Different Methods of Single Reference Database Searching: Estimates of Cost Per Search	45
13.	Referral Service Directories of Information Sources	51
14.	Arabic Language Functions of Computer System	60
15.	Estimated Total and Simultaneous Users of Computer System at a Service Site	63
16.	Estimate of Required Digital Storage Capacity per Service Node	64
17.	Largest "Core" List Percentages of STI Materials Held by an Egyptian Library	68
18.	"Core" Lists: Average Subscription Cost (1980)	70
19.	National Information Services: Annual Cost Estimate	88

LIST OF APPENDICES

		Page
A-1.	Information Service: Agriculture	99
A-2.	Information Service: Energy	99
A-3.	Information Service: Human Settlements	100
A-4.	Information Service: Industry	100
A-5.	Information Servcie: Medicine and Health Care	101
A-6.	Information Service: Science and Engineering	101
A-7.	Information Service: Transportation and Communication	102
B-1.	STI Database Development: Process Flow	105
B-2.	Bilingual Thesaurus Generation: Process Flow	106
B-3.	"Delayed Online" Search of U.S. Databases: Process Flow	107
B-4.	Foreign Document Delivery: Process Flow	110
B-5.	Awareness Bulletin Generation: Process Flow	112
B-6.	Demand Driven Acquisition: Process Flow	113
C-1.	Manual Files (Egypt)	117
C-2.	User Directory (Egypt)	118
C-3.	Financial Accounts File (Egypt)	119
C-4.	Document Order File (Egypt)	120
C-5.	Document Order File (U.S.)	121
C-6.	Search Request File (Egypt)	122
C-7.	Search Request File (U.S.)	123
C-8.	Publications File (U.S.)	124
C-9.	Bibliographic File(s) (Egypt)	125
C-10.	Bilingual Thesaurus (Egypt)	126
C-11.	Arabic Keyword Dictionary (Egypt)	127
C-12.	English Keyword Dictionary	128
D-1.	Information Services: Management Reports	131

Previous Page Blank

CHAPTER I. INTRODUCTION

The case for the development of national systems of scientific and technical information (STI) has been traditionally based on the need of the scientific community to have access to the most recent global results of research. Communication of such information is vital to the progress of science, and it is an important element in the reward system of the science community. Yet while the pool of scientific knowledge is immense, and while virtually all societies and governments recognize a basic human right to access and obtain such knowledge, scientific communities in many nations experience considerable difficulties when trying to gain access to the STI communication channels: not being aware that information exists, not being able to find out where it exists, and not being able to pay the price for obtaining it are three of the most serious obstacles (Saracevic, 1979).

The cumulative effect of these difficulties on national science is nothing short of devastating. A study of the rates and reasons for the rejection of scientific manuscripts found that authors from developing countries experience far higher rejection rates than authors in developed countries (57% vs 17%), and that they are faulted on specific points indicating that their major problems are those of maintaining awareness of current research results. The study concluded that "the problems LDC researchers experience in accessing scientific information are a major factor in inhibiting the quality and quantity of their own information output." (Gordon, 1979; McCarn, 1981). The establishment of national STI systems is rationalized as the effective and economical strategy to remedy the communication problems of the scientific community.

The discovery of a relationship between research/development (i.e., knowledge generation) and industrial productivity, revealed by studies of agricultural and manufacturing industries (Mansfield, 1980) which established that the rate of productivity increase in these industries and their firms is directly related to the amount spent on research and development, indicated that information and knowledge may have a more general impact, one that affects the level and rate of economic growth. A substantial body of knowledge has been gathered in recent years in support of a correlation between knowledge activities and productivity in general. Industries with high productivity have been shown to have a high level of information expenditure per employee (Hayes, 1980). Other investigations have shown that unemployment of the information labor has consistently been lower than unemployment in either the manufacturing or agricultural sectors of the national economy; and that the high technology elements of the information sector (such as electronic components, computers and telecommunications equipment) have experienced appreciably less price rise than has the economy as a whole (Rubin, 1981). High information needs of research-intensive technologies have been demonstrated (Wolfe, 1974).

These and other studies offer convincing support for the intuitive feeling that "high technology fields depend heavily on information, better management depends on good communication and good internal information management systems, better educated and well-informed workers may well be more productive, better information may well result in increased sales and better relationship between product design and market needs," etc. (Hayes, 1980). Conversely, poor access to or unavailability of information has a detrimental effect on human problem solving and decision making. The fact that an empirical relationship exists between knowledge and productivity makes scientific and technical information a national resource of enormous value, since it is well-known that the rate of productivity growth affects the rate of economic growth (Council of Economic Advisors, 1979).

Another indicator of the importance of knowledge and information surfaced with the hypothesis that an increase in economic growth is strongly associated with an increase in the ratio of knowledge-producing labor to physical labor (Machlup, 1962). Machlup's observation that the efficient organization of production and government seems to require an increasing portion of labor going toward knowledge-related activities (in contrast to physical production activities) has since been amply borne out. The 1976 report on the "information economy" of the United States offered strong statistical backing for the hypothesis that the U.S. economy has shifted from a manufacturing base to an information base, in which 46 percent of the 1977 gross national product was attributable to the production and distribution of goods and services (Porat, 1977). Similar studies and comparable figures have been collected for other industrialized countries (OECD, 1980) as well as for some developing countries.

The widening recognition of the pervasive effects of knowledge and information is focusing national attention on the utility and value of information as a resource, particularly as a broad array of human activities has been redefined as symbol manipulating, information-dependent processes. Judicious applications of information technology have been shown to increase the cost effectiveness and productivity of these activities. The overall effect of this trend has been the emergence of information services as a sector of the national economy, and the concomitant perception of information as not only a resource which is indispensable for cost-effective problem solving in all walks of life, but also as an economic commodity.

The emerging relationship between information activities and economic development is complex and yet poorly understood; nevertheless, there is no evidence that it applies only to industrialized countries. To wit, 26.45 percent of professional labor of Egypt is said to have constituted that country's information sector in 1976 (El-Haddad, 1981). Similarly, the patern of growth of the information labor force — largely due to the growth of public and private bureaucracies — is likely to be similar in developing countries (in the U.S., the bureaucracies account for 25 percent of the work force). Thus while the chief preoccupation of many developing countries is with food production and small industry manufacturing, they are in the process of developing a nontrivial information sector.

The rapid recognition of the importance and worth of knowledge and information is having a significant impact on the national planning of STI systems. Perhaps most importantly, these systems are beginning to be viewed as elements of the emerging national information sectors, and are being planned so as to conform to the characteristics of the latter. These characteristics are not yet well formed; however, some of those relevant to both developing and industrialized countries include the following: 1) the information sector consists of two major, overlapping categories: information generators and consumers; and information service industry; 2) the information sector traverses the public/private boundary; 3) the governance of the information sector parallels the respective governance modes of the private and public sectors; 4) the financing of the information service industry is pluralistic, with the public sector being the principal investor; 5) information technology is the major factor shaping the design of information products and services; and 6) the economics of the information sector exhibits characteristics of both regulated and free markets.

These characteristics have numerous implications for the design of national STI systems. The more important ones follow:

1) The foundations of the national information system must be based on the philosophical conviction that one of the basic societal goals is for knowledge to become a desideratum whose worth is recognized by each individual (El-Kholy, 1980). The benefits that the possession of knowledge makes possible do not occur as an automatic consequence of gaining access to knowledge; an esential condition for socioeconomic progress is for people to want knowledge and to want to cultivate it. A national STI system therefore should function in an atmosphere that induces people to want knowledge, that prompts them to actively seek it, and that encourages them to husband it as an indispensable personal and social resource (Slamecka, 1979b).

2) In principle, the national STI system must strive to service all individuals who perform socially useful problem solving functions in the domain of national development. In today's and particularly tomorrow's environment, optimum decision making assumes critical importance not only in science but in development, production, marketing, as well as in social and political management and administration.

3) The proper role of the government is to stimulate the development of the information sector, and to facilitate the provision of services through this sector. Earlier, governments considered it proper and logical to develop, operate and govern national information systems which, because they are deficit-prone, required government support and sponsorship. Today the preferred role of government is to stimulate the development of information services; it no longer needs to be the exclusive builder, operator, funder, and manager of these services, except in countries of a very low level of development.

4) The traditional definition of "scientific and technical information" as the research literature of science is too restricted; it must be rede-

fined to include other forms of knowledge. Two categories of knowledge are important to development: problem solving knowledge, and cultural knowledge. The proper concern of national STI systems is problem solving knowledge. There is much evidence that the knowledge needed most by problem solvers in developing countries is of the experiential variety ("know-how"), much of which is contained in proprietary repositories -- in the memory of human experts or the files of their organizations. The phrase "scientific and technical information" should be interpreted as being synonymous with "problem solving information." (It is so used in this report.)

5) The national STI system must make use of the most advanced information technology appropriate to its functions. Information technology fuels the information industry and it accelerates the process and rate of information innovation. The development of this technology has now reached another milestone: its use and application have become accessible to the non-expert. Low cost, cheap "machine intelligence" moves inexorably not only to the university and research laboratory but to the factory, the shop, the bank, the office, and even the home. Previously, information technology relegated its use to expert and affluent countries and institutions; the latest information technology is user-friendly, user-operable, more reliable, relatively low-cost, and transportable. By using this technology with judicious enthusiasm, national STI systems will contribute to the development of national information sectors.

* * *

These introductory remarks have sought to portray salient characteristics of the atmosphere within which Egypt proposes to develop the country's modern system of problem-solving information services.

CHAPTER II. OVERALL DESIGN OF THE NATIONAL STI SYSTEM OF EGYPT

To provide a common platform for the discussions that follow, it is useful to begin by delimiting the meaning of some basic and frequently used terms and phrases.

"Information resources" refers to the carriers of data, information, expertise, and knowledge. These carriers are of two types: records stored externally to the human mind on such media as paper, film, magnetic and electronic devices; and human memory. The term "information industry" refers to that component of society and the national economy which husbands the information resources: it generates information, processes it into consumable goods such as publications, and retails it via an array of diverse information services. The "information clientele" are problem solvers and decision-makers who are the consumers of the industry's products. The sum of the information industry and its clientele is the national "information sector." A key modus operandi of this sector is the construct "information systems." Whereas formal definitions of this construct are being attempted (e.g., IFIP, 1979), we may view it somewhat colloquially as organized sets of operations through which the components of the information industry attain their roles (Woolston, 1980).

The phrase "national information system" evokes numerous concepts, differentiated primarily with regard to the function the system entails; the content it husbands, operates on or vends; and the structure of organizations it comprises. One can thus speak of a national information system for certain literature, a national information system for support of law enforcement, a national information system that keeps an inventory of valuable commodities such as people or oil, and a national information system that maintains input and output schedules of the national economy. All of these and many others are proper examples of national information systems in existence today.

The phrase "national STI system" connotes, traditionally, a system of services for the scientific research and development community, based on the literature generated by that community. There exist numerous versions of such a system, based on functional and structural options and differences. Examples of these follow.

As regards functional alternatives, one may distinguish between information systems which facilitate the use of existing knowledge, versus those facilitating the generation of new knowledge. In the former category fall systems that store organized records (libraries, databanks, full text databases, computer-aided instruction systems), so-called "expert" systems that store problem solving expertise (describing real world problems and solutions), and "people" information systems. Information systems that facilitate the generation of new knowledge (new solutions) are exemplified by computational facilities (for weather forecasting, modeling, simulation, aggregate data

analysis, and similar), decision support systems, as well as "artificial intelligence" systems that have deductive capabilities.

Numerous alternatives also exist as regards structural considerations of information systems. The options facing the designer range from a single, central institution on the one hand to institutional networks of different arrangement and different modes of governance. The range of permutations is considerable.

1. Design Options and Rationale

Narrowing the choice of design options is accomplished by first specifying the rationale and objectives of the design effort. The design of the Egyptian national STI system described in this document has been guided by a number of generic desiderata which, in toto, form an underlying rationale for the proposed design. The more important of these desiderata are introduced below.

a) The national STI system exists to support the economic and social development of Egypt, and those problem solvers who contribute to such development. This statement has implications on the range of the clientele, the nature of information resources, the type of information services, and priority of access to the services. Relevant indicators and design guidelines have been produced by an analysis of Egyptian information requirements (Sarasohn, 1981).

b) The design should support the long-term evolution of the Egyptian national information sector. Given the reality and importance of the information sector as a socioeconomic paradigm of present and future Egypt, it is essential that national information services have the ability and property of enhancing its evolution. Consequently, the national STI system should possess an organization, functions, governance, and policies that are complementary to and supportive of the evolution of a national information sector.

c) The design of the national system of STI services should contribute significantly to the penetration of problem solving knowledge into all strata of Egyptian society. The benefits of knowledge use and the evolution of the information sector can be attained optimally only if information becomes a basic, everyday staple of the Egyptian problem-solver. Information therefore must not be viewed or treated as a rare, hardly attainable commodity but as a fundamental, common resource. Whenever feasible and economical the information activity should be performed as close as possible to the problem solving site.

d) The national system of STI services should aid the penetration of the newest information technologies into problem solving sectors of Egypt. Previously, the exploitation of information technology was conditional on the presence of highly skilled (and expensive) manpower -- manpower

which has been, and will continue to be, scarce in Egypt. The latest information technology, developed over the past three years, exhibits the property of being usable by a non-expert; coupled with the 28 percent annual decrease of the cost of this technology (or, inversely, the equal increase in computational power per unit of cost), impressive computational information processing facilities can be used effectively, on a dispersed basis, and in environments that do not possess advanced technical, programming and system management skills and training. For the first time, Egypt is truly able to take advantage of this technology on terms almost similar to those of countries that produce it. It is essential that the design of the national system of STI services capitalize on this development to the greatest possible extent.

e) The national STI system must judiciously mobilize and enhance already existing elements of the country's internal information industry -- information professionals, information services, and information resources. The prospect of capitalizing on these human, organizational, and financial resources depends, however, on the ability of the system to preserve the autonomy of the participating organizations. The implementation of the Egyptian system of STI services must thus embody strategies that stimulate and reward voluntary cooperation of existing organizations and agencies, without encroaching upon their organizational autonomy.

f) The first phase of the implementation effort must assure that, at the end of that phase, there exist in Egypt nontrivial operational information services, and that these services be viable and stable as regards continuity of their operation. The viability requirement implies stability of all essential features of the STI system then in existence, namely the demand for services, quality of services, system governance, and financial support. This desideratum affects such considerations as the size of the initial system, the comprehensiveness of initial services, and the system's governance.

2. Objectives and Functions

The overall goal of the proposed effort is to establish and maintain a national infrastructure for the husbanding and use by Egypt of scientific and technical information. The key elements of such an infrastructure are a system of nationwide services that effectively couple information-needing problem solvers with information resources, systematic provision and management of such resources, and a method of governance that assures continuity and stability of the system's operation.

The purpose of the national system of STI services is to bring knowledge to bear on human problem solving in the socioeconomic development of Egypt. This purpose will be accomplished by means of the following generic functions of the national system:

a) Intensive and pervasive "education" of problem solving communities regarding the utility of information, and dynamic marketing of information services of the national system.

b) Facilitation of access to existing recorded knowledge by problem solvers. The national STI system will provide these users with procedural and technical assistance for locating and obtaining data and information relevant to their problem solving activities, regardless of whether the data and information are located in Egypt or abroad.

c) The organization and management of Egypt-produced scientific and technical information. Better exploitation, in and out of Egypt, of the knowledge produced and recorded in Egypt requires that this resource be systematically husbanded, using modern database techniques, and intensively disseminated.

3. Structure

Discussions of national information infrastructures abound (Unesco, 1974; Ackoff, 1976; Urquahardt, 1976; Gray, 1978; Grolier, 1979). In general, the objective is to structure the interactions and relationships of various parties and stakeholders in the national information enterprise into a "system," and to provide a form of governance for the resulting structure.

The three principal constituencies, or subsystems, comprising the proposed Egyptian STI system are a) information users, b) document repositories, and c) information services. Their relationship is shown graphically in Figure 1.

The component members of the Egyptian national STI system are autonomous organizations in the public, government and private sector of Egypt. The design is predicated on the assumption that the organizations that are to comprise this system are prepared to adhere to certain common rules of conduct and procedure. Coherent evolution and performance are attained through a set of "social contracts" among the member organizations, a set of agreed-upon operating procedures and protocols, and a mechanism of governance and funding. Since membership and participation in the national system are voluntary, the form of its government must be participatory rather than authoritarian. The recommended form of governance, detailed in Chapter V, also encompasses such common functions as methodological assistance and manpower development.

The proposed macro-structure emphasizes a user and service orientation; it is open-ended as regards system size and complexity; its functions do not compete with other types of systems in the information sector (such as library and computer networks); and it is hospitable to future information requirements of the user community and, indeed, to the expansion of that community.

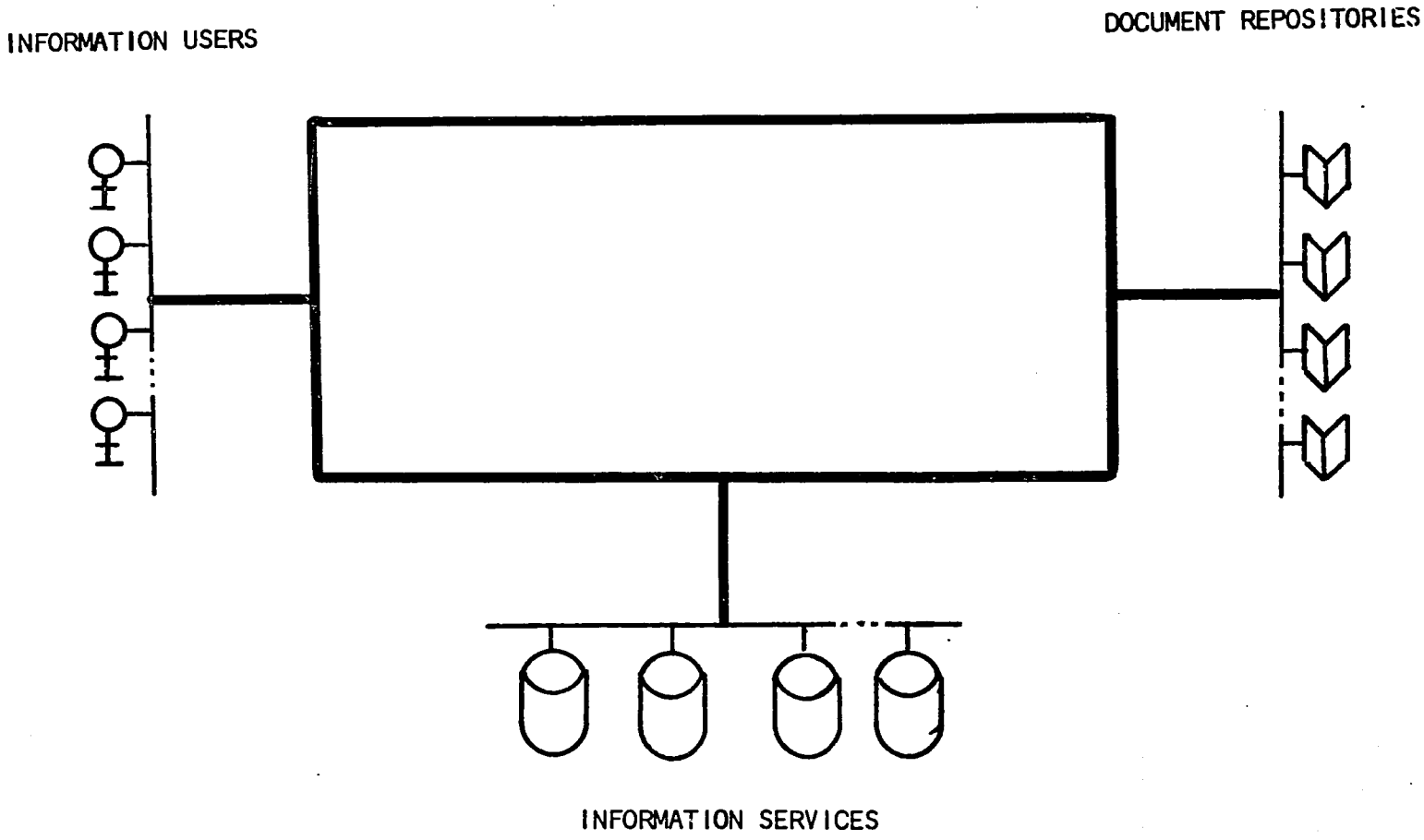


FIGURE 1. THE EGYPTIAN NATIONAL STI SYSTEM.

The three subsystems of the national STI system are further characterized below.

a) The Services Subsystem

The pivotal function of the national STI system is the linkage coupling members of the information user community with repositories of documents and expertise that comprise global information resources. The need for these information services is given by the vastness and complexity of these resources.

The subsystem of information services is comprised of an open number of autonomous organizations that may belong to the public, governmental or private sectors. The initial principal function and mandate of these organizations is the

i) development and maintenance of databases of scientific and technological information produced in Egypt and relevant to their clientele;

ii) searching of databases located in Egypt and abroad;

iii) mediation of requests for document delivery from Egyptian and foreign repositories;

iv) production and distribution of specific products emanating from the contents of such databases;

v) referral services for information requests and needs that cannot be met through one of the above services; and

vi) building up user clientele in the sphere of activity of each service.

More technical descriptions of these services are given in Chapter III.

These six functions are intended to be implemented at the outset; a future expansion of services is to be expected. The particularly useful and urgent future information service is "information analysis," the purpose of which is to assist the problem solver by synthesizing, evaluating and interpreting the data and information relevant to the problem (Carroll, 1980). This advanced form of information service is very desirable in Egypt, but it requires dual competence: in professional information work as well as in the subject of the problem domain. Provision of information analysis service in Egypt is contingent on first training such professional personnel.

In the future, selected information services are also likely to license foreign-produced databases, bring them to Egypt, and operate them locally. The economics of this service becomes favorable when the total cost of such an operation is less than the cost of using the databases remotely (abroad);

this is clearly a function of the number of searches carried out per year. As will be shown in Chapter III, none of the large foreign bibliographic databases (containing over a million records) have currently an Egyptian clientele large enough to justify the economics of operating them under license in Egypt.

As the first step toward developing a subsystem of information services, it is proposed to establish a small number (up to six) of fully operational model information services. A list of seven user constituencies recommended to be served by these services and based on priority areas of Egypt's socioeconomic development is given in Figure 2. It is recommended to proceed, at the earliest time possible, as follows: 1) screen a number of agencies or organizations active in each of the subject areas selected as candidates for the service (an extensive list of evaluation criteria has been developed); 2) contract with the chosen organizations or agencies to organize public information services for their respective constituencies of problem solvers; 3) assist the agencies or organizations methodologically, financially, and through personnel training to develop such a service.

The approximate scope of operations of each service site becomes apparent from Table 1 and Figure 3. Table 1 shows the minimal initial staffing recommended for each service site, and Figure 3 shows the requirements for physical space (about 450 square meters), and exemplifies the physical organization of activities. The personnel and space requirements are based on the following assumptions: each information service will build, during the first three years, several small databases relevant to its constituency; the demand for searching foreign-based databases will average, during the first three years, 500 requests annually per site; and each service will engage in intensive marketing efforts, and some publishing.

b) The User Subsystem

Human interaction with information has varied purposes. One way of categorizing it is to consider the behavioral goals of individuals interacting with information. Such goals may be said to be of three types: problem solving, learning, and entertainment. Each of these imposes different considerations on the individual's interaction with data and information. From the standpoint of the national STI system, problem solving is the critical function, because the quality of solutions to socioeconomic problems depends strongly on interaction with quality data and information. Problem solvers should be given highest priority by the Egyptian national STI services at this time.

The information user subsystem is then comprised of individual problem solvers who are current or potential users of information services and/or consumers of information. Whereas traditional STI systems tend to serve predominantly users who by profession are scientists or engineers, the intent of the Egyptian national STI system is to serve, directly or indirectly, the following categories of problem solvers: i) the manager (policy maker, business and government decision maker); ii) the professional practitioner (engineer, physician, planner, educator, farmer, etc.), and iii) the resear-

FIGURE 2. PRIORITY SECTORS

SECTORS	SUBJECTS
AGRICULTURE	COTTON WHEAT RICE SUGAR CANE FISHERIES LIVESTOCK LAND RECLAMATION IRRIGATION
ENERGY	PETROLEUM ELECTRICITY (NUCLEAR, THERMAL, HYDRO, SOLAR) GAS
HUMAN SETTLEMENTS	URBAN PLANNING HOUSING RECONSTRUCTION
INDUSTRY	TEXTILE INDUSTRY FOODS INDUSTRY ENGINEERING INDUSTRY CHEMICAL INDUSTRY METALLURGICAL INDUSTRY
MEDICINE AND HEALTH CARE	MEDICINE PHARMACOLOGY VETERINARY MEDICINE PUBLIC HEALTH
SCIENCE AND ENGINEERING	NATURAL SCIENCES ENGINEERING BEHAVIORAL SCIENCES, INCLUDING MANAGEMENT SOCIAL SCIENCES
TRANSPORTATION AND COMMUNICATIONS	TRANSPORTATION (RIVER, ROADS, RAILWAYS, AIR, MARITIME, SUEZ CANAL, PORTS) TELECOMMUNICATIONS

TABLE 1. INITIAL STAFF OF AN INFORMATION SERVICE

FUNCTION	FULL-TIME EMPLOYEES PROFESSIONAL	SEMIPROFESSIONAL	CLERICAL
ADMINISTRATION			
DIRECTOR	1		
SECRETARY (WORD PROCESSING)		1	
TYPIST, TELEX OPERATOR			1
CLERICAL (MAIL ROOM, REPROGRAPHY			0.5
DATABASE DEVELOPMENT*			
PROOFREADING, VOCABULARY DEVELOPMENT	1		
DATA COLLECTION, ITEM DESCRIPTION	2	1	
DATA ENTRY**		1	
TYPING, CLERICAL			0.5
DATABASE SEARCHING***/DOCUMENT PROVISION			
SEARCH FORMULATION, EXECUTION	2		
MAINTENANCE OF COMPUTER FILES	1		
DOCUMENT DELIVERY SERVICE			0.5
LIBRARY			
REFERENCE COLLECTION, REFERRAL SERVICE	1		
TYPING, CLERICAL			1
PUBLISHING			
COPY WRITING, COMPOSITION	1		
MARKET DEVELOPMENT			
SERVICE REPRESENTATION, USER TRAINING	2		
TYPING, CLERICAL			0.5
COMPUTER ROOM			
SYSTEM EXPERT/INSTRUCTOR	1	1	

*DEPENDING ON DATABASE TYPE, ADDITIONAL EXTERNAL EFFORT MAY BE NEEDED FOR DATA COLLECTION.

