2.2.4 Second Five-Year Plan for Socioeconomic Development

While the First Five-Year Plan for Socioeconomic Development shaped a dramatic expansion in Egypt's telecommunications services, the Egyptian government has carried on its effort to develop a second five-year plan and still continuing plans, contemplating to increase the telephone density to 6.0 per 100 inhabitants by the year 2002 when the fourth five-year plan is scheduled for completion, with about 4 million telephone lines.

The second five-year plan covers the period from 1987/1988 to 1991/1992. This is the second year of the plan. The telecommunications part in this plan is briefly described below.

(1) Development goals

The following six goals have been set for the Second Five-Year Plan:

a) To push the telephone density to 3.3 per 100 inhabitants by the end of the five-year plan by pursuing further installation of telephone lines that began in the first five-year plan.

b) To make telecommunications services available in new industrializing or residential cities, such as Sadat, as part of the infrastructure needed to achieve regional development and decentralization of population.

c) To implement automatic dialing services in towns and villages (Markaz and Village).

d) To fortify international telecommunications services to support commercial transactions with foreign countries and Egyptian workers abroad.

e) To induct and maintain a modern communication system for information and data to keep pace with growing applications of computers and data banks.

f) To encourage local production of electronic exchanges. Egypt expects to start local production of digital exchanges jointly with Siemens, West Germany. Plans call for an annual 200,000 terminals to be produced initially, which will be expanded ultimately to 300,000 terminals with full operation.

(2) Qualitative goals

Table 2.5 indicates the qualitative goals set for subscriber telephone and telex subscribers by the Second Five-Year Plan. Table 2.6 outlines goals of expansion of exchange capacity and the number of main lines per 100 inhabitants.

Table 2.5 Quantitative Target of Telephone and Telex Lines for 1991/92 Compared to 1986/87

Detail	Expected 1986/87 end of first 5-year plan	Target 1991/92 end of second 5-year plan	Growth rate (%)
Telephone exchange capacity	1,443,000	1,908,000	32.2
Telephone lines in use	1,045,000	1,520,000	45.5
Telex lines in use	6,350	8,873	39.7

Table 2.6 Exchange Capacity and Telephone Density in 1986/87 and 1991/92 Targets by Governorates

Governorates	As of 30 June 1987 Capacity (1000's)	As of 30 June 1987 Per 100 capita	As of 30 June 1992 Capacity (1000's)	As of 30 June 1992 Per 100 capita
Cairo	552.40	6.50	726.00	7.70
Giza	139.90	5.80	194.90	5.80
Qalioubla	22.10	1.60	40.10	2.00
Alexandria	227.90	7.70	300.90	8.50
Beheira	30.70	0.90	37.70	0.90
Mersa Matrouh	9.10	4.80	11.10	4.10
Manoufia	34.30	1.50	38.30	1.50
Gharbia	57.40	1.90	63.40	1.90
Kafr El-Sheikh	25.00	1.30	30.00	1.40
Damietta	12.50	1.70	16.50	1.90
Dakahlia	73.30	2.30	89.30	2.20
North Sinai	11.90	7.40	13.90	8.30
South Sinai	3.20	12.80	3.20	10.30
Port Said	20.70	5.30	26.70	6.20
Ismailia	16.40	3.30	20.90	3.50
Suez	11.50	4.20	15.00	4.50
Sharkia	49.20	1.40	60.20	1.50
Beni Suef	14.40	0.90	20.90	1.20
Fayoum	9.00	0.50	14.50	0.80
El-Minya	36.70	1.30	39.20	1.20
Assiout	23.30	1.10	31.30	1.20
New Valley	8.30	6.60	10.30	6.80
Sohag	20.40	0.80	32.40	1.20
Qena	19.30	0.80	29.80	1.20
Aswan	11.00	1.40	17.00	1.90
Red Sea	3.10	4.00	8.60	8.90
Total	1443.00	3.00	1882.10	3.30

(3) Investment plan

The Second Five-Year Plan undertaken by the Ministry of Communications was financed by a total investment of L.E. 694,695,000. The investment in the telecommunications fields, less the share for the Postal Services Corporation, was L.E. 657,605,000, which was accounted for by internal currencies with L.E. 331,245,000 (48%) and foreign currencies with L.E. 363,450,000 (52%). The ministry's own fund represents L.E. 353,640,000 or 36.5% of the investment.

Table 2.7 breaks downs the amounts of investment by agencies under the control of the Ministry of Communications. NTI's investment comprises L.E. 6,155,000 for facility completion projects and L.E. 1,200,000 for research expansion projects. A sum of L.E. 33,000 000 has been appropriated for the Egyptian Company for Manufacturing Telephone Instruments to complete production line improvement that began in the preceding fiscal year.