**AVERAGE INPUT RATE = 50 KEYSTROKES/MIN (EXCLUDING CORRECTIONS).

***ASSUMES LESS THAN 5 REQUESTS/DAY FOR RETROSPECTIVE SEARCH OF DATABASES OUTSIDE EGYPT.

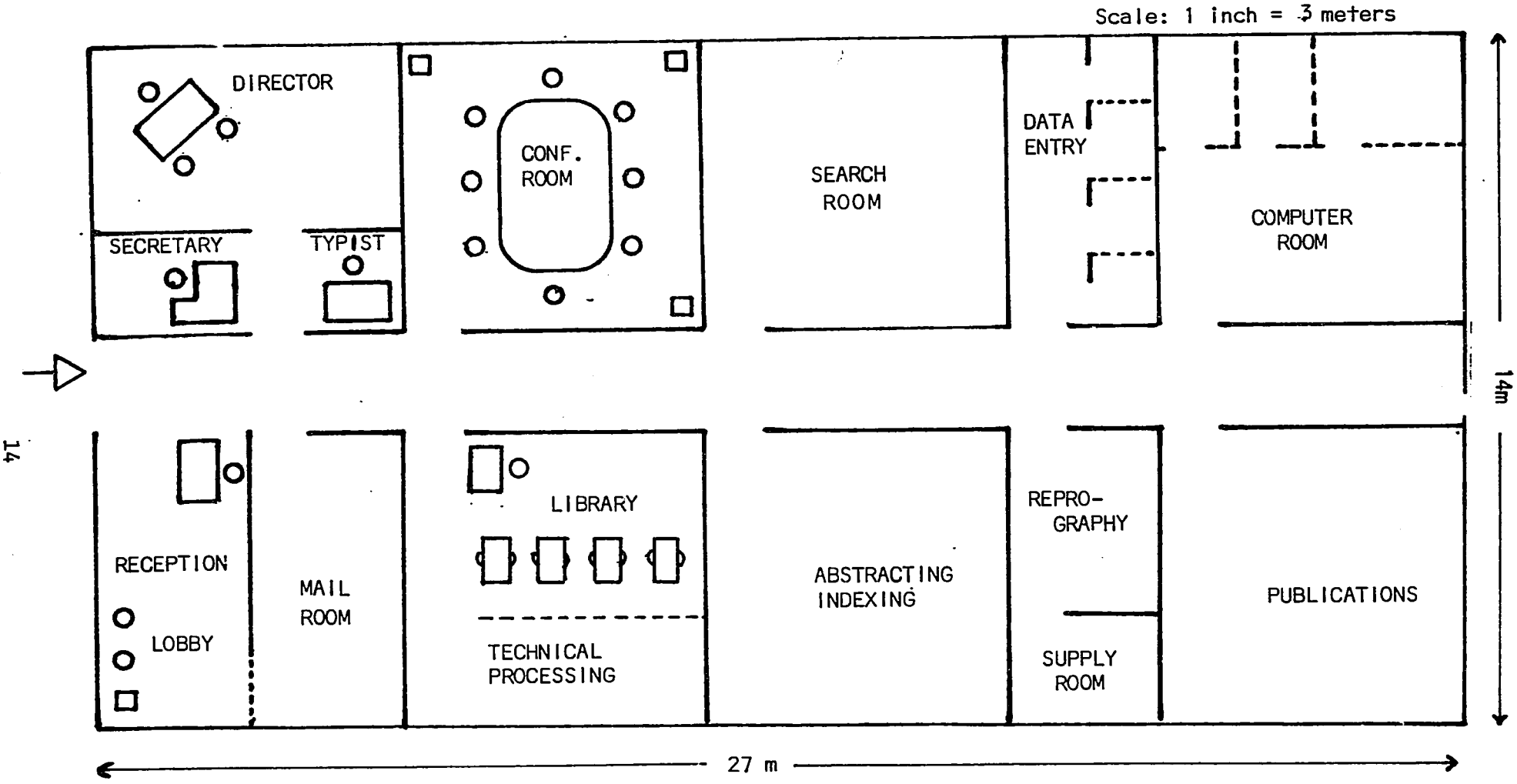


FIGURE 3. INFORMATION SERVICE: TYPICAL FLOOR PLAN

cher (natural and social scientists). The constituency of the user subsystem does not include at this time the general public. This omission is of course not intended to preclude access to information by the Egyptian public; rather it is a matter of setting initial priorities, as well as a reflection of the relative lack of readiness of the general public to make use of scientific and technological information.

Cumulatively, individual problem solvers comprise the user subsystem. While in principle the system allows them to interact freely and directly with all elements of the other two subsystems (information services and document repositories), in practice such interaction is likely to have two characteristics: the users will cluster according to problem solving subject areas; and each cluster will tend to relate more strongly to one information service and repository than to others. Conversely, each information service and repository may be said to have a "natural" clientele within the user subsystem. Appendices A-1 through A-7 tentatively identify the primary and secondary clienteles of each of the recommended initial information services.

Concretizing of a visible, institutionalized information user subsector is of crucial importance. Clearly, it is not always practical for information services to build up a clientele by contacting individually all problem solvers; nor is it likely that the majority of problem solvers will be in individual, direct contact with the information service. The strategy of the information services thus will be to assist in the establishment of "service representatives" (information officers, "gatekeepers" and similar functions) in large and medium size organizations and agencies, amounting to an extension of the information service into client organizations. These extensions are to be operated (funded and staffed) by personnel of the parent organizations, not by the information service.

Table 2 shows the categories of potentially the most effective "representatives" of information services in their respective local settings. The long-term goal is to gradually infuse certain information service functions into the user community itself, so as to allow the national information services to focus mostly on managing national information resources. Such a permeation of informational functions into the problem solving community is an essential as well as an effective strategy for raising the inclination of Egyptian problem solvers to use information.

c) The Document Repository Subsystem

Data and information that support problem solving activities in socioeconomic development cannot be fully enumerated. Usual categorizations (Saracevic, 1979) are in terms of

i) levels of information needed: policy and management information enabling decisions on choices (of alternate strategies, negotiation capabilities, etc.), scientific and technical information enabling technical decisions and training, and operational information enabling production and services;

TABLE 2. INFORMATION SERVICE AGENTS

PRIORITY CLIENTELE	SERVICE AGENTS
PLANNING, GOVERNMENT AGENCIES	INFORMATION UNIT
RESEARCH INSTITUTIONS	LIBRARY
PUBLIC CORPORATIONS	INFORMATION UNIT
• UNIVERSITIES	LIBRARY
SCIENTIFIC/PROFESSIONAL SOCIETIES	EDITORS

ii) <u>necessary knowledge</u>: "know-why" information (more scientifically oriented, generally readily found in the literature and easily transferrable), "know-how" information (more technically oriented, not so readily found in the literature, and hard to transfer), and "show how" information (operational, training, maintenance, etc. not found in the literature, in need of repackaging, and hardest to transfer); and

iii) <u>sources of information</u>: formal information sources (the open literature, report literature, abstracting and indexing services, databanks), informal information sources (personal contacts, consultants, meetings, invisible colleges), and specialized or negotiable information sources (operational information, surveys, statistics, data on industrial processes and products).

A still different categorization (Ackoff, 1976) distinguishes between three types of recorded transmittable "messages": i) primary: messages believed by their producers to convey information not previously communicated (for example, papers and patents reporting new findings); ii) secondary: messages about primary messages which affect awareness of their existence and availability (for example, bibliographies and indexes); and iii) tertiary: messages about the content of other messages (for example, abstracts, reviews, digests, state-of-the-art papers).

An essential function of the Egyptian national STI system is to deliver copies of the primary information sources (called here "documents" and incorporating journal papers, reports, patents, tapes, data, etc.) identified and requested by users of information services. The procurement, organization, reproduction, and delivery of these primary information sources is the function of the document repository subsystem. Although a large percentage of such documents is not available in Egypt and will have to be imported, a certain percentage of essential or frequently required information sources must be maintained within the country.

There are two strategies available to create this subsystem. One option is to assign the function to a single organization, and to build a central repository of primary STI sources; the other option is to construct a distributed subsystem comprised of a number of participating repository organizations operating in a collaborative mode (McDonald, 1981). Assuming that a certain minimal level of cooperation among selected Egyptian libraries is attainable, the latter strategy is highly preferable, primarily because of its resource-sharing effect. Information resource sharing is now seen as an absolute national necessity (Black, 1981).

The proposed document repository subsector of the national STI system of Egypt consists of a small number of selected Egyptian libraries whose collections contain a high proportion of primary STI sources, and which consent to make these collections available to the national system users. Natural candidates for membership in this subsystem are academic and special libraries, and special collections (such as patents). The number of such organizations in the system will be relatively small, and their selection is subject to their meeting the criterion of being able and willing to share their information resources with the user subsystem.

The document repository subsystem is also the ideal vehicle for systematically strengthening Egypt's STI resources, as described in more detail in Chapter IV.

The recommended strategy to develop this subsystem consists of the following steps: i) determine candidate libraries for membership in the subsystem; ii) contract with the selected libraries to become document repository nodes in the Egyptian national STI system; and iii) assist these libraries to implement document delivery services.

CHAPTER III. INFORMATION SERVICES OF THE NATIONAL STI SYSTEM

This chapter discusses functional specifications and cost estimates of initial services to be provided by the Egyptian national STI system. The following are definitions of several terms used frequently in this chapter.

Database: a file of data, in natural- and/or artificial- language, in digital form.

Source database: a database intended to present to the user the the ultimate information source; contains "primary" information (e.g., full text of documents, original survey data, etc.).

Reference database: a database intended to refer the user to ultimate information sources; contains secondary information (e.g., abstract/citations of documents, inventories of information sources, etc.)

Bibliographic database: a reference database containing surrogates of documents

Retrospective search: an on-demand, longitudinal database search.

Online search: a database search conducted in interactive, real-time mode.

Current awareness search: a recurrent database search covering recent additions to the database.

Search output: the product of running a search query against a database.

SDI (Selective Dissemination of Information): current awareness service, distributed to selected users.

Current contents: a service providing photocopies of contents pages of journals or other documents received (all or selected).

Bulletin: an internally produced publication containing output of database searches, news and other materials.

The specific information services to be provided by each service site are: database development; searching of local and foreign databases; document delivery; referral service; and publishing. Each of the five functions is discussed in more detail below. The chapter begins with a discussion of strategies for building up or strengthening the clientele of each information service, and it concludes with a section on the information technology to be provided for and used by each service site.

1. Clientele Development

The overwhelming importance of developing an Egyptian clientele for the proposed information services and of conditioning it to use problem-solving information more intensively has been highlighted by the analysis of Egyptian information needs and uses. One of the conclusions from this analysis states (Sarasohn, 1981):

> A majority (56%) of user requirements survey respondents acknowledge that information is essential or at least important in their work. A significant number said, however, that it was not important; almost half of the professors and teachers answered in this vein.
>
> The study of the Five-Year-Plan showed that many of the projects are dependent upon "new technology" and, hence, upon new information. But in discussing their needs with survey respondents, interviewers were frequently faced with a skepticism that information could be useful.
>
> These contradictions were pursued further for a rational explanation. The answer seems to be that a generation of managers, professionals, government administrators, teachers and others have grown up and are at work handicapped by the lack of adequate information resources. They have become accustomed to being frustrated. They no longer expect to have valid sources of information made available to them. As a result, many of them have ceased to seek or use new information. They succeed in their work to a level that may be limited by knowledge they have personally gained or by experience of their immediate coworkers.

The lack of propensity to seek out and/or use information is a phenomenon not unique to Egypt; its roots are both cultural and economic (Slamecka, 1979b). Problem solvers exhibit such a lack for various reasons: they may be unaware of their need for information; unaware of the existence of information; unable to find existing information; unaccustomed to ask for assistance; cautious about appearing inquisitive; disinterested in learning; not encouraged to exhibit innovativeness in problem solving; conditioned, through emphasis on rote memorizing during schooling, to believe that they should address only problems whose solutions they recall from memory; or simply because they are of passive personality.

To make a perceptible change in these predispositions of problem solvers requires a truly massive and long-term effort. In Egypt, this effort should have two primary and strong loci: the governance organization of the national STI system, and the information services of the national STI system.

a. Clientele Development through Information Services

Two major approaches are recommended for each information service to build up its clientele and to stimulate the use of its services.

First, and foremost, each information service should seek to establish its presence within major organizations of potential clients (such as large production plants, universities, professional societies, departments of government) in the form of "liaison officers." As the choice and appointment of such officers are the prerogative of the client organizations, it is mandatory that this effort be pursued via the management level, and that it be visibly supported by the agency coordinating the early development of the Egyptian STI system.

The objective of this effort is the gradual development, by each information service within its subject realm, of a network of information "extension agents." The functions of the latter are to provide direct linkage with in-house end users, by promoting available information services, attracting problem solvers to avail themselves of such services, and assisting in interpreting users' needs.

The development of this extension network will very likely rely on incentives such as free training of the liaison officers, reduced cost of service, free provision of tools such as thesauri, and possibly assistance in the procurement and installation of online terminals for direct access to the information service network and its databases. Each information service will wish to keep its community of liaison officers effective through periodic training sessions, frequent visits, meetings for exchanging experiences, and supply of working tools and public relations materials.

Second, each information service should pursue an intensive marketing effort in those segments of its potential markets which are unlikely to establish liaison offices (because of small size, geographic dispersion, etc.). Upon its establishment each information service should develop an in-depth regional or nationwide profile of its potential clientele, and compile a directory of potential user organizations. With optional assistance from the agency coordinating the development of the national STI system, each service will then develop appropriate public relations materials, design sales incentives, etc., so as to penetrate this market to an extent commensurate with its ability to serve it.

Two full-time "marketing specialists" are recommended for initial employment by each information service. The training of these specialists is to be provided centrally by the agency coordinating the development of the national STI system; the latter agency should also monitor, advise and assist the marketing staffs to carry out their functions. This assistance notwithstanding, the responsibility for the development of the user clientele rests with the information services, and their success shall determine, to a large extent, whether the key objective of the national STI system development — to bring information to bear on problem solving — will be attained.

b. Clientele Development through the National Governance Organization

Whereas the development of markets for information services is a function of the service organizations, the agency responsible for the governance of the national STI system should formulate and execute long-term approaches aimed at raising the proclivity of Egyptian problem-solvers to use information. The formulation or selection of these approaches is an Egyptian prerogative that cannot be prescribed by outsiders: the strategies must be suitable for or adaptable to the Egyptian cultural, social and political milieu. One may, however, provide a list of possible strategies and tools, so as to facilitate the Egyptian task of evaluating them for their appropriateness, potential, and applicability. Such a list includes the following:

i. Inducing change within the educational system of Egypt regarding education for problem solving.

ii. Using the venue of professional and trade associations to promote information use.

iii. Stimulating the development of "information engineering" consultants within large organizations and as private-sector entrepreneurs.

iv. Inducing extension service agents in the agricultural, industrial, and health sectors to utilize information services.

v. Working through chambers of commerce to promulgate the dissemination and use of information.

vi. Motivating club, hobby and paramilitary organizations to publicize the utility of information services.

vii. Increasing the effectiveness of product salesmen by information backup.

viii. Nurturing the development of "information gatekeepers" as intracompany communicators.

ix. Sponsoring advertising and public relations campaigns via mass communications media.

x. Instituting programs of rewards and awards for exemplary usage of information.

Some guidelines are available to aid the agency governing the national STI system to select and pursue means for inducing information awareness into the Egyptian environment (Wilson, 1980).

On a long-term basis, the central and essential thrust must take place in the educational system and institutions of Egypt. As the information service network reaches universities and technical schools, formal introduction of faculties and students to the use of these services should become part of the curricula of higher education, preferably in the form of classroom and laboratory instruction; ample models for such courses exist (Evans, 1977; Bourne, 1980).

Obviously, Egypt should be prepared to bear significant costs associated with the short- and long-term efforts to raise the propensity of Egyptian problem solvers for the use of information. This investment is absolutely mandatory, even though its effectiveness is not easily measurable. An impact of these efforts may be reflected in an increased usage of information services; the ultimate effect sought, however, is a higher quality of human problem solving.

2. Database Development

One of the important functions of each information service of the national STI system is to contribute to the collection, organization and systematization of data generated in Egypt and/or pertaining to Egypt. The objective of husbanding domestic information resources exceeds by far the objective of any single project, even that of the national system: the variety, volume and complexity of these resources, combined with the inherent impossibility of anticipating all uses and relationships of data, renders such an objective Sisyphean. It is essential therefore to delimit and give some direction to the efforts of the information service nodes in this area.

The principal state-of-the-art vehicle for organizing and systematizing collections of data are machine-readable "databases." The term refers to any collection of such data gathered and organized for a specified purpose, whether the data is represented in natural language (e.g., Arabic, English), an artificial language (numbers, graphics), or both. A definitive taxonomy of databases is wanting and may elude the discipline for some time (cf., Roland, 1982). A useful distinction has been made, however, between "reference" and "source" databases (Wanger, 1980).

Reference databases are those that refer to a primary source of complete information. They encompass two different types of data: "bibliographic," which contain abstracts and/or citations of the primary literature; and "referral," which contain descriptions of projects, institutions, activities, the expertise of individuals, and other non-print sources.

Source databases are those that themselves contain the primary or source information. They encompass a much more varied set of data: numeric, containing numeric values from original surveys and/or data that have been summarized or statistically manipulated; textual-numeric, containing records with fields of textual information, numeric information, or both; properties, containing dictionary or handbook-type chemical and physical data; and full-

text, containing records of the complete text of an item or some primary source.

In Egypt, as elsewhere, the database building activity should be guided principally by the defined needs of the user communities. The latter, because of differences in the nature and purposes of their work, may be expected to make use of both source and reference databases. It is therefore inappropriate to restrict, a priori, the database-building role of the national STI system. On the other hand, because of a number of considerations, it is desirable to recommend directions for its initial database-building activity. These considerations include the following:

i) An existing organization, the Central Agency for Public Mobilization and Statistics (CAPMAS) of the Ministry of Planning, is already mandated to develop and maintain certain national source (statistical) databases. CAPMAS is in the process of providing access to these files which will, presumably, become also available to the nodes of the national STI services. By the same token any plans of these services to embark on the development of demographic or other source databases must be coordinated with CAPMAS; the objective is to assist compatibly CAPMAS's responsibility rather than to duplicate or overlap with it.

ii) Another agency, the National Information and Documentation Centre (NIDOC) of the Academy of Scientific Research and Technology, has had a mandate to develop and maintain databases of the scientific and technical research literature produced in Egypt. As of this time work on such a database has not begun at NIDOC; a registry of agricultural publications issued in Egypt, being maintained at the Ministry of Agriculture as part of an international project, is the only continuing effort in this area. The development of a public database of Egypt-produced scientific and technical literature should thus have a high priority.

iii) The information technology being recommended for the initial operation of each information service node is sufficient to support small to medium-size databases. Since this technology is new in the environment of the national STI system, and since it is desirable that it be put to effective use as rapidly as possible, the information service nodes would be well-advised not to undertake initially database projects that require huge efforts in data gathering, verification, and compilation.

iv) The financial resources available for the three-year implementation phase of the national STI system are insufficient for undertaking the development of large databases. Such databases and information systems (for example, the contemplated investment information service) have to be built outside the current budget of the national STI system project, although the efforts should be coordinated.

In view of the above considerations, the prudent database building direction of the incipient national information service nodes is likely to focus on reference rather than source databases. Although the determination of the number of databases to be built, and of their scope and content, will have to be made by each information service, the following suggestions are offered.

a. Referral Databases

Table 13 (in Section 5 of this chapter) lists some of the referral databases that may be needed by the respective information services. The databases differ in size, in difficulty of data gathering and verification, and in the frequency of updating. No attempt is being made in this study, therefore, to design or discuss these databases in detail; each information service is expected, however, to evaluate the utility and urgency of these (and other) databases, and to assess the manpower effort and cost associated with data gathering, evaluation, compilation, entry and dissemination.

To the extent possible, the national STI system of Egypt intends to use a standard database technology, as described in Section 7 of this chapter, for the maintenance of the databases developed under its auspices.

b. Bibliographic Database

It is strongly advocated that the national STI system also undertake the compilation and maintenance of a bibliographic database consisting of surrogates of primary scientific and technical publications generated in Egypt. The purpose, scope, flow of operations, and estimated costs are described in this section.

This database should be built and maintained cooperatively by the information services for science and engineering, agriculture, biomedicine, and industry, each processing its respective segment of the literature. While it is possible — and initially probably more efficient -- to have such a database generated and maintained by a single organization, the strong reason for producing it cooperatively from the outset is to gain experience with distributed database technology. As discussed more amply in Section 7, the major new direction of database technology development is in the area of distributed databases. The Egyptian national STI system has an excellent opportunity to employ this technology from the outset, and so to join the avant-garde of the next database generation.

The proposed bibliographic database will provide a record, in machine form, of citations and brief summaries of selected Egyptian publications. The principal uses of this database are twofold: to produce printed indexes and current awareness bulletins for general distribution and sale (as described in Section 6 of this chapter), and to conduct bibliographic searches on specific topics. While several information services will each build their subject portion of the database, the distributed components will be

periodically merged into one database whose copies will then be mounted in full at all service sites. In this manner all information services will be able to offer search services to their clients using identical copies of the database. (Distributed database access, transparent to the user, is not contemplated at this time due to lack of suitable telecommunications.)

Final coverage selection is to be determined by consensus of the information service sites involved. The following considerations should be taken into account.

It is estimated that the number of Egyptian scientific, technical and trade publications is in the low hundreds. Some of those that appear in English (such as the major research journals) are covered by international abstracting and indexing services. It is not desirable to compete with these international services unless Egypt is prepared to meet or surpass them in terms of quality of abstracting and indexing, or by more timely coverage -- both being unrealistic goals in the short run. On the other hand, it is of importance to Egypt to create, maintain and publicize a directory of the country's printed output in science, technical and other applied fields. This implies that the database should contain surrogates of both English and Arabic language documents.

Since all of these publications are easily obtainable within the country, it is possible to relax somewhat the quality of abstracting and indexing, and to concentrate on generating a timely database containing "annotations" (brief, indicative summaries of what the document is about) rather than exact and extensive abstracts.

The flow of steps required to add a bibliographic surrogate to the database is shown in Appendix B-1. While most of the steps are self-explanatory, a few may require additional comment.

The purpose of the subject classification of a document is to aid the organization of the printed product or products that will be generated from the database (as discussed in Section 6).

A standard bibliographic citation form should be employed by all information services of the national system that will handle bibliographic databases. An acceptable standard for machine readable bibliographic decriptions was issued by Unesco (Martin, 1974); while in principle being a specification manual for formatting bibliographic information for exchange in magnetic tape form, it includes stipulations relating to the preparation of bibliographic records, and covers serials, monographs, reports, theses and dissertations, patents, and conference publications. For serial titles, the ISBD standard (IFLA, 1977) is recommended.

It is intended that the bibliographic database use two languages, Arabic and English. The surrogates of the document will appear in the database in the language of that document (Arabic or English) except that the titles of Arabic language documents should also have the citation entered in an English translation, so as to indicate the document contents for non-Arabic users.

Each document surrogate will contain an annotation in lieu of the abstract, either taken from the document (if a summary or abstract is available) or prepared by the abstractor in the language of the document. The international standard (ISO, 1976) or the American standard (ANSI, 1971) are appropriate guides to the preparation of indicative abstracts.

A common form is to be developed for recording document surrogates for input in the computer. The design of the form should facilitate online data keyboarding by entry clerks, and be compatible with the data entry software referenced in Section 7.

The indexing function involves decisions regarding the indexing language and terminology. Since the bibliographic database of Egyptian STI will be small (on the order of thousands of documents), the use of unmodified subject thesauri that exist for fields like chemistry, engineering, etc. is inappropriate, inasmuch as they contain too large numbers of indexing terms. Unfortunately, an adequate, internationally accepted macrothesaurus for the entire domain of science and engineering does not exist. The next best way is for each information service to generate its own thesaurus of terms in English (Unisist, 1973), with the assistance of existing relevant thesauri, and then translate it into Arabic (Austin, 1980). The suggested procedure for the development of such bilingual thesauri is shown in Appendix B-2. For a given field (e.g., pure science, engineering, medicine, agriculture) the thesauri can be reasonably well firmed up in 12 months of service operation. Social sciences present a fortunate exception in that an English/Arabic macrothesaurus for this field already exists (Macrothesaurus, 1979).

Elements of the database that pertain to English-language documents issued in Egypt may constitute also input to internatinal abstracting and indexing services (a la the current collaboration with AGRIS). Each service site will have to determine which documents are to be so included, and it may have to use the appropriate abstracting guide and indexing thesaurus, possibly having to augment initially assigned indexing terms.

The following figures are offered as guidelines to estimating the manpower and cost required to generate a bibliographic database of Egypt-produced scientific and technical literature.

In 1980, representative industrial-country costs of preparing an abstract and entering it in a database were about $21 (Williams, 1981). Table 3, which shows the distribution of this figure among different activities, implies that approximately 70 percent (or $15) is accounted for by labor costs. Taking the average industrial-country salary of an information professional to be $10/hour plus overhead, the average man-effort per abstract is less than one hour. It is unlikely that this level of efficiency can be initially attained in Egypt; perhaps four hours of effort is more realistic. Assuming the average hourly wage of a trained Egyptian professional will be $3, and non-labor costs in Egypt to be comparable to those in industrial countries (approximately $7 per abstract), we calculate the Egyptian cost for adding an abstract to the database to be $19.

TABLE 3. LARGE DATABASE CREATION: DISTRIBUTION OF COSTS

	LABOR (%)	NON-LABOR (%)	TOTAL (%)
INPUT			
ACQUISITIONING	2.4	4.5	6.9
DATA TRANSFORMATION	36.1	4.0	40.1
COMPUTING*	1.7	7.1	8.8
R & D	10.2	1.8	12.0
SERVICES	3.0	4.5	7.5
SUBTOTAL	53.4	21.9	75.3
OUTPUT			
PHOTOCOMPOSITION, PRINTING, DISTRIBUTION	2.0	22.7**	24.7
TOTAL	55.4	44.6	100.0

*DOES NOT INCLUDE SYSTEM DESIGN/DEVELOPMENT COSTS.

**ASSUMES SUBCONTRACTING FOR PRINTING AND DISTRIBUTION.

SOURCE: ELIAS, A.W. "THE ECONOMICS OF ONLINE DATABASE CREATION." PAPER PRESENTED AT THE ANNUAL MEETING OF THE AMERICAN SOCIETY FOR INFORMATION SCIENCE, MINNEAPOLIS, MI, OCTOBER 1979.

For purposes of illustration, if we assume further that the entire database will cover 50 Egyptian serials, each appearing six times a year and each contributing to the database 10 abstracts per issue, we arrive at a total of 3,000 abstracts per year. Using the above estimates of required effort (4 man-hours/abstract) the total number of man-hours per year (distributed among the collaborating sites) is 12,000 or approximately 6 full-time staff members, including five professionals and one data entry clerk. The annual cost of generating a database of 3,000 abstracts comes to $57,000.

3. Access to Foreign Databases

Providing access to existing databases, and assisting users to retrieve from them information relevant to their needs and interests, is a central function of all modern information services.

The global number of public machine-readable databases probably exceeds one thousand, and their growth since 1975 continues to be quite remarkable. As shown in Table 4, the number of bibliographic and natural language databases between 1977 and 1979 has grown by 46 percent, and the number of their records by 118 percent. The private sector produces some 75 percent of these databases, as compared to 25 percent produced by government agencies. Sixty percent of the bibliographic databases are in science and technology, slightly over 10 percent in social sciences. Nearly 50 percent of the bibliographic databases are of medium size (30,000 to 300,000 records).

Source databases outnumber reference databases; 60% of some 400 databases listed in the Directory of Online Databases (Landau, 1979) are of the former type. A large majority of source databases (75%) are numeric (Wanger, 1980).

In the U.S., some 90 percent of databases are available online (i.e., they can be searched interactively in real time from remote terminals connected to the database by telecommunications). Europe purports to have access to over 1,400 databases of the reference and the source types, of which some 500 are accessible online (EUSIDIC, 1981). Many databases are of course of considerable relevance to problem solvers in developing countries (Slamecka, 1979b). There exist several excellent database guides (EUSIDIC, 1981; Landau, 1979; Williams, 1979a; Luedke, 1977).

The major parties of the "online industry" are database producers and database vendors. The latter are organizations which license databases from producers and make them available for access by the general public against payment of fees, parts of which revert to the producers in the form of royalties. The largest U.S. vendor provides access to some 130 databases; the largest European vendor services about 30. However, many databases, particularly of the source variety, are available only from database producers. The global revenue from database searching is estimated at $90 million, and the annual growth of the online industry at 25-40 percent.

TABLE 4. GROWTH OF BIBLIOGRAPHIC DATABASES, 1975-1979

DATABASE ORIGIN	1975 DATABASES (NO.)	1975 RECORDS (MILLION)	1977 DATABASES (NO.)	1977 RECORDS (MILLION)	1979 DATABASES (NO.)	1979 RECORDS (MILLION)
U.S.	177	46	208	58	259	93.5
CANADA, EUROPE, JAPAN	124	6	154	13	269	54.5
TOTAL	301	52	362	71	528	148.0

ADAPTED FROM: WILLIAMS, M.E., "DATABASE AND ONLINE STATISTICS FOR 1979." ASIS BULLETIN, 7:27 (DECEMBER 1980).

Clearly, it is essential that the national STI system of Egypt obtain and maintain effective access to global databases. This objective requires considerations of a) identification of databases potentially relevant to the Egyptian clientele, b) means of obtaining access to them, and c) estimates of volumes and costs. These aspects are considered below, and are followed by a set of recommendations.

a) Relevance of Foreign Databases

Historically, the information profession has been preoccupied with attention to reference databases, particularly of the bibliographic kind; this is due largely to the facts that the information profession is the intermediary between these databases and their end users, and that it has contributed to the development of the databases. In contrast, most source databases are used directly by end users, with little or no assistance by the information "intermediary," and hence have received relatively little attention by the information profession.

There is increasing evidence, however, that source databases dominate the user market in industrialized countries. It is estimated that during 1980 some 6 million database searches were carried out in the Western industrialized hemisphere, and that 90% of these were directed to source databases. Two 1981 surveys (in the UK and the US) predict that as database users, managers will outnumber others (such as scientists and technicians) by a ratio of 9:1. A survey of 10,000 subscribers to Source, a U.S. computer utility that provides 1,200 databases, programs, etc., has determined that three times as many businessmen and managers are likely to use the service than other professionals, including computer professionals (MIS Weekly, 1981). Interestingly, the 1980 user survey in Egypt (Sarasohn, 1981) identified Egyptian managers as having the highest perception of the importance of information, and greatest awareness of the lack of information services in Egypt.

These indicators suggest strongly that the national STI system cannot ignore accessing foreign source databases, and, indeed, that its information services catering to managers and businessmen should give these databases priority. This conclusion has considerable implications, particularly on the staffing and personnel training of these services.

b) Options for Accessing Foreign Databases

There exist four options for Egypt to obtain access to foreign databases: licensing for domestic operation, online access, delayed online access, and batch search. This section examines the feasibility and economics of these alternatives.

i) Licensing. Some databases, although not the majority of them, can be licensed for annual fees ranging upward from several thousand dollars. Depending on the database in question, the fee includes a royalty for the database as well as a rental fee for the computer software needed to operate the database.

To become a vendor of foreign produced databases and to operate these databases in the online mode, Egypt would require, apart from skilled staff, appropriate hardware, suitable operating systems, and database retrieval software. For a large database of one million records or more, exemplified by the PREDICAST economic databases, the MEDLARS database of the National Library of Medicine or the COMPENDEX database of the Engineering Index, the monthly U.S. rental cost of adequate computer facilities, appropriate software, and maintenance contracts is about $25,000. (This estimate is based on the following configuration: IBM 4341 computer, two megabyte CPU, 2 gigabyte disk storage units, printers and terminals, operating system, database software, and maintenance. Egyptian cost is like to be 25 percent higher.) A minimum of ten employees would be required to maintain the system and perform inhouse searches. Adding the database licensing fee, the annual cost for Egypt to operate a single large database would be in excess of $300,000 per year.

The economic rationale for justifying this alternative is determined as follows. Assume that the average total cost of an online search from Egypt of a database located abroad is $60; then $300,000 will buy 5,000 such searches per year. It will be more economical for Egypt to operate such a database domestically if there exists a local demand for more than 5,000 searches. It is not probable that such a volume of one-database searches will be attained in Egypt during the next five years -- at which time there is a possibility that new storage technology (optical discs) may cause major changes in the distribution of recorded knowledge. It appears prudent not to make such major investments at the present time.

It is also possible to establish a much more modest licensed facility in Egypt, by operating a large foreign database in a batch (rather than online) mode, using smaller equipment and older software, both obtainable at much lesser cost. For example, the PREDICAST database license cost is $27,000 per year, older IBM software ("type 3" programs) is available inexpensively if not gratis, and an IBM System 360 computer with magnetic tape drives might be found and used part-time in Egypt. Including maintenance and staff salaries, the Egyptian annual cost of operating the database in batch mode would nevertheless be at least $100,000, or equivalent to the cost over 1,600 retrospective searches abroad. The inadvisability of making a commitment to older hardware and old database technology should also be taken into account.

On the other hand, Egyptian information services should explore and pursue the possibility of licensing small foreign databases, provided their operation in Egypt is technically feasible (i.e., they can be reformatted to run on the equipment that will be provided), and cost-effective (i.e., inexpensive to obtain and of commensurate demand and usage).

ii) Online search. For the typical user, online access to databases poses two problems: the availability of adequate telecommunications for connecting the user to the database; and knowledge of the "query language" by means of which a given database can be searched. Query languages and search protocols vary considerably from one database to another; their incompatibility has led to the development of a new information profession, the so-called

"database intermediary" who specializes in database search. Since an intermediary is typically able to maintain high familiarity with only a small number of databases, information search services serving general clienteles (e.g., universities) must maintain a staff of these specialists. For Egypt, the training of intermediaries is a high-priority task, particularly with regard to source database access.

Direct digital communication between Egypt and the U.S. can be obtained in a number of ways; they are differentiated according to the communication facilities used, and they differ in cost. The communication facilities of primary interest are termed here "public data networks" or PDNs, and they include three types:

- Circuit switched networks, using direct-dial voice telephony. At this time the number of voice telephone lines between the U.S. and Egypt is limited (although American Telephone and Telegraph Co. reports that the number will be doubled in September 1981). The cost of communications using this analog line, which requires modems, is equivalent to long-distance telephone calls; they usually offer transmission rates in the 0.3-4.8 kilobit range, although 1.2 kilobit is more prevalent and offers more reliable transmission. The Egypt-U.S. line currently uses half-duplex switches, not permitting simultaneous two-way (full duplex) transmission.

- Leased circuit networks, which are conditioned voice lines typically providing point-to-point, half or full duplex circuits. They feature low error rates (less than 1 bit in 10 million bits transmitted), fast call set-up times of one second or less, and charges for connect time only. Circuit-switched lines are leased from an International Record Carrier (IRC) such as Western Union, RCA, or ITT. The leased lines optionally offer high speeds (9.6 kilobits/sec); their cost is in the range of $12,700 per month (International Telephone & Telegraph Co., 1981).

- Packet switching networks, which share digital network paths among multiple, low-volume users. Data is transmitted over the network in fixed-sized blocs called "packets." The interface to packet networks is usually more complex; in turn, the network provides certain control functions, which are referred to as "value-added" services. The cost of using this network is independent of transmission distance, and consists of a low connect charge (about $12 per hour per user), plus a charge of $0.60 per 1,000 characters transmitted. (Packet switching data networks require, of course, that a line be leased by someone, usually the telecommunications agency, in each country that has access to the network. The cost of the leased line is $12-14,000/month; thus from a national point of view these networks are equally expensive as leased circuit networks. They are inexpensive from the viewpoint of a single user who assumes only a fraction of the total cost.)

Packet switching networks are most economical for low-volume data transmission such as occurs in online searching of databases. On the other hand, digital circuit-switched networks may be cheaper for transmitting large volumes of data, such as voluminous outputs from textual databases (Branscomb, 1979).

Assuming that online database access demand from Egypt averages 10 searches daily, at 30 mins/search, the total connect time required is 5 hours. It is quickly obvious that the cost of direct-dial long-distance telephone, at $4 per minute ($1,200/day) is untenable, as is the leasing of a channel from an IRC (AT&T does not permit data transmission). Clearly, the most economical are packet switching networks: a connect-hour costs about $12, plus a charge for each of the data packets transmitted. The approximate monthly costs of the three types of transmission, for the assumed 5 hour connect time/day, are compared in Table 5.

One immediately available online option is for Egypt to access a packet-switching network via a country other than the U.S., by using direct-dial line between Cairo and a network node in a nearby country (TELENET is available, for example, in Saudi Arabia and Bahrain). The cost of such connection has not been investigated; its major component is the direct voice line that would be engaged for hours per day. This cost can be obtained from the Egyptian national telecommunications authority.

iii) Delayed online search. This technique, developed by ASRT/NIDOC and Georgia Tech, involves forwarding search queries via telex from Egypt to a U.S. intermediary who, in turn, conducts an online search (using the search statements formulated in Egypt but having the option of optimizing them online). The query formulation, transmission and online execution can be accomplished in 24 hours; and depending on the mode of delivery of the search output (decribed in subsection c below), the average turnaround time of the entire process will vary from 5 to 21 days.

The total cost of the delayed online search is approximately that of U.S. online searches (including information labor). The economy is attained by shifting some professional activities to Egypt, and thereby compensating for the additional costs of international communications.

iv) Batch search. Another option for accessing foreign databases from Egypt is to have them searched in a batch mode. Search queries are formulated in Egypt and transmitted by telex to a foreign intermediary who enters them, online, in the database vendor's system. The batched queries are then executed in off-peak hours, and the output is forwarded to Egypt. Retrospective, demand batch searches are only somewhat less inexpensive than online searches, as the intermediary's time of interaction with the system is shorter; on the other hand, there is no opportunity to optimize the search logic. For the latter reason, batch searches are more suitable for recurrent, SDI (selective dissemination of information) searches using well-formulated, tested queries. (In the ASRT/NIDOC experimental search service, recurrent searches have been conducted in batch mode.)

TABLE 5. ALTERNATE COMMUNICATIONS COSTS OF ONLINE ACCESS* TO U.S. DATABASES FROM EGYPT

COMMUNICATIONS	MONTHLY COST	COST PER SEARCH
DIRECT-DIAL	$24,000	$120.00
LEASED CIRCUIT NETWORK	12,700**	63.50
PACKET SWITCHED NETWORK	1,600	8.00

*ASSUMING 10 SEARCHES PER DAY, AT 30 MINS. CONNECT TIME, AND 20 DAYS PER MONTH.

**ITT QUOTE, AUGUST 1981.

It is apparent that the most economical, and affordable, online access from Egypt to U.S. databases must await the installation in Egypt of a node of a packet switching network. When one or more of these networks establish Egyptian nodes, it should be possible for Egypt to access foreign databases at a cost not exceeding that of, say, American users.

c) Options for Search Output

From Egypt's standpoint, another important question is that of the media for recording the database search results, and the method of delivering the output to Egypt. The factors to be considered are the costs of the different output recording media, of the means of delivering these media to Egypt, of output storage, and of output reproduction. Clearly (and importantly), each medium has different connotations as regards user acceptability.

i) Output recording media. The currently supported media for recording output from database search services are: online computer printout (on terminal screen or paper, at the user's facility); offline computer printout (on paper, at the vendor's facility); and recording the output in digital form on electronic media and transmitting it digitally to the user's site. The latter method has been successfully tested by Dialog Information Services, Inc. and the Georgia Institute of Technology.

Another prospective new search output medium is microfilm. One major U.S. vendor is currently (August 1981) studying the possibility of using a computer-on-microfilm (COM) printer to produce, online, microfiche of the search results; a decision is to be made before the end of 1981. Microfiche can also be generated at the user's site, from search output received in digital form. Current U.S. contract prices for producing a master microfiche run approximately $0.0065 per frame, or less than a dollar per 90-frame microfiche having a reduction ratio of 24:1. Microfiche copies, under a bulk price contract, cost $0.07 per fiche if made at the same time as the master, or $0.25 per fiche if made from the master.

ii) Output delivery. The method of delivery of search output is, obviously, related to the output medium. Thus offline computer printouts must be airmailed to Egypt. Printed matter airmail is limited to a maximum weight of four pounds, at $15.48 (1 lb, $4.44). Current delivery time for airmail is about two weeks. A more expeditious, but more costly, way is to use airfreight or courier service. Minimum charge for airfreight is $45.00; if the package is handcarried to the airport (which increases the cost of delivery), delivery to Cairo airport takes two to three days. Courier service (DHL, 1981) costs, which include door-to-door pickup and delivery in both countries, are as follows: $60.50 (1 lb), $66.00 (2 lbs), $94.05 (4 lbs), $130.63 (8 lbs).

The cost of digital transmission from the U.S. to Egypt varies with the rate of transmission and the channel type. Table 6 shows the theoretical times required to transmit a daily search output of 1,000 abstracts (200,000 words) at different speeds; actual times are one-third higher. Table 7 shows the comparative costs of sending the hypothetical daily search output to

TABLE 6. DIGITAL TRANSMISSION TIMES* FOR 1,000 ABSTRACTS

TRANSMISSION RATE (CHARS PER SEC)	TRANSMISSION TIME (MINS)
30	664
120	166
240	83
480	42
960	21

*THEORETICAL TIME: ACTUAL TIME IS ONE-THIRD LONGER.

TABLE 7. COMPARISON OF METHODS OF TRANSMITTING DAILY SEARCH OUTPUTS* TO EGYPT

METHOD OF TRANSMISSION	COST ($/DAY)	DELAY
AIRMAIL - HARD COPY (8 LBS @ $14.58/4 LBS)	30.96	14 DAYS
AIRMAIL - DISKETTES (2 LBS)	8.12	14 DAYS
AIRMAIL - MICROFICHE (1 LB)	4.44	14 DAYS
COURIER - HARD COPY (8 LBS)	130.63	3 DAYS
COURIER - DISKETTES OR MICROFICHE	60.50	3 DAYS
DIRECT-DIAL TELEPHONE - 240 CPS ($4/MIN)	333.00**	83 MINS
PRIVATE LEASED LINE (IRC)***	610.00**	21 MINS
PACKET-SWITCHING NETWORK - 960 CPS ($12/HR, $0.60/1000 CHARS)	724.00**	21 MINS

*200,000 WORDS (10 SEARCHES @ 100 ABSTRACTS @ 200 WORDS/ABSTRACT).

**THEORETICAL COST; ACTUAL COST TO BE HIGHER.

***24-HOUR LEASE OF 960 CPS LINE: ASSUMES NO OTHER USERS.

Egypt in one batch via different forms and channels. Table 8 compares the combined annual costs of online search and digital delivery of output. it shows that packet switching is most economical for negotiating the online search but not for the digital transmission of search results.

iii) Output storage. The medium of the search output (paper, microfilm, or electronic storage) carries with it implications of storage cost. Table 9 summarizes annual costs of storage, again assuming daily output of 1,000 abstracts.

iv) Output reproduction. It is likely that some search outputs will be produced, or reproduced, in more than one copy. Table 10 shows the costs of reproducing output copies from their respective storage media, as well as the combined costs of storage and reproduction. Figure 4, which illustrates the comparative annual costs of reproducing outputs from searches stored on different media, documents the economy of the microfiche.

d) Total Costs of Database Searching.

The total cost of an online search is the sum of manpower costs (for the search query preparation, the interactive search negotiation, and the output review and processing), and the database vendor's charge. Typically, vendors quote the cost of database services in terms of "dollars per connect hour" (the latter aggregating the vendor's prorated cost of facilities and operations, vendor's prorated royalty to database producer if different from vendor, and prorated cost of the use of the telecommunication line leased by vendor), and a unit cost per item of search output. (The charges vary from one database to another. For example, the "World Textiles" database from Dialog Info. Services, Inc. is $55.00 per connect hour and $0.10 per record printed. The MEDLINE database available from the same vendor costs $35 per connect hour, and $0.15 per abstract printed. AQUALINE, a database on water management, costs $35 per connect hour and $0.30 per abstract.)

For planning purposes, one may estimate the manpower effort to be equal to two manhours per search request. Based on worldwide estimates for 1980 (and recalling that 90% of them were of source databases), the average length of an interactive online search session is 15 minutes, and the average vendor's charge $15 per search. U.S. statistics cite 20 minutes per search of bibliographic databases, and the experience with ASRT/NIDOC searches supports this figure: for approximately 500 searches conducted, the U.S. vendor's charge for retrospective online searches averaged $20 per database; for offline SDI searches, $6.00. However, since the number of bibliographic databases queried per search averaged 1.75, the total costs averaged $35 and $10 respectively (Dodd, 1981). Online searches from Egypt may initially expect longer connect time per search; the estimates in this study assume 30 minutes.

An attempt has been made, in Table 11, to derive the total costs for each of the four methods of accessing U.S. reference databases. A search is taken to consist of 50 words of input, and 20,000 words (100 citations and abstracts) of output. Next, Table 12 shows the minimum and maximum per-

TABLE 8. ONLINE SEARCH AND DIGITAL OUTPUT TRANSMISSION COST COMPARISONS[A)]

COST CATEGORY	DIAL-UP LINE (240 CPS)		LEASED LINE (24 HRS, 960 CPS)		PACKET SWITCHED LINE (960 CPS)	
	MINS/DAY	$/YEAR	MINS/DAY	$/YEAR	MINS/DAY	$/YEAR
ONLINE SEARCH (10 SEARCHES x 250 DAYS)	300	300,000	300	10,400[B)]	300	10,400
DIGITAL OUTPUT TRANSMISSION (1.2 MIL. CHARS. x 250 DAYS)	83	83,000	21	152,400	21	180,000
TOTALS	383	383,000	321	162,800	321	190,400
TOTAL COST PER SEARCH	-	153	-	65	-	76

A) INCLUDES VENDOR AND TELECOMMUNICATION COSTS ONLY

B) SEARCH VIA PACKET SWITCHING LINE.

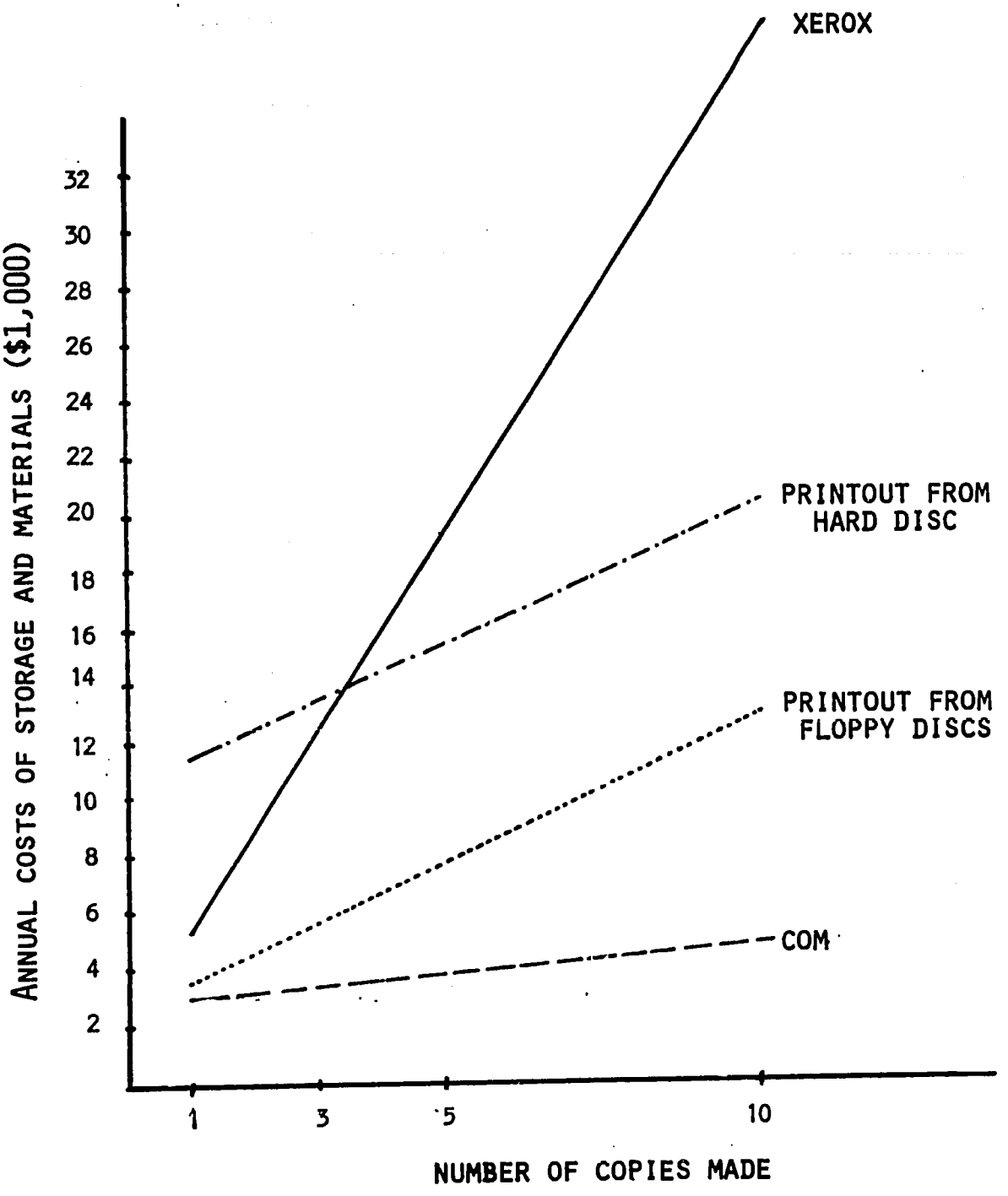


FIGURE 4. COMPARISON OF ANNUAL COSTS FOR COPYING 2,600 SEARCH OUTPUTS (@ 100 ABSTRACTS).

TABLE 9. COMPARATIVE ANNUAL COSTS
FOR STORING SEARCH OUTPUT*

	MEDIUM	VOLUME	UNIT COST	FACTOR	TOTAL COST/YR
1.	PAPER	70,000 PAGES 45 FT CABINETS	$0.015/PAGE $200/FILE	x70,000	1,000 800 } 1,800
2.	FICHE (COM)	2,000 MASTERS	$1/MASTER	x2,600	2,600
3.	DISC (HARD)	260 MBYTES	$40,000/DISC	÷4**	10,000
4.	FLOPPY DISC	260 MBYTES***	5/DISC	x520	2,600

*ASSUMPTIONS: 2,600 RETROSPECTIVE SEARCHES/YEAR @ 100 ABSTRACTS AND 1,000 CHARACTERS/ABSTRACT.

**AMORTIZED OVER 4 YEARS.

***FLOPPY CAPACITY 0.5 MBYTE.

TABLE 10. ANNUAL COSTS OF REPRODUCING 2,600 SEARCH OUTPUTS*

MEDIUM	STORAGE COSTS	COSTS OF REPRODUCTION 1X	3X	5X	10X	TOTAL COSTS 1X	3X	5X	10X
1. XEROX OF COMPUTER PRINTOUT	1,800	3,500	10,500	17,500	35,000	5,300	12,300	19,300	36,800
2. COMPUTER PRINTOUT FROM DISC	10,000	1,050	3,150	5,200	10,400	11,050	13,150	15,200	20,400
3. COMPUTER PRINTOUT FROM FLOPPIES	2,600	1,050	3,150	5,200	10,400	3,650	5,750	7,800	13,000
4. FICHE DUPLICATION**	2,600	182	546	910	1,800	2,782	3,146	3,510	4,400

*MATERIALS COST: $0.015/SHEET OF COMPUTER PAPER, $0.05/PAGE XEROX, $0.07/FICHE DUPLICATE.

**DOES NOT INCLUDE COST OF MICROFICHE READERS.

TABLE 11. COMPARATIVE COST ESTIMATES FOR DIFFERENT METHOD OF SINGLE REFERENCE DATABASE SEARCH [A] (IN $)

SEARCH METHOD	EGYPT-BASED COST	INPUT TRANSMISSION COST	US CONTRACTOR COST	US VENDOR COST	OUTPUT TRANSMISSION COST [E]			
		TELEX			PACKET LINE	(HARD COPY)	COURIER (FICHE, FLOPPY)	AIRMAIL
LICENSING (1 DATABASE)	$100,000 [B]	-	-	-	-	-	-	-
ONLINE	$9 [C]	-	-	$20	$72	$13	$6	$3
DELAYED ONLINE	$6 [C]	$4	$20 [D]	$20	$72	$13	$6	$3
BATCH	$6 [C]	$4	-	$20	$72	$13	$6	$3

A) INPUT = 50 WORDS, OUTPUT = 100 ABSTRACTS = 20,000 WORDS PER SEARCH.
B) TOTAL ANNUAL COST FOR DATABASE SYSTEM AND PERSONNEL.
C) SALARY RATE $3/HOUR (OVERHEAD NOT INCLUDED).
D) INCLUDES OVERHEAD.
E) PRORATED FOR 10 SEARCH OUTPUTS: SEE TABLE 7 FOR DETAILS OF CALCULATION. THE ONLY TELECOMMUNICATION METHOD CONSIDERED IS PACKET SWITCHING.

TABLE 12. DIFFERENT METHODS OF SINGLE REFERENCE DATABASE SEARCHING: ESTIMATES OF COST PER SEARCH ($)

SEARCH METHOD	TOTAL COST/SEARCH MINIMUM	TOTAL COST/SEARCH MAXIMUM	TURNAROUND TIME
LICENSING[E] (1 DATABASE)	$67[D]	$200[C]	1 DAY
ONLINE	$32[B]	$101[A]	1 DAY
DELAYED ONLINE	$53[B]	$132[A]	4-21 DAYS
BATCH	$33[B]	$ 88[A]	5-21 DAYS

A) DIGITAL OUTPUT TRANSMISSION VIA PACKET SWITCHING DATA NETWORK.

B) OUTPUT TRANSMISSION VIA AIRMAIL.

C) BASED ON 500 SEARCHES/YEAR.

D) BASED ON 1,500 SEARCHES/YEAR.

E) ASSUMES FIXED DOLLAR COST TO BE $100,000/YEAR.

search costs that may be expected for each method, the hard currency component of that cost, and the approximate turnaround time for ech method. The reader should be cautioned that both tables are based on various assumptions, some of which refer to currently nonexistent facilities (e.g., packet-switching telecommunications).

e) Recommendations

The upshot of the preceding analyses are the following conclusions. The vast majority of global databases is, and will continue to be, located abroad. The economics of licensing databases for domestic access in Egypt will become attractive when Egypt develops stronger information markets and clientele; the process will take several years.

The most economical method for the Egyptian national STI system to obtain online access to foreign databases is via packet switching network where the leased line costs are shared with other parties. The packet switching line is not the most economical means of transferring to Egypt the search output in digital form. As Tables 7 and 8 show, direct-dial telephone transmission is cheaper if the search turnaround time is to be almost instantaneous; or, if a delay of 3-4 days is acceptable, delivery of digital output on diskettes via courier is most economical.

This study recommends two actions regarding Egyptian access to foreign databases: i) Egypt should install, as rapidly as possible, a gateway node to a packet switching network; and ii) meanwhile, Egypt should continue temporarily to search U.S. databases via the "delayed online" method of database access, and deliver search outputs to Egypt in digital form. The two recommendations are discussed in more detail below.

i) Access to packet switching network. The ASRT, as promoter of the national STI system, should approach without delay the Egyptian telecommunications agency and urge it to set up a network gateway node. Typically, the hardware switching equipment is supplied by the network; the one-time cost to Egypt to install a node with adequate capacity should be $100,00-200,000. The Egyptian network agent is to supply a network line. If the agent is the Egyptian telecommunications agency, the costs are borne by it; if the agent is a private operator, the cost of the line will be about $14,000/month. The network node operation will require the staff (two persons) to be trained by the network company.

Clearly, the volume of international database traffic from the national STI system will be quite small, and even a minimally configured gateway node should be operated as a public service and made available to other customers, such as banks, corporations, and government. The network operation could provide a nontrivial income for the Egyptian network agent (presumably, the telecommunications agency). The governing agency of the Egyptian national STI system might theoretically seek to become such an agent, so as to partially defray the otherwise deficit operations costs; assuming responsibility for operating an Egyptian network node would, however, require commitment to ancillary activities such as marketing, assuring adequate network capacity for

the growing clientele of its users, etc.

ii) U.S. database searching. Until such time that more economical public data network services are available in Egypt, it is essential for the national STI system to access foreign databases of the source and reference kind in an indirect manner. The "delayed online" access method is recommended for use by all the initial information service sites, employing TELEX for query transmission and, whenever possible, diskettes for output delivery by courier.

The process flow of this "delayed online" database search is shown in Appendix B-3. The flow is essentially that being used currently, except that each information service (and the U.S. intermediary) will employ its own computer system for managing information about users and searches, and its own TELEX line. A single Egyptian address (e.g., a post office box) should be used for forwarding all search outputs from the U.S. during this temporary setup.

The U.S. contractor organization which will carry out the online search step must meet certain qualifications. Primary among them is the necessity to have a large and experienced staff of search specialists (a minimum of ten professionals) assigned on a fulltime basis to database work. This staff must have familiarity with the major databases in all subject areas covered by the initial Egyptian information services, particularly with source databases. The U.S. contractor should have standing contracts with major database producers and vendors; have computerized administrative and accounting procedures; be prepared to execute search requests in 8 hours or less; charge Egypt prices that are charged to the contractor's inhouse staff; and be willing to train Egyptian intermediaries on the contractor's premises. The U.S. contractor must also have available machine-to-machine facilities to record and process digital output of database searches as well as dataphone communications to Egypt. The turnaround time for searches whose output is delivered by courier should not exceed five days; turnaround for searches with airmailed output should not exceed three weeks.

iii) Estimated search volume. There are no reliable models for estimating initial demand for online database searching in developing countries. Statistics from small industrialized countries indicate that an R&D employee with university education requests one to two searches per year (1.3 searches in Holland; 2.0 searches in Sweden) and that when working in a university environment, such an employee is likely to conduct several searches per year (5.8 in Holland; 7.7 in Sweden). If online usage increases annually by about one-third, the average usage figures in 1976 — when online services became popular — in Holland and Sweden would have been, respectively, 0.26 and 0.4 search per university-educated R&D worker, and 1.1 and 1.5 for university-based, university-educated R&D workers. In Egypt, which is said to have "more than 20,000 R&D workers" (ASRT, 1979), a corresponding theoretical figure would be on the order of 7,000 searches per initial year. Earlier, an independent study had predicted that 17,000 searches would be carried out from Egypt during three years (Romerio, 1977).

It is also reasonable to expect that the level of the national R&D budget, as a percentage of the gross national product, will have an effect on the availability of, and ability to use, information services. The Egyptian R&D budget, as a percentage of the gross national product, is about 40 percent of that of Holland or Sweden (CAPMAS, 1980). If the dependency between the R&D budget and information use were reasonably linear, one could assume the initial annual Egyptian demand for online searches to be about 3,000 searches.

Such reasoning is quite speculative, of course. However, the experience of the ASRT/NIDOC search service operated during 1981 indicates that the figure of 3,000 searches is not unreasonable. ASRT/NIDOC has processed, in six months, approximately 500 searches, at least half of which were in health-related disciplines.

Based on this experience, this study postulates that the number of (partially subsidized) Egyptian searches during the first three years of the existence of information services will be 2,500 per year (approximately 500 per year per information service site), or averaging 10 searches per working day. This figure (2,500 searches/year) has been used as the basis for the related cost estimates.

A uniform policy on user charges must be set and applied across all information services. Typically, search costs may be expected to be defrayed by the user's employer; large organizational customers should be encouraged to open accounts with the information service most appropriate to their interests. Whereas the eventual goal of the national STI system is to recover the full cost of the database searches, it is unlikely that this goal will be reached soon. To make the service more attractive a few "sample" searches may be offered to each customer gratis, to be followed by less-than-full charges for a year or so.

The shape of the "demand curve" for database services, and the effect on it of various marketing strategies, are reasonably well known (Lindquist, 1978), but have not been evaluated in developing countries.

4. Document Delivery

Providing the user with documents identified through database searches is an absolutely essential component of Egyptian information services. Unfortunately, Egyptian document repositories can be relied on to supply only a percentage of such documents, even after their holdings have been systematically strengthened. Consequently, the national STI system requires a set of policies and procedures to obtain such documents from abroad.

Appendix B-4 shows the sequence of steps involved in procuring requested documents from abroad.

In considering the design of the document delivery service, the key factors are speed, reliability, and costs. Document supplier services around the world are quite numerous (The Information Store, 1981). Some database vendors provide computerized ordering procedures tied to their database search services. Typically, the vendor will receive online requests for documents from an earlier search, and pass them to a document delivery service affiliated with the vendor. Major database vendors operate small networks of such affiliates, the latter often specializing in particular types of literature. (The largest U.S. database vendor, Dialog Information Services, Inc., operates such a service under the name "Dialorder." Another vendor, System Development Corporation, calls a similar facility "Electronic Maildrop.")

The typical cost of a document procured through these sources is based on a standard fee (about $7 per document), $.20 or more per page, plus postage. A copy of an average scientific article (six pages) will thus cost Egypt about $10; this cost covers also a copyright charge which reverts to the publisher.

When Egypt has available online telecommunications for accessing U.S. databases, the most efficient document delivery service will be to use the database vendors; this is so because the communication protocols are straightforward, allowing the Egyptian information services to identify requested documents by simply referring to them by their number on the database search output. Until then, however, Egyptian information services should engage a single U.S. contractor for all document requests from the United States.

It is preferable (but not necessary) that this contractor be the same organization as the U.S. intermediary carrying out online searches on behalf of Egyptian information services, as efficient communication formats for document requests will be easier to develop. It is important that the document delivery contractor be able to fill a large percentage of the requests from his inhouse document collections, and do so at low cost. This suggests that the document contractor be a large scientific library, and that it be located in a city having ample information resources. (As an indicator, the Georgia Tech Library which serves as a single source for document delivery in the experimental project phase, has been able to meet 95 percent of Egyptian document requests from the collection of the university library network in the Atlanta area, at about 60 percent of the commercial services costs.)

The U.S. document delivery contractor should use air freight to Cairo, batching the documents in one parcel mailed, say, twice a week. In contrast to air mail which takes about two weeks, air freight (from Atlanta via Frankfurt) will arrive in Cairo in 3 days, on the average. Technological developments indicate that within three to five years it will be feasible to transmit at least some copies of documents electronically by telefacsimile, at a cost more economical than the $10/page charged currently.

The purchase of documents from overseas is expensive, and the Egyptian national STI system should have a uniform policy regarding the financing of this service. Naturally, users prepared to pay the full cost of documents

requested need not be limited as to the volume of requests; other, however, whose requests will be temporarily or partially subsidized by the national system, must be prudent. As an incentive it is preferable to subsidize database searches rather than document delivery.

5. Referral Service

A referral service "refers the inquirer to the source or sources most likely to provide the desired information." This definition differentiates referral from other information services, and it clearly delimits its function to the suggestion of sources that are likely to satisfy the client's information needs. Referral does not duplicate functions of other information services, such as library reference, in which the preferred objective is to provide the actual data or information rather than pointing to their possible source. Referral service provides, in principle, answers only to questions which request information on available sources. The referral function is a vital one in Egypt.

Referral centers vary as to the orientation of their service, according to both the clientele they serve and the particular information needs of that clientele. In different countries, referral services are variously functioning within a national library, the national information system, or in specific agencies of the central or local governments. In Egypt, where the referral service is not a prevalent phenomenon, it is incumbent upon the national information system to initiate it. The proposed national STI system and its distributed information service nodes are an ideal substrate for the referral function, allowing each such node to specialize — that is, to serve the specific referral needs of its particular clientele. Since one primary source of information is databases, the referral service may often direct the inquirer to the database search service provided by its node.

An indispensable element of an effective referral service is various internal files of information sources; these are the primary tools which the service must create and which allow it to perform the referral function. Although the specific referral orientation of each information service, and hence the specific types of information directories, will have to be developed after more insight is obtained regarding the particular user clienteles of each information service of the national system, it is possible to identify a priori a number of directories that are likely to be in demand by these services sites. These directories are shown in Table 13.

The directories have to be compiled by the referral service staff; procedures for doing this have been described elsewhere (Unisist, 1979). It is suggested that all nontrivial directories be produced in machine-readable form, using the standard computer and database software facilities to be provided for each information service of the national system (see below). This will assure not only instantaneous availability of the data but will be in-

TABLE 13. REFERRAL SERVICE DIRECTORIES OF INFORMATION SOURCES

SECTORS	SELECTED DATABASES
AGRICULTURE	GOVERNMENT AGENCIES' PLANS, PROJECTS AGRICULTURAL COOPERATIVES' CHARACTERISTICS RESEARCH AND TESTING LABS AND PERSONNEL EXPERTS (CONSULTANTS, EXTENSION WORKERS) DOMESTIC RESEARCH LITERATURE
ENERGY	GOVERNMENT AGENCIES' PLANS, PROJECTS RESEARCH FACILITIES (GLOBAL) EXPERTS
HUMAN SETTLEMENTS	NATIONAL AND LOCAL PROJECTS, AGENCIES SOCIAL SERVICE AGENCIES AND PROGRAMS LAWS, DECREES (E.G., ENVIRONMENT, HOUSING) VARIOUS FACILITIES (E.G., CULTURAL, RELIGIOUS, SPORTS)
INDUSTRY	PRODUCTION FACILITIES OF EGYPT PRODUCT CATALOGS FOREIGN PRODUCT SOURCES, PRICES EXPERT, IMPORT LAWS CONSULTANTS TESTING LABORATORIES STANDARDS AND NORMS PATENTS DOMESTIC TECHNICAL REPORTS SAFETY REGULATIONS
MEDICINE AND HEALTH CARE	HEALTH FACILITIES, AGENCIES, PROGRAMS PHYSICIAN'S ROSTER EPIDEMICS AND EMERGENCY FACILITIES DOMESTIC RESEARCH LITERATURE HEALTH RELATED LAWS HOSPITAL MANAGEMENT SYSTEMS
SCIENCE AND ENGINEERING	RESEARCH FACILITIES, PROJECTS ROSTER OF SCIENCE PERSONNEL THESES OF EGYPTIAN UNIVERSITIES DOMESTIC RESEARCH LITERATURE SCIENCE MEETINGS AND CONFERENCES IN EGYPT
TRANSPORTATION AND COMMUNICATION	GOVERNMENT AND OTHER AGENCIES' PROGRAMS SOURCES OF SCHEDULES TRANSPORTATION CAPACITY STATISTICS

strumental in keeping the directories easily uptodate, and allow publishing them periodically in printed form for more general distribution. The recently issued directory of ongoing research projects in Egypt is an excellent example of such a directory published from a machine-readable database (ASRT, 1981). Eventually, large directories in machine-readable form should be accessible online by Egyptian users.

In addition to the internally compiled directories, each referral service in Egypt will assemble a small collection of published reference works, dealing with information sources. Many such guides have been issued by international organizations and/or publishers.

Possibly the most important information source of referral services are human experts and expert organizations. While each information service node will presumably wish to maintain lists of Egyptian experts and firms in its domain of interest, access to foreign expertise is usually obtained through appropriate referral services in those countries. The Egyptian referral services must therefore establish direct contacts and communication protocols with such major U.S. institutions as the National Referral Center of the Library of Congress, the Technical Assistance Information Clearinghouse, and Volunteers in Technical Assistance. By the same token, a number of international organizations — UNIDO, UNEP, World Data Center, to name a few — provide leads to experiential knowledge. An extensive directory of expert, development-related organizations exists (Gaul, 1979).

It is not superfluous to reiterate that the Egyptian information services must provide access to possibly the most important and direct information source — people, and that the referral function is the classical method of rendering this service; its effectiveness depends, however, largely on the communication channels that the referral services will keep open.

The referenced Unisist publication details additional administrative aspects to be observed by the referral service, including the logging in of information requests, handling of replies, record of inquiries handled, and the publicizing of referral services.

6. Publication

The availability of databases in machine readable form offers an attractive possibility for generating rapidly and relatively inexpensively a variety of current, printed outputs. For example, many international bibliographic database producers use the database to publish printed abstract journals. Historically, development of bibliographic databases in machine form was the result of attempts to automate the abstract publication process, so as to make it more economical; only later did the availability of the database lead to the development of online database search services. Currently the use of online search services is beginning to have a negative effect on

the economics of printed abstract journals; for example, one major database producer estimated that whereas in 1979 the printed abstract journal accounted for 78 percent of income, in 1980 — one year later -- this proportion would drop to 66 percent (Williams, 1981). Undoubtedly the trend will continue, as industrialized country users having access to online search services are discontinuing subscriptions to the printed product, and as inflation drives the printed product costs upward.

In spite of this international trend, the national Egyptian STI system should undertake the production of printed outputs from its public databases. Serious consideration should be given to the national STI system becoming the publisher of a series of publications in two forms: a periodic "STI Awareness Bulletin," and ocassional monographs issued as "separates" of the series.

a) STI Awareness Bulletin

The primary purpose of the STI Awareness Bulletin is to alert the broadest strata of problem solvers to the existence of easily available information in Egypt. Its emphasis is thus on timeliness, wide subject coverage, and broad audience penetration — rather than on permanency and appearance. The contents of the STI Awareness Bulletin should include the following: i) summaries ("abstracts") of Egyptian STI literature; ii) selected bibliographies generated by nonproprietary searches of foreign and domestic databases; and iii) news and other materialspertaining to services of the national STI system.

Section 1 in this chapter presented the philosophy for and design of the database of Egyptian publications. Figure 5 shows the main characteristics of a monthly Awareness Bulletin of Egyptian scientific and technical literature; it can be derived almost entirely automatically from such a database, following the process flow in Appendix B-5. A camera-ready master copy can be prepared from the machine-readable database by the use of word processing programs that will be a part of the software capabilities at each information service. A notable characteristic of this Bulletin, which can be issued cumulatively for all subject sections or separately (depending on the volume of material), is its bilingual nature which allows it to be read by Egyptians who do not have a command of the English language.

b) Monographs

The occasional monographic publications generated from computer files may include directories prepared by the referral service of the information service organizations (cf. Table 13) as well as formatted printouts from numeric databases that have broad appeal. The number of these publications will understandably be small, but they will provide for increased service and visibility of the national STI system. Since the information services will be operated by autonomous organizations, the national STI system may wish to subsidize in part their printing, so as to become a co-publisher.

FIGURE 5. EGYPTIAN STI AWARENESS BULLETIN

CONTENTS:	o SUMMARIES OF EGYPTIAN-PRODUCED STI o SELECTED REPRINTS, BIBLIOGRAPHIC AND NON-BIBLIOGRAPHIC SEARCHES o NEWS, ANNOUNCEMENTS, CONTRIBUTIONS FORM NATIONAL STI SYSTEM
COVERAGE:	EGYPTIAN STI SOURCES (ARABIC AND ENGLISH)
ABSTRACTING:	INDICATIVE SUMMARIES, IN THE LANGUAGE OF DOCUMENT
INDICES:	AUTHOR AND SUBJECT (THE LATTER ARABIC AND ENGLISH) GENERATED FROM INDEXING TERMS IN DATABASE
LANGUAGE:	BILINGUAL, USING THE LANGUAGE OF THE DOCUMENT (EXCEPT THAT ARABIC DOCUMENT TITLES TO BE ALSO TRANSLATED INTO ENGLISH)
ARRANGEMENT:	BY MAJOR SECTOR (PARALLELS EGYPTIAN INFORMATION SERVICE NODES), AND WITHIN SECTOR BY DISCIPLINE (USING A GENERAL CLASSIFICATION, SUCH AS THE BROAD SYSTEM OF ORDERING)
FREQUENCY:	MONTHLY
DISTRIBUTION:	2,000 COPIES, FOR INDIVIDUAL SUBSCRIPTION

c) Cost Estimate

Assuming (from Table 3, which showed the distribution of the costs for creating a bibliographic database) that the cost of producing printed output from a database is approximately one-third of the cost of producing the database (for large international abstract publishing services, slightly over $7 per abstract), and that the cost of printing and distribution in Egypt is half of that of the industrialized countries, we arrive at an Egyptian equivalent cost of $3.50 per abstract. An estimate of the total annual publishing cost, based on 3,000 abstracts, is $10,500.

Assuming 2,000 issues to be printed and distributed monthly, the average cost is $0.43 per monthly issue; this is within the range of lower-end costs for inexpensively produced announcement bulletins reported from industrialized countries (Rowley, 1978).

7. Information Technology

There is evidence that the decreasing rate of national productivity in industrialized countries is contributed to by the information sector -- specifically, because the falling productivity of the growing white collar bureaucracies surpasses the productivity increases of the blue collar manpower (Thurow, 1981). While the overall effect may not be the same in developing countries, productivity of the white collar sector in countries such as Egypt which have a nontrivial information sector is a cause for concern. Improvement of the productivity of the information sector is thus of global importance.

The single factor which will have the most profound impact on the problem solving sector and the information industry itself is information technology. Modern information management cannot be cost-effective without the use of information technology. Indeed, information technology is being regarded as the single factor which will change most the way in which decision makers and problem solvers operate (Martin, 1981). Until very recently, however, much of this modern technology has been unwittingly denied to problem solvers, not only in developing countries but in industrialized countries as well. The reason is simple: this technology could be used, more often than not, only when supported by highly trained, expensive professionals and specialists. This condition was the result of the novelty and complexity of the technology, the magnitude of the development effort necessary to make it usable, and the low compatibility of the hardware and software on the market. Between 1955 and 1980, the ratio of U.S. software-to-hardware costs rose from 15 percent to nearly 90 percent (Ewers, 1981); and the number of information systems personnel that would be needed in 1985 has been estimated at 4.2 percent of the total U.S. labor force (Lecht, 1978). In some sense, despite its promise, the information technology itself may have helped to accentuate the declining productivity of the white collar sector.

It is essential that the introduction of information technology into the Egyptian national STI system be conceived on a different basis (Madkour, 1980). The resources — manpower and finances — that have been required until now to exploit this technology are unavailable in Egypt. Fortunately, recent advances in this technology are changing the situation (El-Kholy, 1979). These positive developments relate to both hardware and software, and their combined effort now renders the technology usable and attainable economically by Egypt.

Advances in the hardware technology are due to the introduction of large scale integration into the design of logical circuitries of the computer. Due to microelectronics, larger and larger computational capacities are becoming available in ever smaller physical size, at constantly decreasing costs, and with increasing reliability. Computer performance is increasing (or computer price is decreasing) by 28 percent a year; telecommunication cost decreasing by 11 percent a year (Branscomb, 1979). Some 100 computer manufacturers offer about 300 makes of business computer systems at prices ranging from $100,000 to a few thousand dollars; the average price of a small system with one work station was $18,000 in 1980; of small multistation systems, $43,000 (Datamation, 1980). The distinction between "personal" computers (costing between $1,000 and $5,000) and small business systems has begun to erode as major manufacturers have entered, in 1981, the mass market with systems priced in that range. A computer is becoming a personal machine, and extension of its capacity is being made possible by distributed computing which provides access to shared resources, when needed, via telecommunications.

The parallel developments in software are no less significant. The major change in data processing management relevant to Egypt is the use of information technology without programmers. The use of computers by the non-programmer and layman has been made possible because now the interface between man and the machine is a small set of simple instructions (commands) whose "menu" is often displayed by the machine itself. The emergence of user-operated systems is creating new types of software, new computer languages, and new systems analysis techniques. The concept of the database has emerged as a fundamental cornerstone of the software technology of the 1980's. Distributed computer networks allow databases to be generated from or at different geographical points via "word processing" terminals operated by clerical personnel.

These dramatic advances in the ease of application of information technology must be exploited by the national STI system of Egypt.

a) Functional Specifications

It is intended that the functions assigned to each information service site will be supported by information processing technology having the following capabilities:

i. Online generation of bilingual databases (bibliographic, full text, and numeric);

ii) Inhouse online searching of local databases using, at the searcher's option, either Arabic or English search commands;

iii) Remote online searching, from user terminals, of Egyptian databases stored at any service site, in Arabic and English, using a domestic public data network;

iv) Online searching, by English commands only, of foreign databases, using public data networks;

v) Online editing and formatting of camera-ready printouts, Arabic and English, of selected portions of database contents;

vi) Forwarding and storing of Arabic and English messages between any two service sites of the national STI system, and between the sites and remote users, initially using TELEX, later a domestic data network;

vii) Support of administrative functions at each site: files maintenance, billing, training, and hardware/software maintenance.

To support these applications, the national STI system service nodes will operate a "ring computer network" communicating via circuit switched communication channels; the latter will also connect individual remote terminal users to any of the system sites. The network is illustrated in Figure 6. Although adequate telecommunication channels are not yet available in Egypt, their eventual implementation is certain; therefore, the computer system to be installed at each information service site should now provide for asynchronous communication, in serial transmission mode. These facilities should also allow each site to access directly an international packet switching network, when available in Egypt.

Meanwhile, each service site should be provided with a narrow band communications facility (TELEX), allowing it to communicate with others, and to forward requests for foreign database searching.

b) Software

The key requirements for the software of the Egyptian national STI system are that i) when delivered and installed, it will constitute a complete, finished product requiring no additional effort on the part of either systems or applications programmers in Egypt; ii) the software must be operable by the professional and clerical staffs of the information service sites, after appropriate training; and iii) the software must have certain bilingual capabilities. In residence at each site as a member of the staff will be one person acting as computer operator and software instructor; these staff

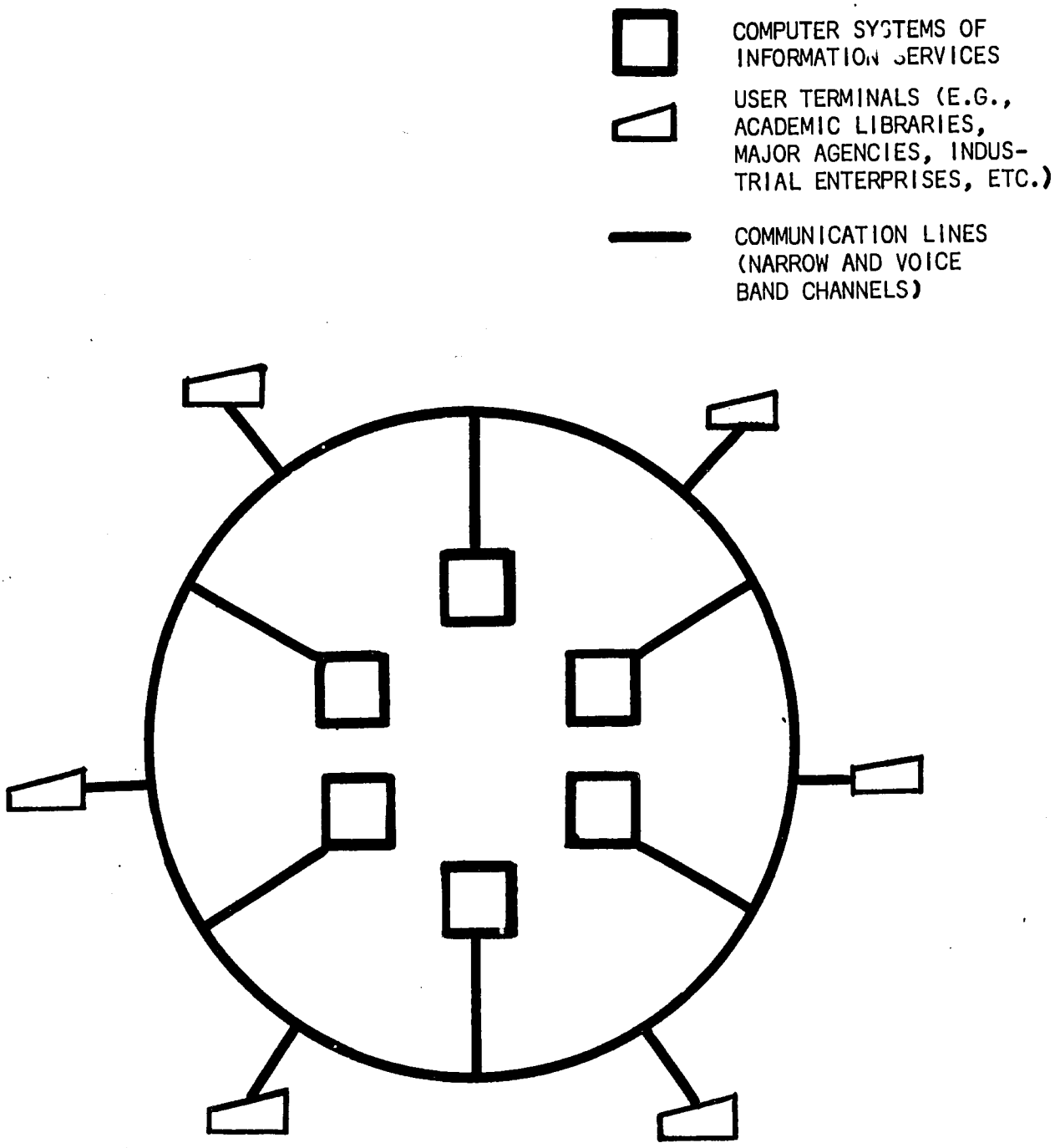


FIGURE 6. THE EGYPTIAN NATIONAL STI SYSTEM AS A "RING" NETWORK

members are to receive in-depth training in the use of hardware and software, but their function should not involve program development.

These requirements have the following implications as regards software. The operating system must be transportable to equipment of more than one manufacturer, so that the standard software of the national STI system can be used even if in the future new information service sites choose a different make of hardware (because future hardware is likely to be even more cost-effective). The operating system should be able to differentiate among different categories of users, and allow them access to only those software facilities that are necessary to perform their respective functions. In this manner, the computer system will achieve a degree of security, as well as facilitate the training of users. The user categories to be so differentiated are: the systems and database manager; database searcher staff; remote database searchers (outside users); data entry staff; secretarial staff; publication preparation staff; and administrative staff using internal databases.

The database software should be able to support the development, maintenance and searching of both reference and source databases, and use a single high-level command language. The desideratum of simplicity and ease of use (Barnhardt, 1980) points strongly in the direction of the relational database model (Codd, 1970). Although most relational database software has been written for source databases (with few exceptions, such as the Canadian MINISIS system which is, however, restricted to a single vendor's hardware), its advantages for bibliographic data storage and retrieval are being recognized (Crawford, 1981), as is the desirability of extending it to support both types of databases (Rabinski, 1981).

Certain software facilities should be bilingual, so as to allow the handling of Arabic-language data in Arabic, and more importantly, allow monolingual users to access and search databases, regardless of the language of the data. Automatic or semiautomatic translation from English to Arabic is approaching operational status but its cost is high; more importantly, the proposed functions of the information services in the first five years do not require such capability. Rather, what is desirable is that certain functions of the information services can be performed in their original language, and that the staff can create, and the users interrogate, mixed Arabic/English databases using, at the their option, Arabic or English commands. To implement this capability, the software requires two facilities: a bilingual thesaurus (for indexing and searching of bilingual databases); and Arabic equivalents of the English commands.

Table 14 summarizes the desirable bilingual functions. Appendix B-2 shows the steps required to generate an English/Arabic thesaurus. The set of Arabic commands should be created by translating English commands, probably entailing some changes to the source code. Arabic-language input/output requires appropriate peripherals — terminals and printers.

Given these software specifications, it is unlikely that an adequate, off-the-shelf software complex (operating and database systems) can be lo-

TABLE 14. ARABIC LANGUAGE FUNCTIONS OF COMPUTER SYSTEM

FUNCTION	ENGLISH	ARABIC
A. DATABASE/FILE CONTENTS		
NAMES OF RELATIONS, ATTRIBUTES	✓	✓
BIBLIOGRAPHIC FILE (ATTRIBUTE VALUES)	✓	✓
BILINGUAL THESAURUS	✓	✓
ENGLISH KEYWORK DICTIONARY	✓	
ARABIC KEYWORD DICTIONARY		✓
USER DIRECTORY	✓	
SEARCH REQUEST FILE	✓	
DOCUMENT ORDER FILE	✓	
ACCOUNTING FILE	✓	
NAMES OF MACROS (SHELL PROGRAM NAMES)	✓	✓
B. DATABASE/FILE OPERATIONS		
DATABASE CREATION, MAINTENANCE COMMANDS	✓	✓
DATABASE QUERY COMMANDS	✓	✓
TEXT PROCESSING COMMANDS	✓	
OUTPUT FORMATTING COMMANDS	✓	
O/S COMMANDS	✓	

cated; rather, a nontrivial software development effort will be required to render suitable programs compatible, and to arabize them. The software development should be a joint Egyptian/U.S. effort, and a period of nine calendar months should be allowed for a four-person team to implement it. (It should be noted that although a considerably more modest, monolingual software could be implemented in Egypt with little additional development, the proposed effort is highly desirable. The proposed system, which will be tailored to the current and foreseeable future information processing requirements of a national STI system, will support the vernacular language of its users, and will be completely user operable, shall constitute a leading edge of computer applications. The cost of this software development, estimated at about $250,000, is relatively modest when compared with the investment necessary to build a new bibliographic database system.

c) Hardware

The primary requirement of the computer hardware to be selected is that it support reliably and efficiently the chosen software system. The equipment should obviously employ the latest technology and architecture.

The size and configuration of the computer facility for each information service site is a function of its information processing and data storage requirements. These are considered first, followed in turn by general hardware specifications.

i) Processing requirements. The number of geographic sites is the same as the number of information service nodes -- possibly six in the initial three years. The total number of users seeking online access to the databases of the national STI system will initially be comprised of only those having access to terminals that are hardwired to the computers (on account of the unavailability of public data networks); these are staff members of the information services, plus possibly users of one or two other cable-connected terminals at each site (up to a distance of 50 meters). When a public data network becomes available in Egypt, the number of organizations having online remote access to Egyptian databases via telecommunications is not likely to exceed, initially, 10 per service site. This is based on the premise that each service site will first cater to large organizations in its subject domain (e.g., research institutes, large enterprises, administrative agencies), and that each of these organizational users will obtain acess to the database network from remote terminals operated by its personnel.

The service staff members using the computer system at each site will initialy number about ten. They fall into three groups: inquiry/response users (database searchers, publications composers), data entry users (for database development), and administrative users (maintaining and querying administrative files, billing, training, and computer system maintenance). Virtually all of these functions are interactive, not batch (with the possible exception of billing). Assuming that each site will perform all the functions suggested for the information services, and assuming that the site

staffing will be that shown in Table 1, Table 15 shows the initial numbers of users in each category, and the number of users to be supported simultaneously (since with the exception of the data entry function access to the system will be intermittent).

The desirable response times for each category of user are as follows: inquiry/response, 2-20 seconds (depending on complexity of search); data entry, less than 2 seconds; administrative, less than 5 seconds (except database updating and batch operations).

ii) Storage requirements. The approximate sizes of the databases that are likely to be maintained in the first three years at each site are estimated in Table 16. These estimates are derived, in part, from Appendices C-2 through C-12, which list the principal record elements of each database, and by making assumptions regarding the record size and the number of records of each database.

iii) Hardware Requirements and Configuration. The information processing and storage requirements identified above imply the following hardware system size.

As regards peripherals, a minimum of five monochromatic terminals per information service site is required. Since some of the databases will be bilingual, all terminals should have capability to generate Arabic and English characters. A single dual speed (50-200 cps), multifont printer is adequate to support the output at each service site for 3-5 years. One of the terminals will require a Telex conversion box to send, receive, and store all Western Union message formats, including Telex, TWX, Mailgram, cable and telegram, within Egypt and abroad. A diskette drive or magnetic tape drive is desirable as back-up storage, and as data-exchange media.

As regards mass storage, the calculations above show that the applications at one site are likely to require, in three years, 40 million bytes of disk storage (the bottom capacity of fast access disks). Since the price differential between a 40 Mb disk and an 80 Mb is small, it is recommended to double the theoretical storage capacity and purchase an 80 Mb disk for each site.

As regards the central processing unit, it is theoretically possible to estimate the processing times for each usage type expected at each information service site, given five simultaneous users and the database size estimated above; it is more difficult to say, however, how realistic such estimates are. On the other hand, ample operational experience with small to medium size databases suggests that a 0.5 Mbyte central processing unit (CPU) will support 6-10 simultaneous dumb terminals on current 16- and 32-bit machines. Allowing for the facts that bibliographic database searching is demanding on the CPU, that for some operations the relational database software is slower than other database software, and that central memory is relatively inexpensive, it is suggested to procure a CPU of 1.0 Mbyte. Depending, among other things, on the internal cycle speed of the hardware, 1.0 Mbyte CPU should support 16-32 simultaneous users. Sixteen

TABLE 15. ESTIMATED TOTAL AND SIMULTANEOUS USERS OF COMPUTER SYSTEM AT A SERVICE SITE

TYPE OF USER	NUMBER OF USERS	
	TOTAL	SIMULTANEOUS
INQUIRY/RESPONSE	3	2
DATA ENTRY	2	1
ADMINISTRATIVE	3	2

TABLE 16. ESTIMATE OF REQUIRED DIGITAL STORAGE CAPACITY PER SERVICE NODE

FILE	SIZE OF RECORD (BYTES)	NO. OF RECORDS	5-YEAR VOLUME (BYTES)
USER DIRECTORY	150	500	375,000
SEARCH ORDERS	200	2,600	2,600,000
DOCUMENT ORDERS	75	2,600	975,000
BIBLIOGRAPHIC DATABASE	1,500	3,600	27,000,000
BILINGUAL THESAURUS	100	10,000	1,000,000
ENGLISH KEYWORD DICTIONARY	15	10,000	150,000
ARABIC KEYWORD DICTIONARY	15	10,000	150,000
OTHER REFERENCE DATABASES	1,000	5,000	5,000,000
UNION CATALOG	300	2,000	600,000
TOTAL			37,850,000

asynchronous ports should be provided for each initial system configuration at all service sites.

iv) Maintenance. The preferable way to initially maintain the systems at each service site is by contracting with a single hardware representative in Egypt. In parallel the national STI system should employ and train two Egyptian computer maintenance engineers to service all systems, and provide for them an adequate supply of spare parts. One may expect the electromechanical devices such as printers and disks to require more maintenance than the processors themselves; the latter are typically contained on one or more boards that are exchangeable once the malfunction has been diagnosed, usually with the assistance of diagnostic programs provided by the manufacturer.

d) Estimated costs

The configuration of the computer facility recommended for each information service node is shown in Figure 7.

Given the technology and U.S. prices of 1981, the configuration described above (1 Mbyte CPU, 16 ports, 80 Mbyte disk, 5 graphics terminals, a diskette or magnetic tape drive, 1 dual-speed multifont printer, and 1 Chat Automated Telex) is in the vicinity of $100,000. One-time software license costs are likely to be in the range of $5-10 thousand per site. Operating costs will include maintenance (typically, two percent of the purchase cost), computer supplies such as disk packs, ribbons, paper, etc. ($3,000 per site per year), and line communications costs (Western Union telex rates).

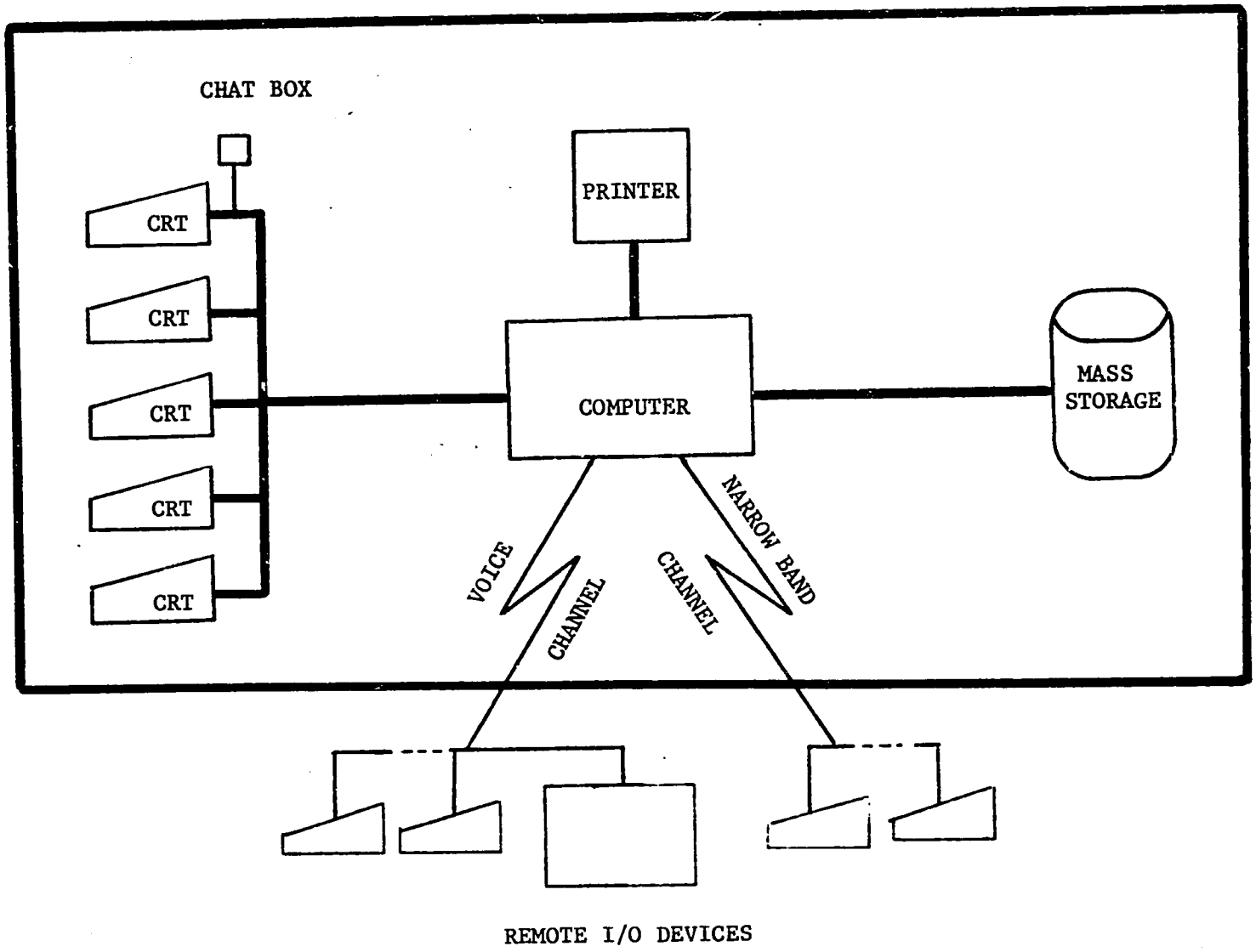


FIGURE 7. INFORMATION SERVICE NODE COMPUTER SYSTEM.

CHAPTER IV. STRENGTHENING EGYPT'S INFORMATION RESOURCES

Chapter II outlined briefly the necessity for and the role of the document repository subsystem of the Egyptian national STI system. This chapter offers technical details and design.

1. Local Document Availability

One may approach the question of adequacy of national document availability in Egypt in the following manner. In 1980, there were roughly 62,000 journal titles published globally, up from 19,000 in 1960; 20,000 titles (McEwan, 1981; Bourne, 1962)). Bradford's Law (Bradford, 1946) suggests that in order to have local access to 90 percent of the significant literature in a given scientific field one would have to subscribe, in 1980, to 500-1,000 different titles in that field. Garfield's Law (Garfield, 1971), which postulates that the core of highly cited literature in all science is only moderately larger than the literature core of a single discipline, is partially borne out by the experience of the British Lending Library: in its collection of over 45,000 titles, 80 percent of requests are met by 5,000 titles, and two-thirds of the collection are never requested (Line, 1981). Figures such as these offer some support for the position that "the important literature of science is encompassed by less than 1,000 titles, and that secondary information services (abstracts and indexes) need to cover only about 3,000 titles" (Garfield, 1972; Garfield, 1976).

Recently developed "core" lists of books, abstracting and indexing (A&I services), and journals for biomedicine, agriculture, science, and engineering (King Research, 1980a) contain 3,057 books, 245 A&I titles, and 2,500 serial titles. In terms of cost, serials comprise the largest percentage (64 percent) of the 1980 costs of this core collection, the remainder being for books (22 percent) and A&I services (14 percent). These core lists were used to check the holdings of major Egyptian academic and special libraries (Zehery, 1981). The results, shown in Table 17, document the unevenness of coverage in terms of both the type of materials and the discipline.

At 1980 prices (McDonald, 1981), making up the difference between the titles of the core lists and those actually held by the Egyptian libraries, as shown in Table 17, would cost approximately $120,000 for the first year, of which $75,000 would be the recurrent annual costs of A/I and serials subscription. In very rough figures, providing ten-year A/I and serial subscriptions (five-year backfile, five years future subscription) and allowing a total of $125,000 for the purchase of books over the next five years, the required investment is about $820,000 ($1 million when allowing for 20 percent inflation).

The financial considerations of local document repositories versus document delivery requests are as follows. Assume that to import a copy of a

TABLE 17. LARGEST "CORE" LIST PERCENTAGES OF STI MATERIALS HELD BY AN EGYPTIAN LIBRARY

TYPE OF MATERIALS	DISCIPLINE	PERCENT HELD	INSTITUTION
BOOKS	BIOMEDICINE	76	FACULTY OF MEDICINE, MANSOURA UNIVERSITY
	AGRICULTURE	33	FACULTY OF AGRICULTURE, ASSYUT UNIVERSITY
	SCIENCE/ENGINEERING	40	FACULTY OF SCIENCE, CAIRO UNIVERSITY
A&I SERVICES	BIOMEDICINE	54	FACULTY OF MEDICINE, ALEXANDRIA AND MANSOURA UNIVERSITIES
	AGRICULTURE	84	NIDOC
	SCIENCE/ENGINEERING	69	FACULTY OF SCIENCE, CAIRO UNIVERSITY
JOURNALS	BIOMEDICINE	55	FACULTY OF MEDICINE, MANSOURA UNIVERSITY
	AGRICULTURE	28	FACULTY OF AGRICULTURE, ASSYUT AND TANTA UNIVERSITIES
	SCIENCE/ENGINEERING	87	FACULTY OF ENGINEERING, MONOFEYA UNIVERSITY

SOURCE: MCDONALD, 1981

journal article from abroad costs ten dollars and that the average annual subscription of serials runs from a low of $52 for agriculture to a high of $131 for science and engineering (Table 18). Then, if the number of requests for article copies from a particular journal is higher than five for agriculture, six for medicine, and thirteen for science and engineering, it is more economical to subscribe to that journal than to procure the single copies through a document delivery service -- regardless of other reasons why it is important to have documents available locally. At the national level, if each of the postulated 2,500 annual database searches generates a request for five documents that are unavailable in Egypt, the cost of the document delivery service will be $125,000 per year. This is more than the annual cost calculated above for completing the core lists of holdings by Egyptian libraries.

Having all the core list titles available in Egypt does not, of course, completely obviate the need for foreign document delivery (nor does it mean that local document delivery is free of cost). However, if there is a high correlation between the titles held in Egypt and those requested by users, the demand for foreign document delivery could be reduced by, say, two-thirds. Assuming then that Egyptian libraries continue subscribing and paying for materials already in their possession, an additional annual investment of about $140,000 should satisfy over 90 percent of document delivery requests (two-thirds of which would be met rapidly from local resources), and it would guarantee Egypt to possess a minimal adequate collection of scientific and technical documents comprising the highest quality scientific and technical information. Having such a collection within its borders is of considerable strategic importance to Egypt.

a) Selection of Repository Libraries

The economic importance of configuring the repository subsystem from existing libraries is thus clear. Unless the national STI system can rely on the collaboration of major academic and special libraries it would have to spend 2.5 times more funds on duplicating their existing holdings. The cost to the STI project would be $2.5 million instead of $1 million. Since this is clearly not affordable, other alternatives -- all suboptimal -- would have to be sought, such as procuring only a fraction of the resources and managing it centrally, or simply supporting only a foreign document delivery service. Everything else being equal, the last option would be the most economical alternative.

The rationale for recommending that the document repository subsystem of the national STI system be comprised of selected Egyptian academic and special libraries is thus inescapable: unless Egyptian libraries agree to share their resources, Egypt cannot extricate herself from the quagmire of information insufficiency. The question is not whether any single library can become comprehensive, for it cannot; the question is whether the sum of Egyptian libraries can provide a minimally adequate national resource of STI. This they can do only through resource sharing, and through partial, volun-

TABLE 18. "CORE" LISTS: AVERAGE SUBSCRIPTION COST (1980)

MATERIALS	COST ($)			
	MEDICINE	AGRICULTURE	SCI/TECH	ENGINEERING
BOOKS	32.49	19.75	30.89	36.35
A/I SERVICES	168.48	269.21	307.57	208.44
SERIALS	64.72	51.91	131.55	131.55

SOURCE: MCDONALD, 1981

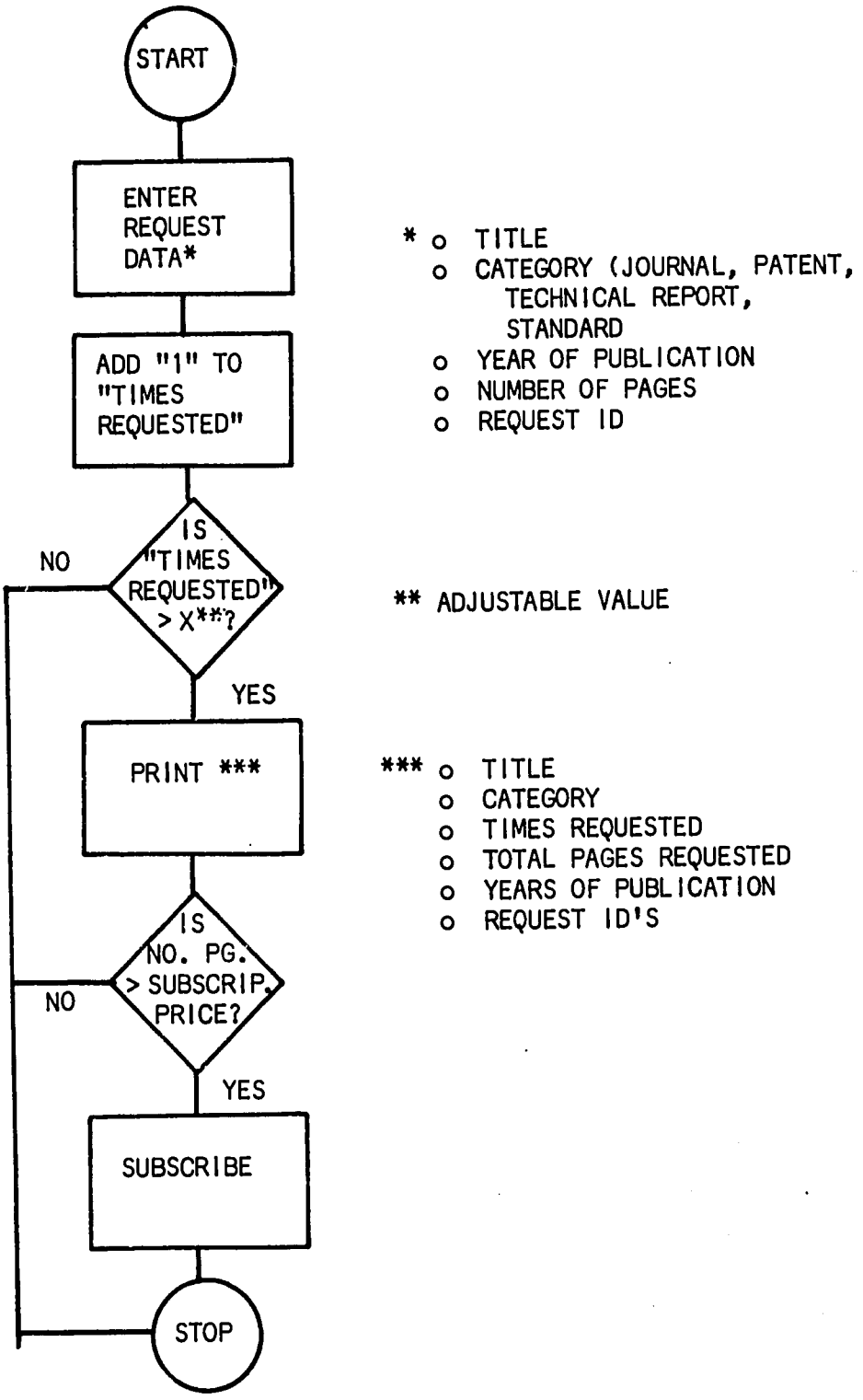


FIGURE 8. SUBSCRIPTION DECISION ALGORITHM

tary coordination of their acquisitions. It is essential that academic and special libraries of Egypt grasp the significance of national considerations over those of individual libraries.

The selection of document repository libraries for the national STI system is thus a critical undertaking, and it should be carried out judiciously but with dispatch. As a minimum, responsibility should be allocated for the following bodies of materials: biomedical literature; agricultural literature; literature of physical sciences and engineering; social science literature; technical reports; industry and trade literature; patents; and standards and norms. The selected repository libraries will become de facto national Egyptian resource centers for materials in their subject domains, and their collections will be supplemented through the acquisition program of the national STI system. Other libraries having substantial collections (particularly libraries of foreign agencies (such as NAMRU and the American University) should definitely be invited to joint the document delivery subsystem.

In return for the libraries' participation as Egyptian document delivery agencies, the national STI system will reciprocate by offering them several incentives. These are: i) development of a union list of STI journal holdings of the repository subsystem; ii) supplementation of their holdings by selective acquisitions, iii) selected staff training; iv) provision of reprographic equipment for document delivery service, and personnel training in its use; and v) early access to the information services of the national STI system.

The first three functions are described in more detail.

b) Union List of STI Holdings

The 1980 survey of 29 Egyptian libraries conducted under the auspices of the STI project has identified Egyptian holdings of items in the "core lists" discussed above. Although these are not the total STI holdings in Egypt, it is essential that the data be compiled into a machine-form union catalog, reproduced, and distributed. The ASRT microcomputer system is quite adequate to generate this temporary tool.

The minimal elements of the database design should include: title, library holding the title, years available, subject field and ISSN Code (ISO, 1975); the latter two to be added to the survey data. As the core lists are arranged by BLLD rank, it will be useful to alphabetize them by title. This can be accomplished by "dumping" the file, sorting it, adding sequential numbers, and reinserting it into the database. Once so conditioned, indexes to the file can be produced and printed. Such printouts may list: titles by library; titles by discipline; and holding gaps by library and title. The cumulative union list should be printed in 200 copies, and distributed or sold.

At 5 minutes per title entry, the data entry effort is estimated at 6 manweeks.

2. Supplementation of Holdings

The ability to correlate a national acquisition policy for STI with document delivery service boils down to finding near-optimal fit between local information resources and the expected needs for documents by users of the national STI system. Although the core lists are based on a plausible rationale and empirical evidence, they are not guaranteed to reflect exactly the Egyptian user's requirements; therefore, a selection algorithm needs to be devised.

a) Selection

In order to improve the probability of supplementing Egyptian libraries with the materials most relevant to Egyptian needs, the following rules are recommended: if the document request is for a serial title that appears in the core list, the title should be subscribed to (unless already available in Egypt); if the title does not appear on the list, the decision algorithm shown in Figure 8 is applied. This algorithm calculates the cost of the document delivery vs the subscription cost, and when a certain (adjustable) ratio is attained, the title is selected for subscription. The selection and acquisition process is shown in Appendix B-6.

The decision algorithm can be applied to materials other than serials provided they are grouped into subject classes. The latter applies particularly to technical reports (issued by NTIS in over 500 subject categories), and patents (the class/subclass categories of the U.S. or international patent classification). Thus, since procurement of the entire NTIS file is exorbitantly expensive, the proposed acquisition rule can point out the more demanded subject categories for eventual subscription in microfiche.

The allocation to repository libraries of serials and other materials acquired will be on the basis of the document's subject discipline. The discipline is apparent from the inclusion of the title in a particular core list, or else will be determined on an ad hoc basis. A running record of "assignments" of acquired materials shall be kept and analyzed periodically, so as to assure a reasonably equitable distribution of materials among the cooperating libraries.

b) Technical Services

Performing the STI acquisition function in a cost-effective manner gives the national STI system an opportunity to provide an exemplary showcase of modern techniques of managing library resource. The acquisition function must be carried out centrally, so as to retain control over the purchasing, billing, and allocation of materials. For this purpose the national STI system should establish an "acquisitions bureau," and either operate it from the project headquarters or, preferably, contract its operation to one of the re-

pository libraries.

The acquisitions bureau will perform the following functions:

i) selecting, for subscription titles indicated by the application of the rules described above;

ii) placing subscriptions and other purchase orders through a reliable, experienced jobber;

iii) receiving and processing all deliveries of materials so ordered (serials check-in, provision of catalog cards, etc.);

iv) promptly forwarding processed materials to designated libraries;

v) maintaining necessary files;

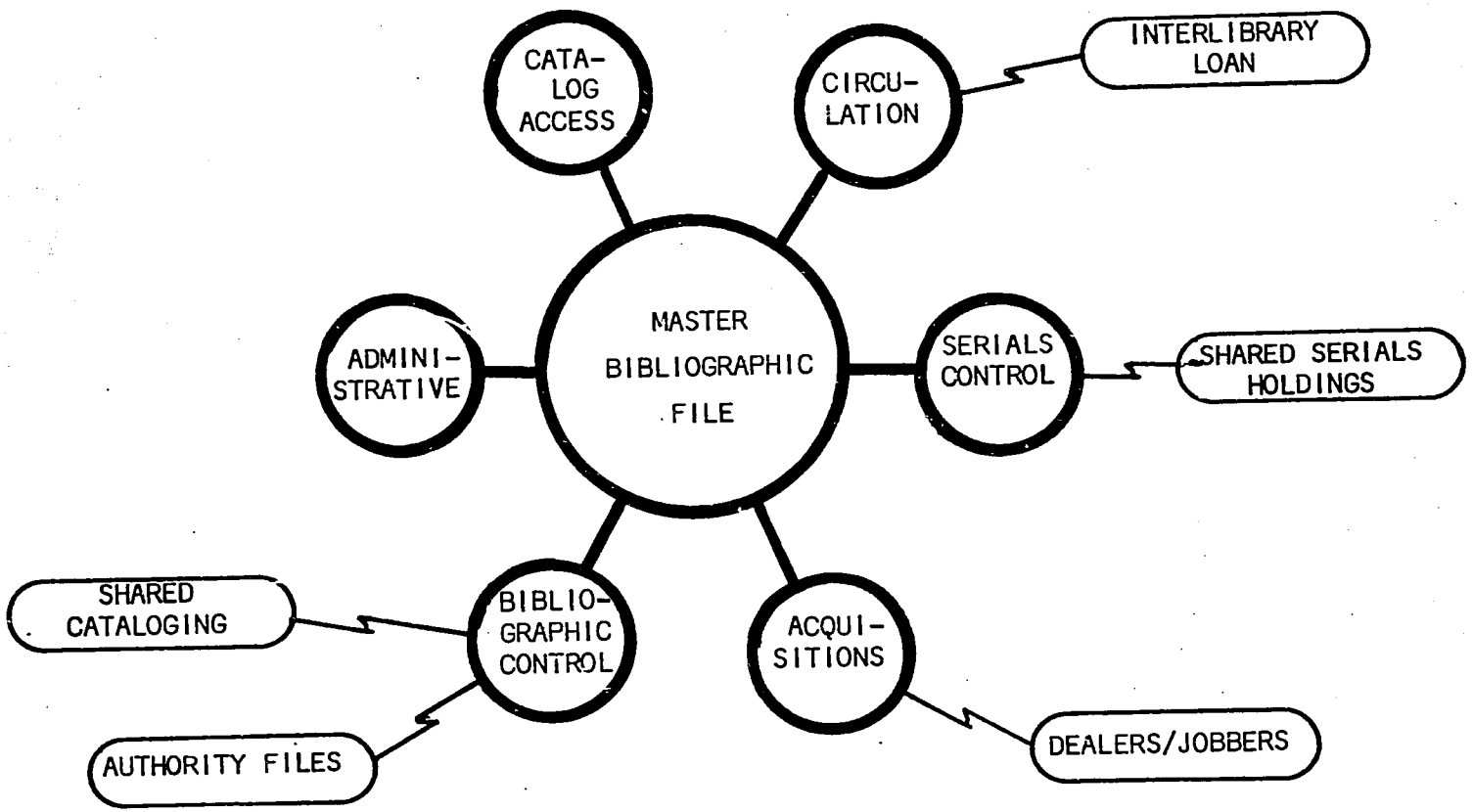
vi) submitting invoices for approval and payment to the appropriate authority (Egyptian or U.S. project director); and

vii) periodically, producing specified administrative reports.

The acquisitions bureau will acquire an off-the-shelf computer-based facility having the necessary capabilities. The system recommended for this function is the Integrated Library System (ILS), a microcomputer-based hardware/software package being developed under the auspices of the National Library of Medicine (NLM, 1981).

ILS is designed as a modular, general purpose, transportable library system, featuring the philosophy of one master bibliographic file supporting all library functions (acquisitions, cataloging, circulation, etc.). The system is implemented on small hardware but does not preclude its being scaled up to larger systems in large libraries. The goal has been to make it easily maintainable and transportable, thus being compatible with the criteria for application of information technology described in the previous chapter.

ILS Version 1.0 (Figure 9) performs the following functions: i) bibliographic control, which maintains integrated bibliographic file and links to shared cataloging and authority files; ii) catalog access, which provides an online catalog for patrons and staff; iii) circulation, which supports circulation processing and overall collection control; iv) serials control, which maintains serial holdings and supports processing of serial issues; v) acquisitions, which processes order data and produces preliminary bibliographic records; and vi) administrative services, which provide summary reports on library activities, and features that allow the library to control system processing. These subsystems are able to interact with related bibliographic activities and organizations outside the local ILS library, such as interlibrary loan, shared serials holdings, shared cataloging, and dealer/jobber files.



SOURCE: NLM, 1981

FIGURE 9. THE INTEGRATED LIBRARY SYSTEM SOFTWARE.

Not all of the above functions need to be performed by the acquisitions bureau, of course. However, the capability of creating a master bibliographic file (which supports a MARC-like format, and allows it to be searched through indexes constructed for online searching) is a useful tool for maintaining the bibliographic records of the acquisitions bureau. As regards cataloging, ILS supports both the method of loading records from a shared cataloging utility and local catalog record creation (a future module will support multiple character sets). The catalog can be searched online by library staff and library patrons, via author, title, subject, conference and corporate name, call number, and identification number; explicit boolean searches are to be implemented shortly. The circulation module, although not of immediate interest to the acquisitons bureau, has a capability of maintaining patron files.

The immediately most useful module to the acquisitions bureau is the serials check-in, which records the receipt of individual serial issues and prepares them for filing and/or circulation. Detailed holdings are maintained in the serial title record showing every volume and issue that has been checked into the system. For issues checked in ILS generates labels and routing slips.

The administrative module provides features which allow the administrator to set up and operate ILS without inhouse data processing staff. The automated reports module features a number of predefined summary reports, database activity reports showing total bibliographic records, a master patron list, etc. An online user manual is available on the ILS.

It is recommended that ILS be purchased to run on the smallest hardware system available (64 Kbyte CPU, 40 Mb of disk storage, 2 monochromatic terminals, and a slow speed printer). The hardware purchase cost is approximately $35,000; software licenses for ILS and its associated operating system are about $10,000 (one time cost). Annual hardware and software maintenance and supply costs are estimated at $6,000.

The acquisitions bureau can be operated by a staff of two professionals and one clerk. One of the professionals should have some experience with computing equipment, and should undergo a two-three week training in the architecture and use of ILS.

While the purchase and operating costs of ILS may be above needs of the acquisitions bureau, an important secondary objective is to bring into Egypt a model library management system that can be demonstrated and used experimentally by the repository libraries of the national STI system. The master bibliographic file and networking capabilities of ILS should go a long way toward providing the necessary technical facilities for inducing a degree of collaboration and resource sharing among these libraries. One of the important purposes of the acquisitions bureau will therefore be the ability to demonstrate these functions to library executives, to assist them in exploring the potential of this technology for the management of their libraries, and to provide a training site for staff members of libraries wishing to ex-

plore this technology. The long term impact of the acquisitions bureau of the national STI system can be most significant.

c) Other Equipment

It is reasonable to expect that the repository libraries of the national STI system will need new equipment allowing them to provide document delivery service. This equipment consists of a xerographic printer, and a microfiche reader/printer. The equipment would possibly be given to the resource libraries on loan, and may have to be maintained under a central contract by the national STI system. Operator training will also have to be provided centrally, as part of the development of procedures for document delivery request and supply. Operating costs (staff time and reprographic supplies) should be part of the document delivery charge.

As an additional incentive later on, the national STI system may consider placing in each library a computer terminal allowing that library access to the information services of the system. Such a gesture should be made in conjunction with the marketing efforts by information service sites.

d) Estimated costs

The overall Egyptian costs of the program to supplement the STI resources include the following elements: cost of information materials, $1 million; purchase cost of ILS facilities, $50,000; operating and staff costs of the acquisitions bureau, $20,000 per year (half for salaries); foreign document delivery, $100,000 per year (gradually decreasing as more information resources become available in Egypt); and $50,000 for the cost of six microfiche reader/printers and six xerox machines. Additional costs should be anticipated in connection with staff training and consulting assistance.

CHAPTER V. GOVERNANCE OF THE NATIONAL STI SYSTEM

The choice of the structure of a national STI system is a function of the system's goals. Some goals, such as the diffusion of information functions and information technology into the problem solving strata of the nation, cannot be optimally served by a structure in which these functions are physically performed at one central site. The proposed structure of the national STI system of Egypt therefore conforms to a distributed system model.

Whereas in a centralized structure the question of governance is often academic (since the central agency is also the governing agency), in a decentralized structure governance becomes a key issue. There are several reasons for this (Kent, 1979): any structure that brings together diverse organizations invariably involves a partial loss of their autonomy (or flexibility, or both). In turn, loss of autonomy or flexibility is an impetus for participation in governance, partly because the system functions may require organizations to modify their legal mandates (for example, allowing them to serve patrons other than their own employees).

Governance has been defined as "the set of processes through which an organization confirms its goals, establishes policy, selects its leaders, and insures the necessary resources to carry out its purposes" (Mathews, 1979). Governance requires "mechanisms for identifying goals and objectives . . . ; for the establishment of policies . . . ; and for the resolution of conflict" (Montgomery, 1979). The purpose of the governing body may be said to be "the exercise of authority to set policy and objectives that serve the needs . . . of the constituency, and to direct management to attain these objectives" (Avram, 1979).

At this time there is no single preferred model for the governance of a national STI system. The Unesco General Information Programme favors governance through a "national focal point" (Unesco, 1973). Beyond this, "the choice must depend almost entirely on national circumstances . . . . The most important need is for the machinery to work well and to command respect among ministers and senior administrators" (Gray, 1978). Among the countries that have described their proposed approaches to governance are China (Tell, 1980); France (Chambaud, 1980); Federal Republic of Germany (Lohner, 1980); Great Britain (Gray, 1979); India (Seal, 1980); Japan (Japan, 1981); Mexico (CONICIT, 1978), Pakistan (IDRC/UNDP, 1978), Saudi Arabia (Burchinal, 1981), Sweden (Swedish Government Commissions, 1978), USSR (Losev, 1980); and the U.S. (Carter, 1967; Ackoff, 1976; Gapen, 1981).

In principle, governance of a national STI system may be exercised by one of three mechanisms: the government, a quasi-governmental body, or a private body (Stevens, 1977). A government-governed mechanism is appropriate, if not mandatory, in states where private enterprise is, for all practical purposes, nonexistent; this is not the case in Egypt, of course. In other countries, including Egypt, which are prepared to support a vigorous

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growth of a national (rather than solely governmental) information sector, a more attractive form of governance of a national STI system is one which includes governmental participation but allows greater freedom (and, usually, greater efficiency) of operation. This quasi-governmental, legislative form of public governance is typified by the "public corporation, such as the Communications Satellite Corporation (COMSAT) or the Public Broadcasting Corporation of the United States.

The third, "private" type of governance of the STI system is one exercised by the membership itself, under a legal charter and by-laws. In this form of governance, relationship to the national and local governments is more ancillary. While attractive to the highly dynamic private sectors of some countries, this form of governance may be premature in Egypt, for several reasons: some government-agency members of the national STI system might be precluded by law from participating in and supporting such a private consortium; most member organizations of the system are probably not prepared to fully subsidize the functions of the consortium (or their own); and a private consortium is less likely to generate consistent and adequate financial subsidy for its operations.

1. Council for Information Resources and Services

The method of governance of the Egyptian national STI system is indicated strongly by the system's structure and constituency. Since all its subsystems are composed of autonomous organizations belonging to the government, the public sector and the private sector, the form of governance must clearly be participatory rather than authoritarian, and be one that is hospitable legally and acceptable psychologically to all three groups of organizations. A public, rather than the governmental or private, form of governance is thus indicated.

A near equivalent of the "public corporation" concept in Egypt are the National Councils, such as the Science Council. The Councils are non-governmental, established by legislation, and able to accept tax monies; they have a well-focused mandate; and they command national prestige and importance. Using them as an approximate model, it is recommended that a "Council on Information Services and Resources" be established in Egypt at the earliest possible time and that it be given the legislative mandate and resources to guide the development of the Egyptian national STI system.

Figure 10 shows the characteristics of the proposed Council.

a) Functions

The Council is seen as a policy, planning, coordinating, and funding agent, not involved in operating information resources or services. Its primary objective is to assure that the national STI system performs its role adequately, and that it meets its objectives; accordingly, it constitutes a

FIGURE 10. COUNCIL ON INFORMATION SERVICES AND RESOURCES

ESTABLISHMENT:	- PRESIDENTIAL OR PARLIAMENTARY LEGISLATION
PURPOSE:	- PLAN FUTURE DEVELOPMENT OF SYSTEM - STUDY INFORMATION NEEDS - ASSIST DEVELOPMENT OF NEW SERVICES - FACILITATE DEVELOPMENT/IMPLEMENTATION OF COMMON POLICIES AND FUNCTIONS - COORDINATE NETWORK SERVICES - ALLOCATE FISCAL RESOURCES
FUNDING:	- BY GOVERNMENT AND MINISTRIES
FORMS OF BUSINESS:	- CONTRACT WITH AUTONOMOUS ORGANIZATIONS FOR INFORMATION SERVICES, TECHNICAL CONSULTING, DOCUMENT DELIVERY, TELECOMMUNICATIONS, ETC.
BOARD OF DIRECTORS:	- APPOINTED BY PRESIDENT - NO CONFLICT OF INTEREST
ADVANTAGES:	- PUBLIC RESPONSIBILITY - VISIBILITY/ACCOUNTABILITY - STABILITY - REGULAR FINANCIAL BASE - DECISION-ORIENTED - INCENTIVE VIA FUNDING SUPPORT - SMOOTHER TRANSITION TO DOMESTIC FUNDING

planning and coordinating platform. It assures, furthermore, performance of functions that exceed the responsibility or capability of any one member of the STI system -- functions such as policy formulation, user education, and manpower training.

The Council is to be responsible for the following specific functions:

i) Continuous monitoring and revision of national information requirements. By regularly monitoring and studying the national socioeconomic plans, executive decisions, and develoment trends of the public and private sectors, the Council shall correlate the provision of information services with changing national information requirements.

ii) Continuous monitoring and optimization of the performance of the national STI system. The Council shall examine the level and equity of information services to different user constituencies in Egypt's socioeconomic development activities, and recommend and take appropriate steps such as expanding the existing number of services, expanding their coverage, arranging for supplementary or advanced personnel training, transferring responsibility for information service from an ineffective member of the system to an existing or new node, revising the principles and rules for building Egypt's STI resources, etc. The Council shall study and recommend appropriate applications of new technology in the national STI system. It shall use administrative reports (Appendix D) of the national STI system nodes to monitor the level, quality, availability, penetration, and cost of information services, including document delivery, and recommend steps to increase the utilization of information by Egyptian problem-solvers.

iii) Contracting for information services. The Council shall have the power to enter into bilateral contracts with autonomous Egyptian and foreign agencies and organizations for performance of specific information services, document delivery, education and training, and such research and studies as may be required. (Contracts using foreign donor funds may be subject to additional regulations.)

iv) Formulation of national information policy. The Council shall pursue the enactment of national information policies in Egypt, insofar as they pertain to the national STI system, and monitor their implementation.

v) Implementation of broad educational programs to increase the use of STI by Egyptian problem solvers. The Council shall formulate and implement multipronged programs aimed at different strata of the problem solving population (executives in government and industry, researchers, production managers, and knowledge transfer agents such as educators, extension workers in the agricultural and health sectors, librarians, editors, and mass communications specialists), exploiting a range of appropriate devices such as high level seminars, conference presentations, printed campaigns, demonstrations, awards, and other incentives.

vi) Planning, instituting, and monitoring the development of professional and paraprofessional manpower. Using a manpower planning model to predict staffing requirements of the national STI system, the Council shall contract for and supervise appropriate educational and training programs in Egypt and abroad.

vii) Submitting annual budgetary requests on behalf of the national STI system. The Council shall develop, justify, and present to the government annual requests for funds, and subsequently allocate these funds for the system operations (financing of the national STI system is discussed later in this chapter). Included in the budget requests will be funds for the operation of the Council as well as for the programs under its auspices, such as policy promotion, manpower training, user sensitizing, research, and international activities.

viii) Functioning as a national focal point vis-a-vis international informational programs. The Council shall review the utility of international programs to Egypt and arrange, preferably through existing nodes of the national STI system, for appropriate participation in such activities. Bilateral or multilateral international projects involving nodes of the national STI system should have the endorsement of the Council if they impact the functions, procedures, standards or financial resources of the national STI system of Egypt.

ix) Organizing regular meetings of the heads and other senior professionals of all information service and document repository nodes of the national STI system. The objective of these roundtable meetings is to share common experiences, record common problems and formulate approaches to their solution, and obtain firsthand input into further development and planning of the national system. The sessions should properly be organized by the Advisory Committees of the Council.

x) Sponsoring an annual national conference of the information service sector of Egypt. The Conference may be cosponsored with other professional and scientific groups. In addition, the Council shall pursue and assure participation by the national STI system in other relevant national meetings held in Egypt and abroad, and be instrumental in organizing technical sessions and/or discussion panels at such meetings.

b) Organization

Figure 11 shows the proposed organization of the Council of Information Services and Resources.

i) Board of Directors. The Board of Directors consists of 8-12 members. Appointees to the Board should be instrumental in promoting acceptance of the Council's recommendations and budget requests; presumably the initial members would be appointed by the President, partially from nominations by the three constituency groups (users, information services, and document repositories). Members of the Board of Directors should not be affiliated with the organiza-

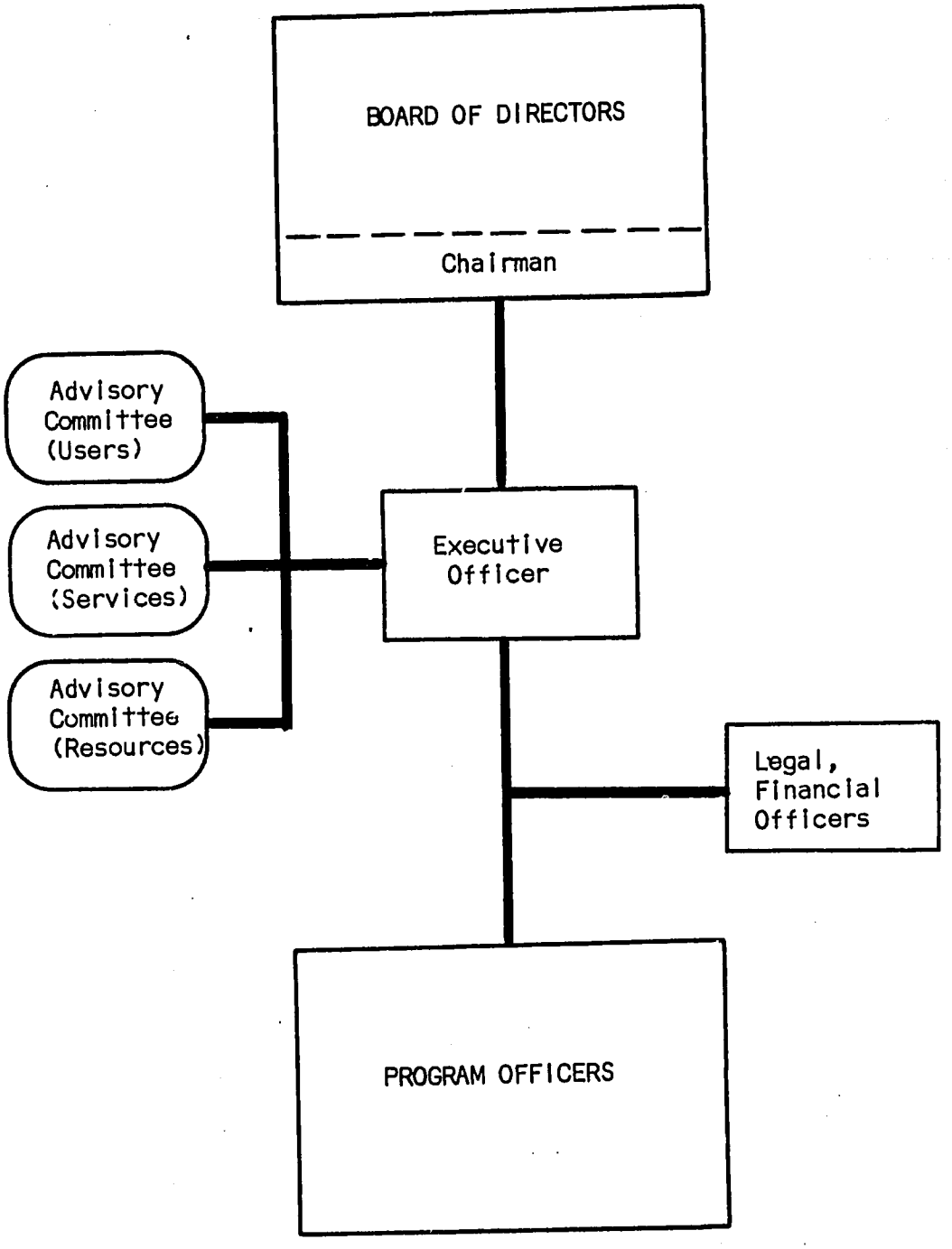

FIGURE 11. COUNCIL ON INFORMATION SERVICES AND RESOURCES: ORGANIZATION CHART.

tions comprising the national STI system. Board members serve a six-year term, with two members rotating every year. The chairman of the Board will be elected by the Board for a period of three years, except that the first chairman will be appointed by the President. Board members should meet no less than quarterly for a period of two days.

ii) Staff. Since the Council will contract for the functions and operations performed by the national STI system, including some of those performed centrally under the auspices of the Council, it is not intended to have a large staff. The professional staff should initially consist of a full-time Executive Director, two full-time program officers, and part-time legal and financial officers. The full-time professional staff should hold no other major salaried employment. The following quote captures the essence of the appointments of the Council's professional staff:

> The national focal point should be staffed by fulltime officers from the outset. Quality is more important than quantity. Taken as a whole, the staff must be well-motivated, must have ideas of their own and the ability to mobilize other people's ideas, must be able to keep up to date on a wide range of topics, must be able to plan and control studies — and perhaps experiments —, must have good writing ability, and must be able to "win friends and influence people." . . . One should seek staff from the widest possible range of intellectual and administrative ability. (Gray, 1978)

The Executive Director and his staff will be assisted by permanent Advisory Committees representing users of the national system, its information services, and its document repositories. Advisory Committee members are appointed by the Chairman of the Board of Directors, in a manner assuring equitable and meaningful representation of the constituencies of the national system. Advisory Committees shall elect their chairmen, and shall meet once a month. Minutes of the meetings shall be recorded, with such recommendations as have been formulated and adopted by the Committees; and copies shall be forwarded, via the Executive Director, to members of the Board of Directors, and to chairmen of other Advisory Committes.

The Council should be housed in suitable quarters, with access to meeting rooms equipped with audiovisual media, and be supported by suitable clerical staff. Communications capabilities are essential, including a terminal and printer coupled via dialup telephone lines to the computational facilities of the information services nodes, and telex.

2. Funding

There are four sources of funds that should be counted upon to support the Egyptian national STI system: income from services; subsidy from the government; operating funds from the parent organization of information service nodes; and grants and donations from other sources.

a) Income from Services

The national STI system should develop and adopt a uniform "price list" of its key services. The principal services whose partial or full costs are to be passed on to the user are database searches and document delivery. User charges should not include the cost of the development of the system and of its facilities, inasmuch as these are at least partly covered by an existing grant. Charges should be reasonable, lest they impede use of services and of information. Database search fees will presumably distinguish between domestic and foreign searches. Although foreign database search costs vary, the user charge for this service should minimize such differences, so as to simplify accounting procedures and make the service more transparent to the user. Service fees should not penalize users resident outside the main metropolitan areas of Egypt.

b) Funding Formula

The desire of industrialized countries is for information services to be self-supporting (i.e., to distribute all costs of service operation among its users). In practice few if any information services attain this objective; the great majority of database producers and database vendors are still deficit operations. It is therefore unreasonable to expect that the Egyptian information services will recover their cost in full; indeed, trying to do so would almost certainly undermine or defeat some of the goals of the national STI system.

The question thus arises as to the division of the costs among the various parties concerned — the users, the central government, and the parent organizations of the information service nodes. Although agreement on a formula for subsidizing the main cost of the national STI system must await discussions by these parties, the following are a few thoughts toward such a discussion.

Having the central government assume the full financial burden, and having the annual allocations distributed by the Council of Information Services and Resources, has the appeal of simplicity. On the other hand, having the parent organizations of information system nodes share the cost of services will assure higher degrees of commitment and attention by the management of these organizations, and hence more effective use of financial resources. Similar reasons dictate that users (or their employers) be levied charges, or else the value and cost effectivenes of the national STI system will remain moot.

One approach to the funding of the national STI system might be the following:

i) the information service nodes contribute the cost of their personnel and premises;

ii) the users meet the Egyptian-currency costs of services and materials (this income reverts to the service node);

iii) the government supplies the hard-currency cost of the services;

iv) the government and foreign donors subsidize other extrinsic costs, such as the operation and programs of the Council for Information Services and Resources, purchase of additional equipment for lease to information service nodes, system research and development, foreign travel, and other central functions.

Reverting the income from users to the service node should provide the latter with a considerable marketing incentive.

3. Budget of the National STI System

The total annual cost of the Egyptian national STI system is estimated at approximately $1.3 million (Table 19). This figure does not include budgets of other existing information agencies; for example, it is assumed that Egyptian libraries will continue, at their expense, subscribing to STI materials they currently hold.

The cost estimate is based on assumptions made throughout this study: six information service nodes; 2,500 foreign database searches/year; foreign document delivery at a rate of five documents per search; and document acquisitions by Egyptian STI repositories up to the level recommended by "core lists." The prorated equipment cost item may be viewed as the annual budget for additional equipment to be acquired for new services (initial equipment will be provided gratis).

The estimated annual budget is equivalent to about 2.5 percent of the R&D budget of Egypt. This figure is half of the typical national operating budget for STI services in developing countries (five percent of the annual R&D budget) and less than one-fourth of the typical start-up cost in developing countries (10-15 percent of the annual R&D budget).

TABLE 19. NATIONAL INFORMATION SERVICES:
ANNUAL COST ESTIMATE

FOREIGN SEARCHES (2,500 @ $56)	$ 140,000
FOREIGN DOCUMENT DELIVERY (5 DOC/SEARCH @ $7.50)	93,750
INFORMATION CENTER: PERSONNEL ($100,000 x 6)[A]	600,000
INFORMATION CENTER: OTHER COSTS ($10,000 x 6)[B]	60,000
EQUIPMENT ($750,000 PRORATED FOR TEN YEARS)	75,000
EQUIPMENT MAINTENANCE (3% OF COST)	22,500
INFORMATION COLLECTIONS (1/3 OF CORE LIST)[C]	125,000
PRINTING/PUBLISHING	20,000
OVERSEAS TRAINING (1 MAN/YEAR)	25,000
COUNCIL ON INFORMATION SERVICES AND RESOURCES[D]	130,000
TOTAL	$ 1,291,250

A) BASED ON SIX INFORMATION SERVICE CENTERS.

B) SUPPLIES, LOCAL TRAVEL.

C) INCLUDES OPERATING THE ACQUISITION BUREAU.

D) ADMINISTRATIVE COSTS, TRAINING, CONFERENCES.

CHAPTER VI. REFERENCES

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APPENDIX A

INFORMATION SERVICE NODES

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APPENDIX A-1.

INFORMATION SERVICE: AGRICULTURE

PRIMARY CLIENTELE:	MINISTRY OF AGRICULTURE MINISTRY OF IRRIGATION MINISTRY OF LAND RECLAMATION FACULTIES OF AGRICULTURE (36,000 STUDENTS) AGRICULTURAL COOPERATIVES
SECONDARY CLIENTELE:	MINISTRY OF SUPPLY MINISTRY OF INTERNAL TRADE MINISTRY OF FOREIGN TRADE ASRT MINISTRY OF PLANNING

APPENDIX A-2.

INFORMATION SERVICE: ENERGY

PRIMARY CLIENTELE:	MINISTRY OF PETROLEUM/EGYPTIAN GENERAL PETROLEUM CORPORATION MINISTRY OF PLANNING FACULTY OF PETROLEUM/MINING (1,000 STUDENTS)
SECONDARY CLIENTELE:	MINISTRY OF INDUSTRY MINISTRY OF FOREIGN TRADE MINISTRY OF RECONSTRUCTION GENERAL AUTHORITY FOR INVESTMENT

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APPENDIX A-3.

INFORMATION SERVICE: HUMAN SETTLEMENTS

PRIMARY CLIENTELE:	MINISTRY OF RECONSTRUCTION AND NEW COMMUNITIES INSTITUTE FOR RECONSTRUCTION PLANNING MINISTRY OF HOUSING MINISTRY OF PLANNING
SECONDARY CLIENTELE:	MINISTRY OF TRANSPORTATION MINISTRY OF DEFENSE MINISTRY OF TOURISM MINISTRY OF FINANCE MINISTRY OF HEALTH MINISTRY OF SUPPLY ASRT

APPENDIX A-4.

INFORMATION SERVICE: INDUSTRY

PRIMARY CLIENTELE:	200 LARGE PUBLIC INDUSTRY FIRMS MINISTRY OF INDUSTRY GOFI GOVERNMENT RESEARCH INSTITUTES
SECONDARY CLIENTELE:	15,000 SMALL PRIVATE ENTERPRISES MINISTRY OF PLANNING MINISTRY OF INTERNAL TRADE MINISTRY OF FOREIGN TRADE GAFI

APPENDIX A-5.

INFORMATION SERVICE: MEDICINE AND HEALTH CARE

PRIMARY CLIENTELE:	MEDICAL SCIENTISTS/PRACTITIONERS (4,000) MEDICAL SCHOOLS (60,000 STUDENTS) MINISTRY OF HEALTH MILITARY MEDICAL ACADEMY
SECONDARY CLIENTELE:	NURSING FACULTIES (1,000 STUDENTS) MINISTRY OF PLANNING MINISTRY OF SOCIAL SECURITY ASRT

APPENDIX A-6.

INFORMATION SERVICE: SCIENCE AND ENGINEERING

PRIMARY CLIENTELE:	ASRT UNIVERSITY RESEARCHERS (2,868 PURE SCIENTISTS, 2,347 ENGINEERING SCIENTISTS, 30,000 SCIENCE AND TECHNOLOGY STUDENTS)
SECONDARY CLIENTELE:	INDUSTRIAL RESEARCH INSTITUTES NATIONAL INSTITUTE FOR MANAGEMENT DEVELOPMENT

APPENDIX A-7.

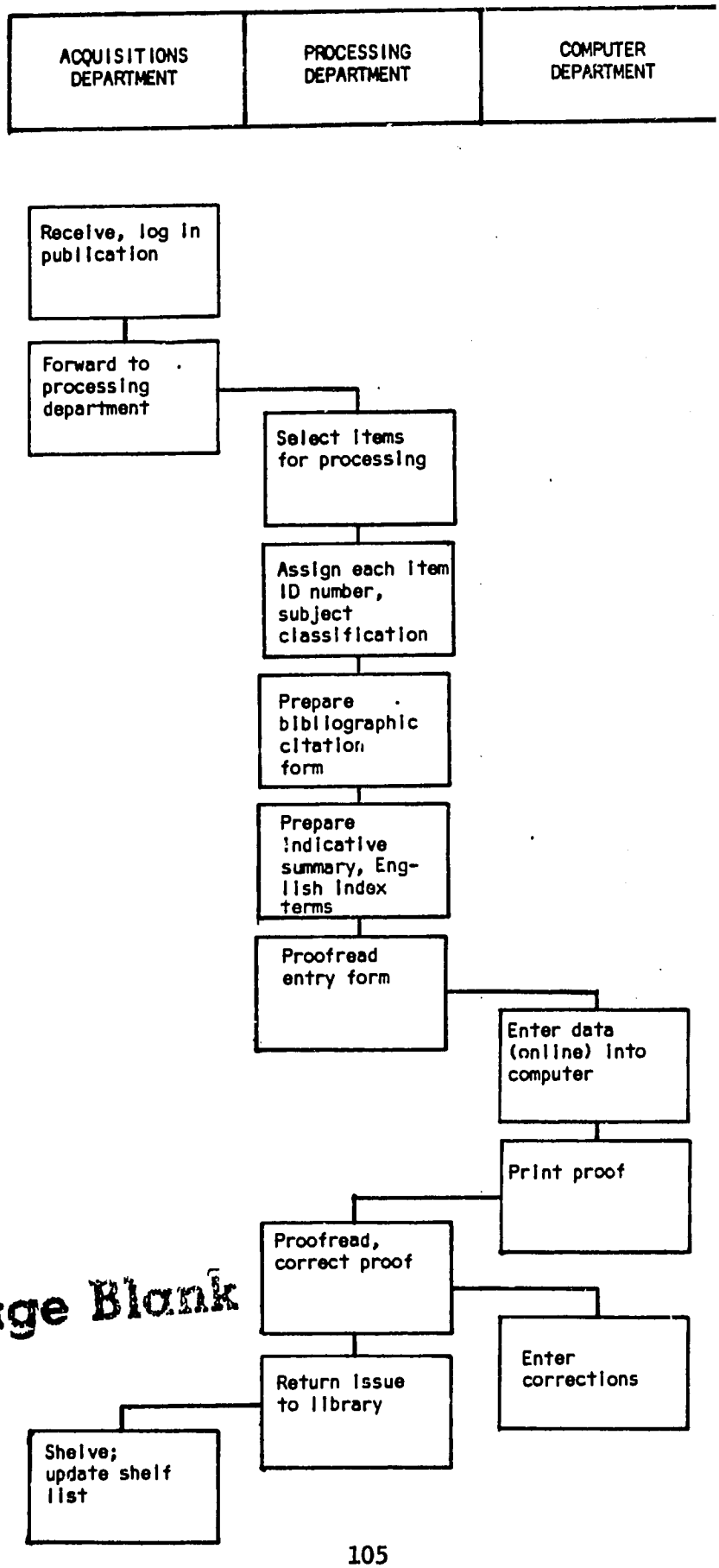
INFORMATION SERVICE: TRANSPORTATION AND COMMUNICATIONS

PRIMARY CLIENTELE:	MINISTRY OF TRANSPORTATION MINISTRY OF MARITIME TRANSPORTATION MINISTRY OF CIVIL AVIATION SUEZ CANAL AUTHORITY MINISTRY OF COMMUNICATIONS MINISTRY OF PLANNING
SECONDARY CLIENTELE:	MINISTRY OF SUPPLY MINISTRY OF DEFENSE

APPENDIX B

PROCESS FLOW CHARTS

APPENDIX B-1. STI DATABASE DEVELOPMENT: PROCESS FLOW



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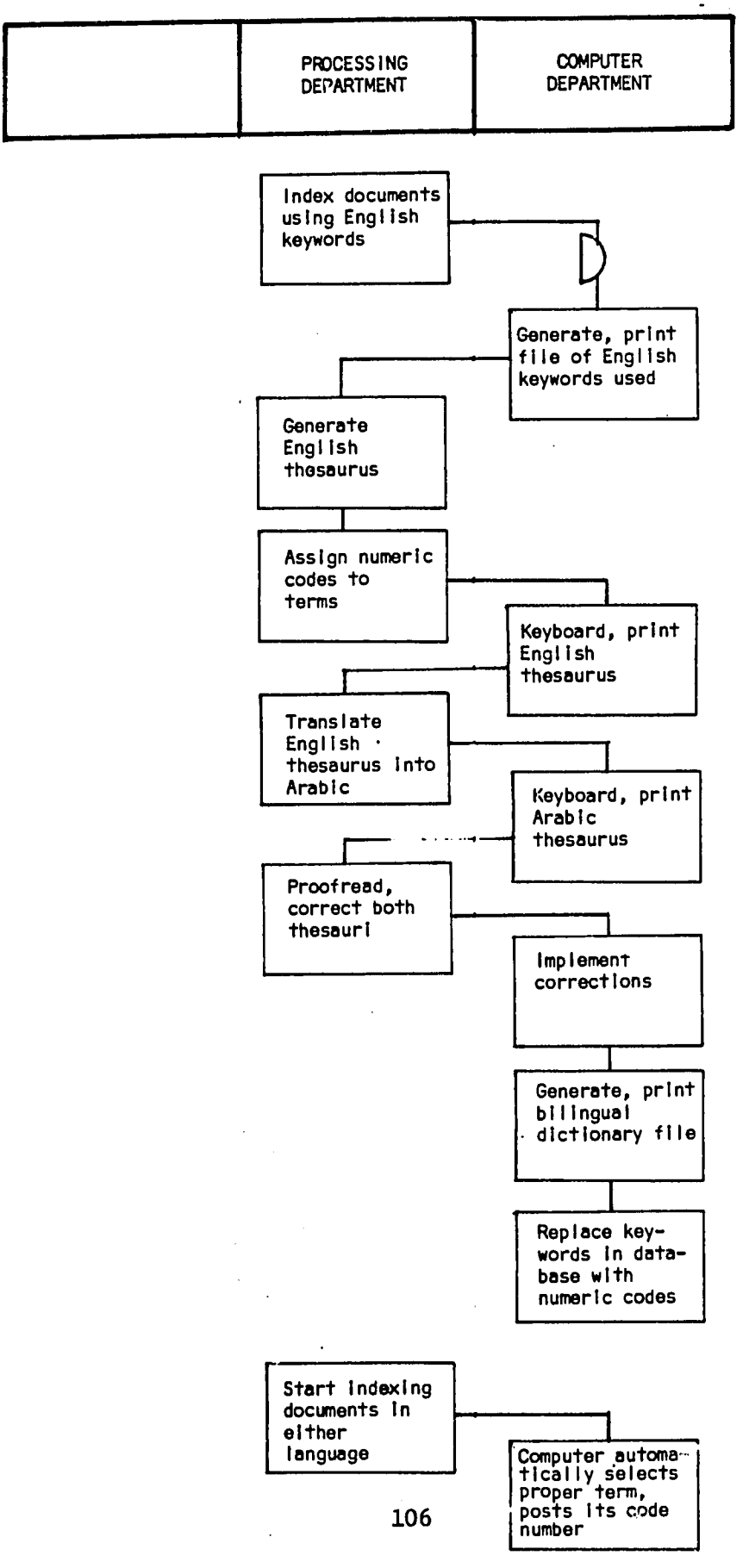
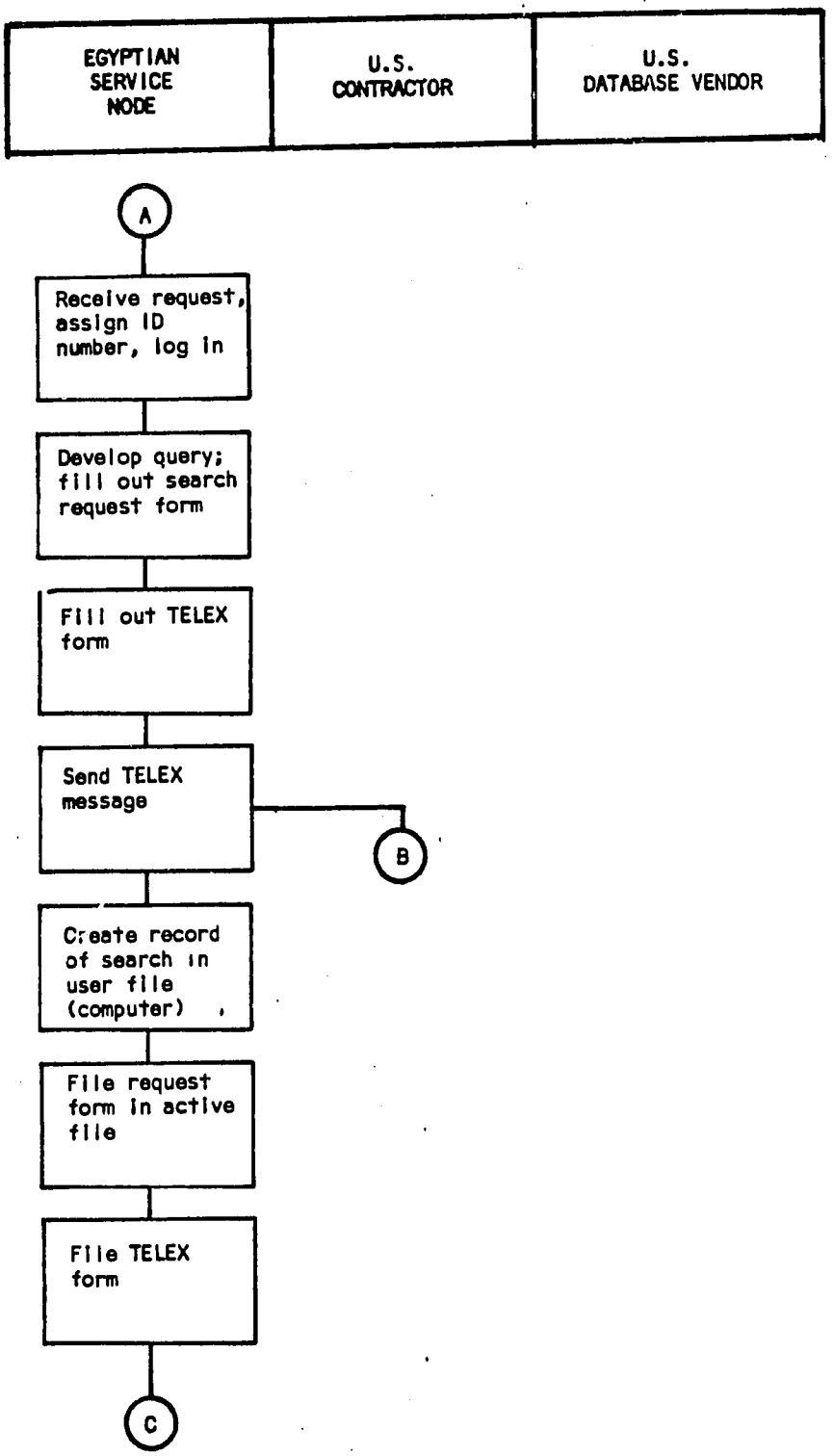
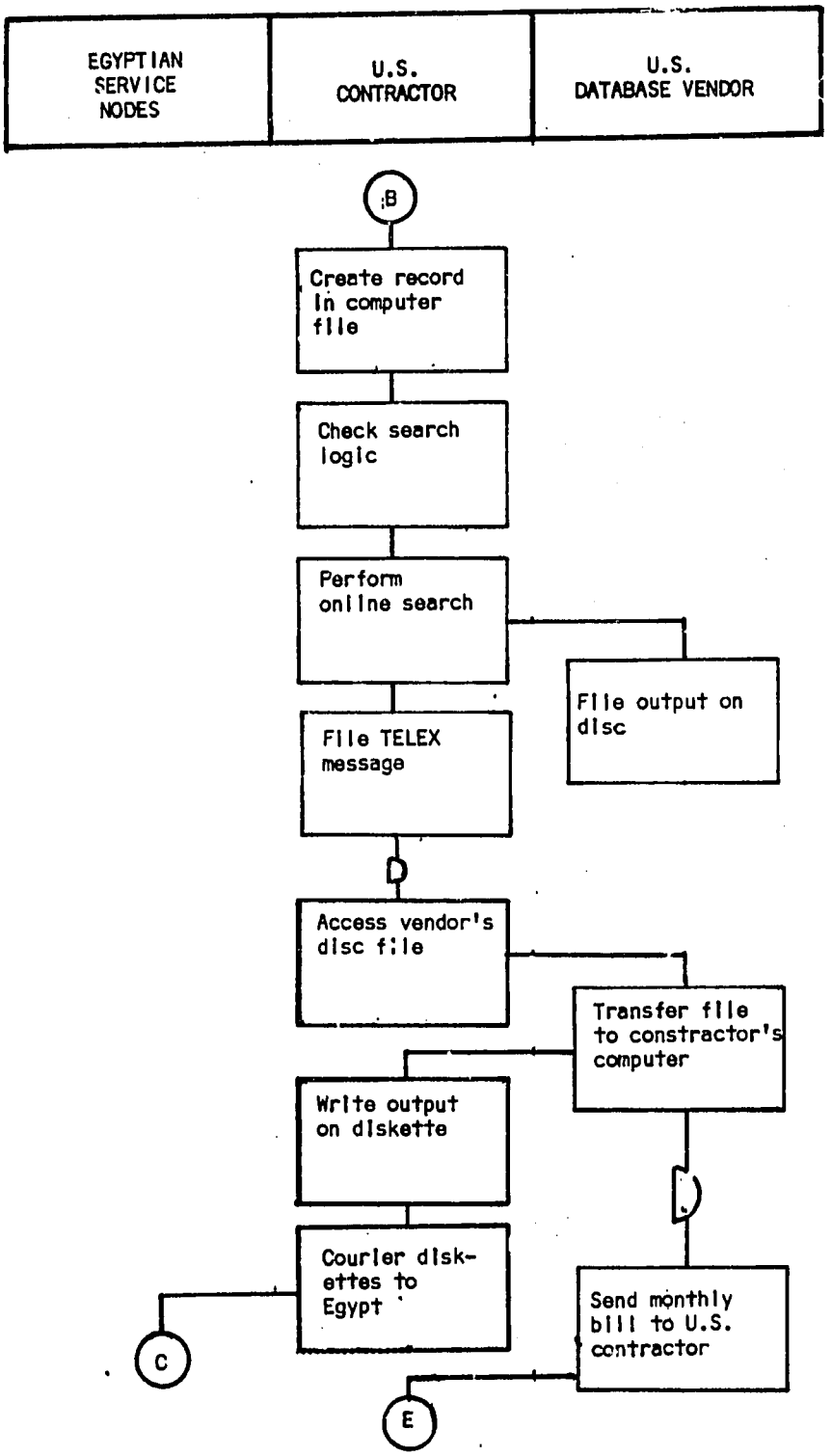
APPENDIX B-2. BILINGUAL THESAURUS GENERATION: PROCESS FLOW



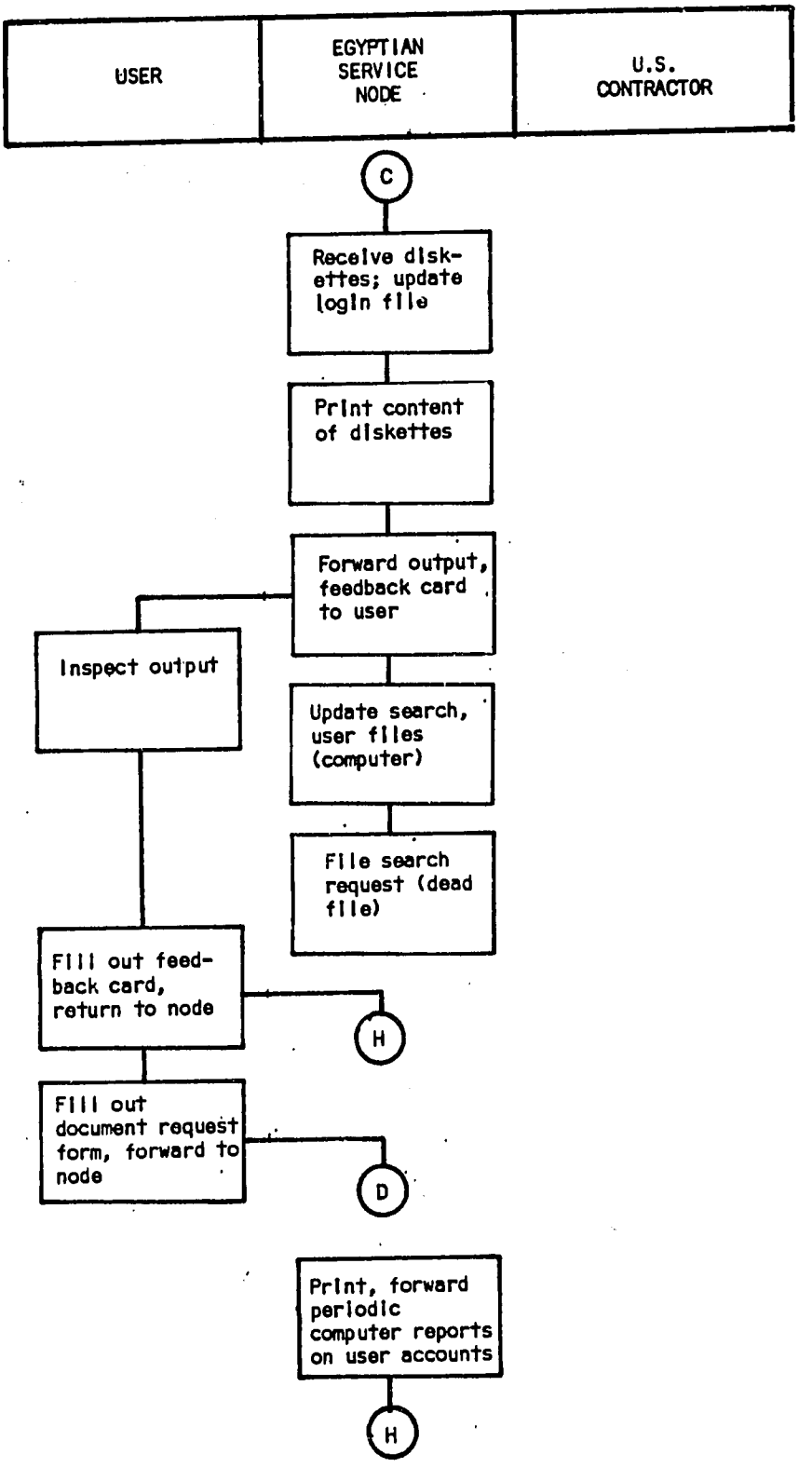
APPENDIX B-3. "DELAYED ONLINE" SEARCH OF U.S. DATABASES: PROCESS FLOW



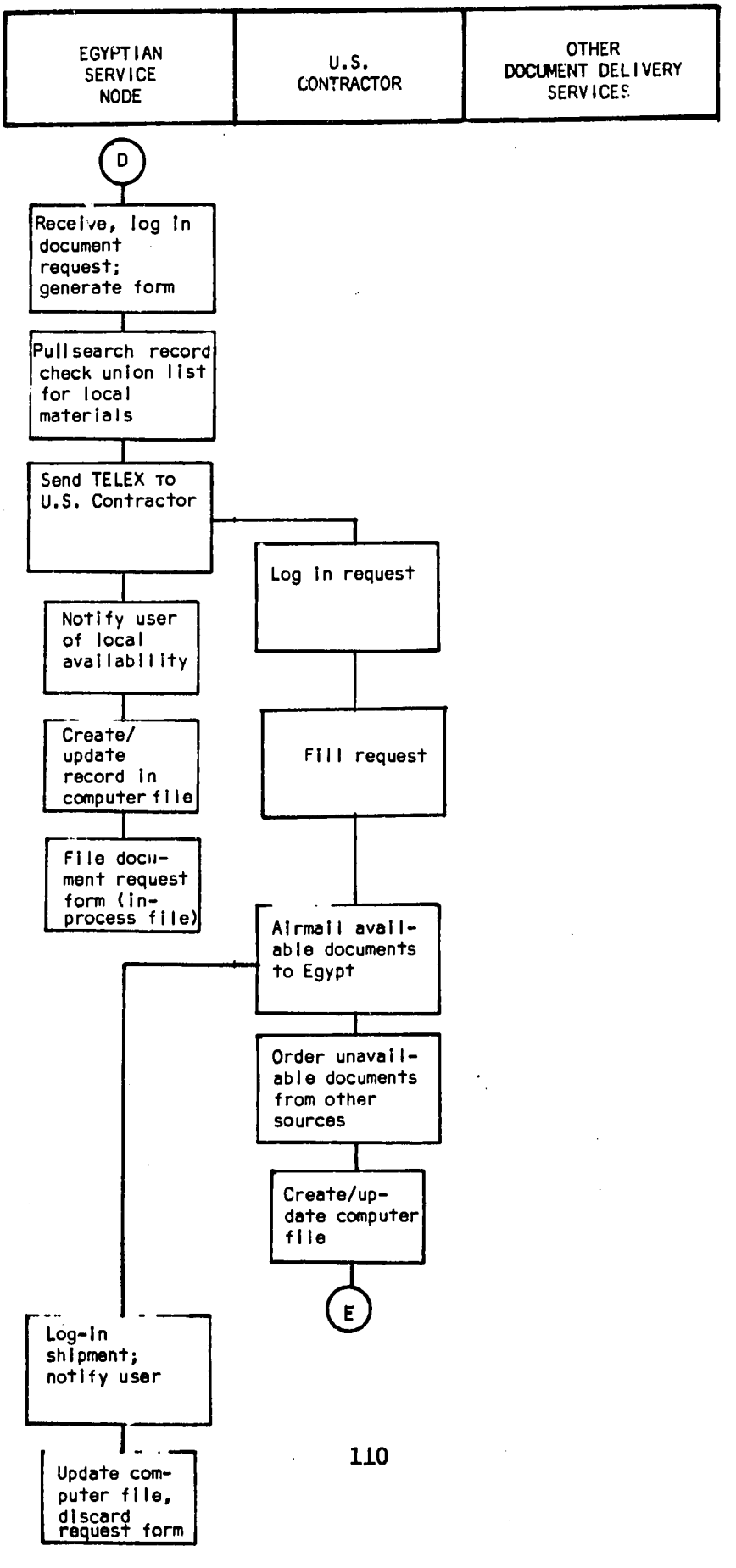
APPENDIX B-3 (CONT'D)



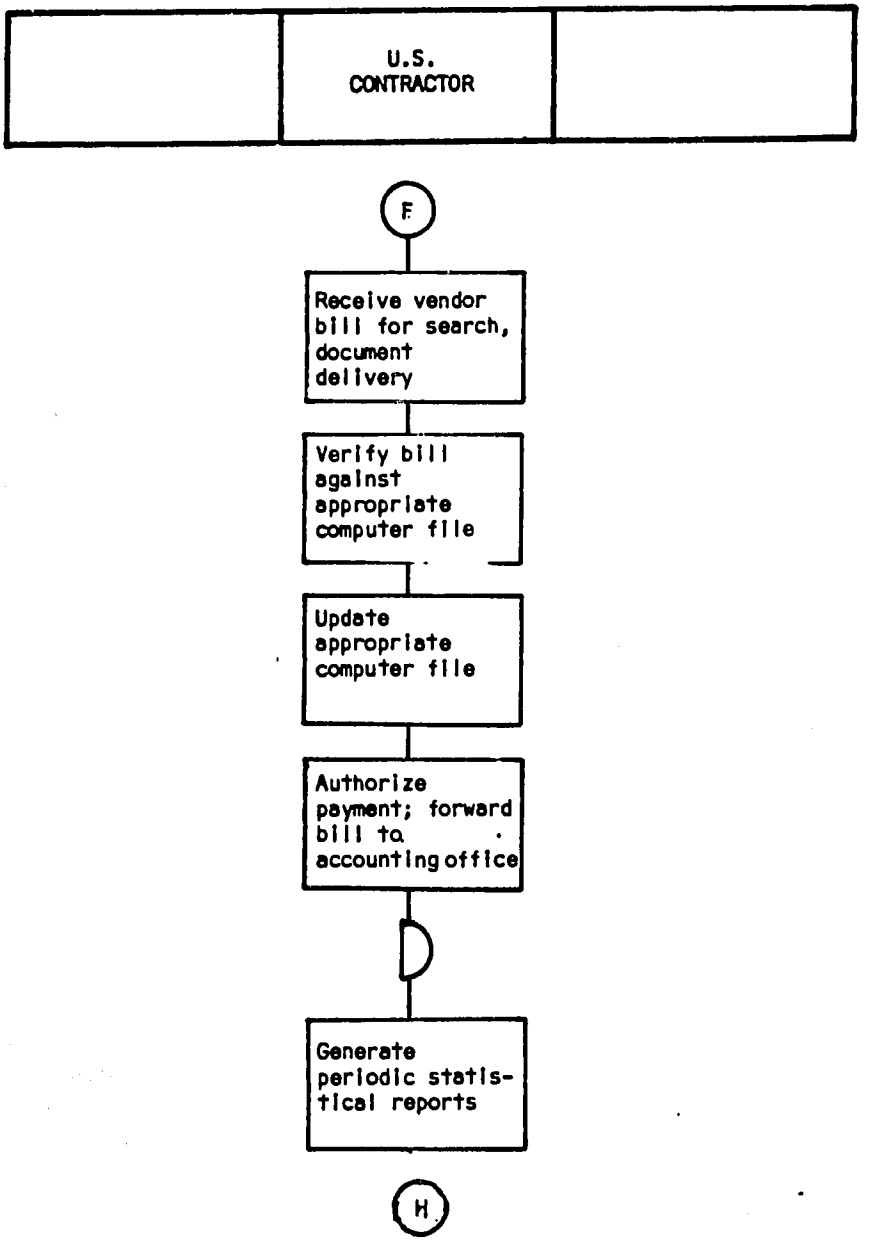
APPENDIX B-3 (CONT'D)



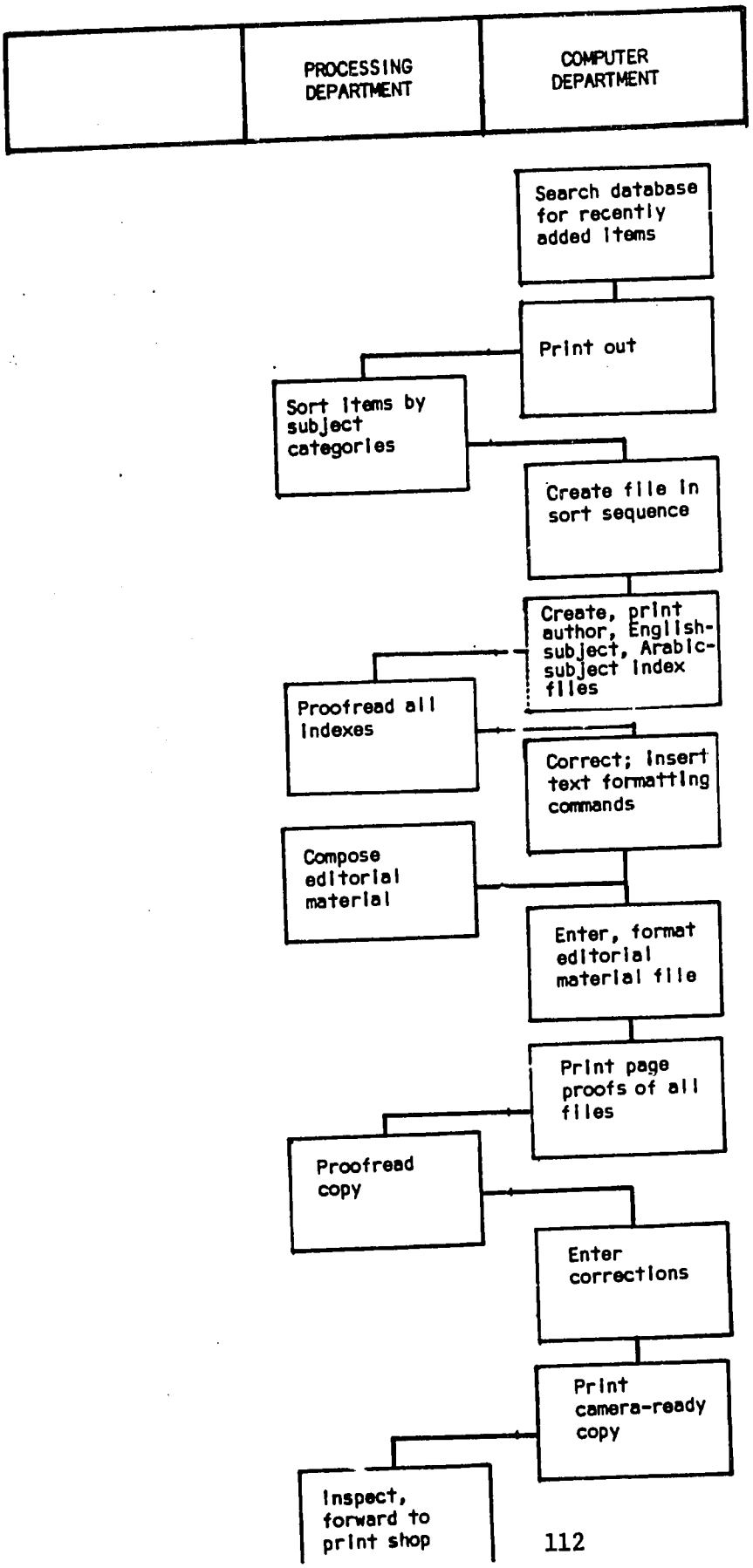
APPENDIX B-4. FOREIGN DOCUMENT DELIVERY: PROCESS FLOW



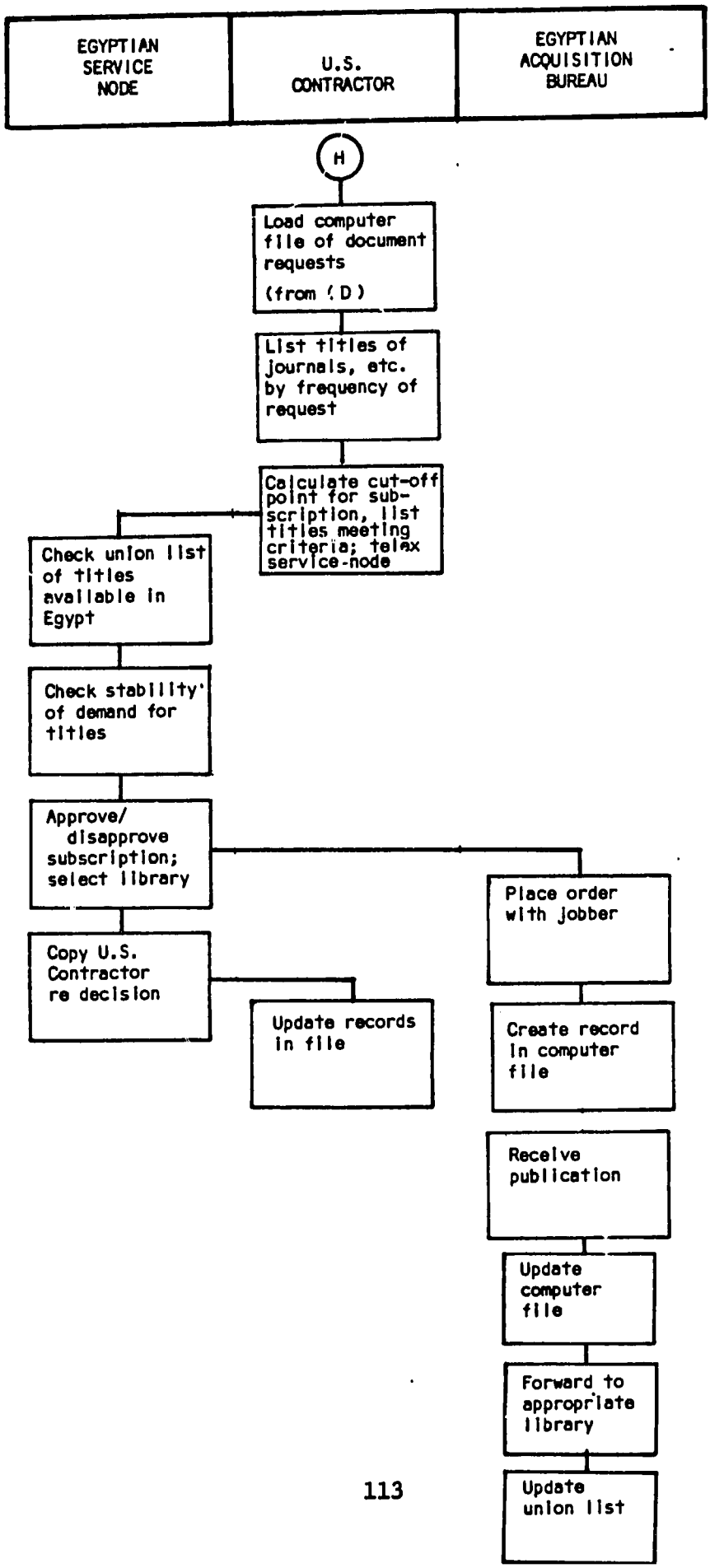
APPENDIX B-4 (cont'd)



APPENDIX B-5. AWARENESS BULLETIN GENERATION: PROCESS FLOW



APPENDIX B-6. DEMAND-DRIVEN ACQUISITION: PROCESS FLOW



APPENDIX C

ADMINISTRATIVE FILES

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APPENDIX C-1. MANUAL FILES (EGYPT)

FILE	ARRANGEMENT BY		
	Search no.	User no.	Date
Search request forms (in process)	X		
Search request forms (completed)	X		
Document order forms (in process)*	X		
Telex messages sent			X
Telex messages received			X
Search outputs (COM)	X		
Feedback forms received	X		
Invoices sent		X	
Invoices received			X

*After document arrival, order forms are discarded.

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APPENDIX C-2. USER DIRECTORY (EGYPT)

CONTENTS: Identification of Users with accounts.

Elements	Remarks
User account no.:	Identifies Egyptian service node plus sequence number
User classification code:	Security, access type, service type, corporate vs. personal
Name:	Personal or corporate name
Other names:	First names, or department name
Employer:	
Address (street):	
Address (city):	
Telephone:	

APPENDIX C-3. FINANCIAL ACCOUNTS FILE (EGYPT)

CONTENTS: Record of customer charges and payments.

Elements	Remarks
User account no:	See "Search File (Egypt)"
Account:	$, L.E.
Reference:	Pertinent Search ID
Transaction date:	Day, month, year
Transaction type:	Deposit received First invoice Second invoice Reimbursement received Refund to user Quotation/estimate Other
Amount:	Sum
Entered by:	Last name of operator

APPENDIX C-4. DOCUMENT ORDER FILE (EGYPT)

CONTENTS: Record of document delivery requests and their disposition.

ELEMENTS	REMARKS
Search no.:	See "Search File (Egypt)"
User account no.:	See "Search File (Egypt)"
Date request received:	Day, month, year
No. of items requested by user:	Numeric total
Date of telex:	Day, month, year
Document vendor:	Name of document delivery service(s)
No. of items requested in telex:	Numeric total
First shipment - date received: no. of items:	
Second shipment - date received: no. of items:	
Comment:	

APPENDIX C-5. DOCUMENT ORDER FILE (U.S.)

CONTENTS: Record of requests for document delivery and their disposition.

ELEMENTS	REMARKS
Search no.:	See "Search File"
Date received telex:	Day, month, year
No. items requested:	Numeric total
First mailing -	
date:	(refers to documents
no. of items:	{ copied from local collection
cost:	{ of U.S. Contractor
Second mailing -	
date:	(refers to documents
no. of items:	{ ordered from other collections
cost:	{ in U.S. or abroad
Comment:	

APPENDIX C-6. SEARCH REQUEST FILE (EGYPT)

CONTENTS: Egyptian record of search requests and their disposition.

ELEMENTS	REMARKS
Search no.:	Identifies Egyptian service node, plus sequential number
User account no.:	Identifies Egyptian service node, plus sequential number
Search title:	Narrative subject of search
Search category codes:	Retrospective, SDI, bibliographic, numeric
Frequency of SDI search:	Weekly, monthly, quarterly, semiannually, annually
Cutoff date of SDI search:	Day, month, year
Date received from user:	Day, month, year
Received, processed by:	Last name of Egyptian searcher
Date telexed to U.S.:	Day, month, year
Date of output receipt:	Day, month, year
No. of citations in output:	Numeric total
No. of requests in output:	Numeric total
Comments:	Notes on other telexes, delay reasons, etc.

APPENDIX C-7. SEARCH REQUEST FILE (U.S.)

CONTENTS: U.S. record of search requests and their disposition.

ELEMENTS	REMARKS
Search no.:	Identifies Egyptian service node, plus sequential no.
Search type:	Retrospective online; SDI batch
Date telex received:	Day, month, year
Date performed:	Day, month, year
Databases searched:	Standard abbreviations of names
Searcher's name:	Last name
Vendor's name(s):	E.g., BRS
Searcher's notes:	Narrative comments
Vendor's charge:	$
Date vendor's bill approved:	Day, month, year
Comments:	

APPENDIX C-8. PUBLICATIONS FILE (U.S.)

CONTENTS: Frequency count of serial and other publications ordered, used as guide to the acquisition program of Egypt.

ELEMENTS	REMARKS
Document category code:	Journal, patent, technical report, etc.
Name of journal, class of patent:	For journals, use ISSN or CODEN
Search ID:	See "Search File"
No. of requests from search:	Numeric total
Date of request:	Day, month, year
Comments:	

APPENDIX C-9. BIBLIOGRAPHIC FILE(S) (EGYPT)

CONTENTS: Indexed surrogate of selected publications issued in Egypt.

ELEMENTS	REMARKS
Document number:	A code uniquely identifying each publication
Title:	
Author(s):	(Repeating group)
AUthor(s)' address(es):	(Repeating group)
Date of publication:	
Publication name:	
Publisher:	
Volume:	
Issue number:	
Pages:	
Summary:	A short indicative abstract
Keywords:	Coded terms from and authority list or thesaurus

APPENDIX C-10. BILINGUAL THESAURUS (EGYPT)

CONTENTS: Coded keywords (English and Arabic), with their synonyms and related concepts, arranged in numerical sequence of the code.

ELEMENTS	REMARKS
Code number:	Unique numeric identifier of each concept
Term (E):	English keyword corresponding to code
Synonym (E):	English synonym of Term (E)
Related term (E):	Other English keywords similar in meaning to Term (E)
Term (A):	Arabic keyword(s) corresponding to code number
Synonym (A):	Arabic synonym of Term (A)
Related term (A):	Other Arabic keywords similar in meaning to Term (A)

APPENDIX C-11. ARABIC KEYWORD DICTIONARY (EGYPT)

CONTENTS: An alphabetic list of Arabic keywords, with their code numbers.

ELEMENTS	REMARKS
Term (A):	Arabic keyword
Code number:	Numeric identifier of keyword

APPENDIX C-12. ENGLISH KEYWORD DICTIONARY (EGYPT)

CONTENTS: An alphabetic list of English keywords, with their code numbers.

ELEMENTS	REMARKS
Term (E):	English keyword
Code number:	Numeric identifier of keyword

APPENDIX D

MANAGEMENT REPORTS

APPENDIX D-1. INFORMATION SERVICES: MANAGEMENT REPORTS

REPORT TYPE	FREQUENCY	CUMULATIONS	RESPONSIBILITY	DATA SOURCE
TITLES OF COMPLETED SEARCHES	QUARTERLY	SEMIANNUAL	E	SEARCH REQUEST FILE (E)
USER STATISTICS	QUARTERLY	ANNUAL	E	USER DIRECTORY (E) FINAL ACCOUNTS FILE (E)
SEARCH STATISTICS	MONTHLY	SEMIANNUAL	E	SEARCH REQUEST FILE (E)
SEARCH STATISTICS	MONTHLY	SEMIANNUAL	US	SEARCH REQUEST FILE (US)
DOCUMENT DELIVERY STATISTICS	MONTHLY	SEMIANNUAL	E	DOCUMENT ORDER FILE E)
DOCUMENT DELIVERY STATISTICS	MONTHLY	SEMIANNUAL	US	DOCUMENT ORDER FILE (US)
US CONTRACT ACCOUNT	MONTHLY	QUARTERLY	US	(US CONTRACTS OFFICE)
BIBLIOGRAPHIC DATABASE STATISTICS	QUARTERLY	ANNUAL	E	USER DIRECTORY (E) BIBLIOGRAPHIC FILE (E)

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