(4) ARENTO investment projects and tasks

In the Second Five-Year Plan, ARENTO has budgeted L.E. 617,200,000 to achieve the goals enumerated in (1) and (2) above, expecting to improve and expand local telephone networks, maintain transmission channels between major cities and urban microwave systems, improve international lines, and expand cellular mobile telephone services. For the improvement and expansion of local telephone networks, four facility renewal projects, 30 continuing projects, and 59 new and expansion projects are scheduled, commanding about 60% of the total budget. The budgeted investment is accounted for by facility replacement plans with L.E. 66,600,000 (10%), continuing and completion projects with L.E. 244,100,000 (40%), and new and expansion projects with L.E. 306,500 (50%). Table 2.8 breaks down the investment plans and operations involved in the Second Five-Year Plan.

Table 2.7 Investment Plans in the Second Five-Year Plan by Agencies under the Ministry of Communications

Agency	Budget (LE)
Ministry of Communications	50,000
NTI	7,355,000
ARENTO	617,200,000
Postal Services Corporation	37,090,000
Egyptian Company for Manufacturing Telephone Instruments	33,000,000
Total	694,695,000

Table 2.8 ARENTO Telecommunications Projects and Investment Plan

Projects	Investment (x 1000 LE)
(1) Replacement and renovation	
- Local telephone networks (four projects, 58,000 lines)	35,400
- Transmission channels between major cities (one project)	10,000
- Telegram and telex equipment (one project)	1,700
- Telecommunications equipment and installation (one project)	4,500
- Regional manual exchange automation (one project)	15,000
	(Total 66,600)
(2) Completion	
- Local telephone networks (30 projects, 400,500 lines)	151,400
- Data transmission (one project)	15,900
- Transmission channels between major cities (one project)	35,000
- Telegram and telex equipment (one project)	3,500
- International line expansion (one project)	1,300
- Cellular mobile telephone exchange expansion (one project)	25,000
- Submarine cables (one project)	5,000
- Satellite communication earth stations (one project)	7,000
	(Total 244,100)

Projects	Investment (x 1000 LE)
(3) Expansion and new	
- Local telephone networks (59 projects, 358,000 lines)	228,250
- Transmission channels between major cities (two projects)	17,600
- Telegram and telex equipment (two projects)	5,500
- Cairo microwave system (one project)	7,000
- Alexandria microwave system (one project)	1,000
- International exchanges (two projects)	2,400
- Exchange office trunk lines (two projects)	7,750
- Mobile exchange and manual exchange automation (one project)	15,000
- Regional manual exchanges (one project)	20,000
- International telecommunications grids, organizing frequencies by computer (one project)	2,000
	(Total 306,500)
Grand Total	617,200

(5) Performance in the first year (1987/1988) and plans for the second year (1988/1989)

Table 2.9 summarizes the results of subscriber telephone and telex installation in the first year of the second five-year plan. For subscriber telephones, both the exchange capacity and number of subscribers advanced at higher growth rates than initially projected. Among other achievements in the first year of the plan are the completion of a Cairo-Alexandria microwave network, that of a Cairo-Alexandria coaxial cable system along agricultural roads, and that of Suez-Qoseir coaxial cable works.

The following operations are scheduled for the second year of the second five-year plan:

a) Expansion in the telephone line capacity from 1,621,000 lines (1987/198) by 195,000 lines to 1,816,000 lines.

b) Expansion in the number of telephone subscriptions by 160,000 to 1,350,000.

c) Introduction of automatic dialing services in new service areas.

d) Expansion in the number of telex lines by 480 lines to 7,175 lines.

e) Additional expansion of Cairo-Alexandria coaxial cables along desert roads.

f) Completion of a Cairo-Aswan microwave network.

g) Completion of a Cairo-Jordan microwave link.

Table 2.9 Accomplishments in the First Year (1987/88) of the Second Five-Year Plan

Detail	1986/87	1987/88 Expected	Expected growth rate %	Target growth rate %
Telephone line capacity (x 1000)	1,453	1,621	11.6	6.9
Telephone lines in use (x 1000)	1,040	1,190	14.4	11.5
Telex lines in use (x 1000)	6,350	6,695	5.4	9.5

2.2.5 Present Status and Tasks of Telecommunications Services

(1) The number of main lines per 100 inhabitants

According to information available from ARENTO, Egypt has a population of 5,288,000 as of December 1988, with 1,200,648 telephone subscriptions, or 2.3 main lines per 100 inhabitants. In the implementation of the Second Five-Year plan, ARENTO expects to boost the number of telephone lines to 6.0 per 100 inhabitants by the year 2001/2002 when the fourth five-year program is scheduled for completion as a long-term goal. Figure 2.2 shows the correlation between the number of main lines per 100 inhabitants and GNP per capita in the world. Apparently, Egypt has a relatively low telephone density and should require continuous growth in its telecommunications as part of the infrastructure underlying the nation's economic activities. As of June 1988, 1256 public telephones are installed mainly in the city of Cairo.

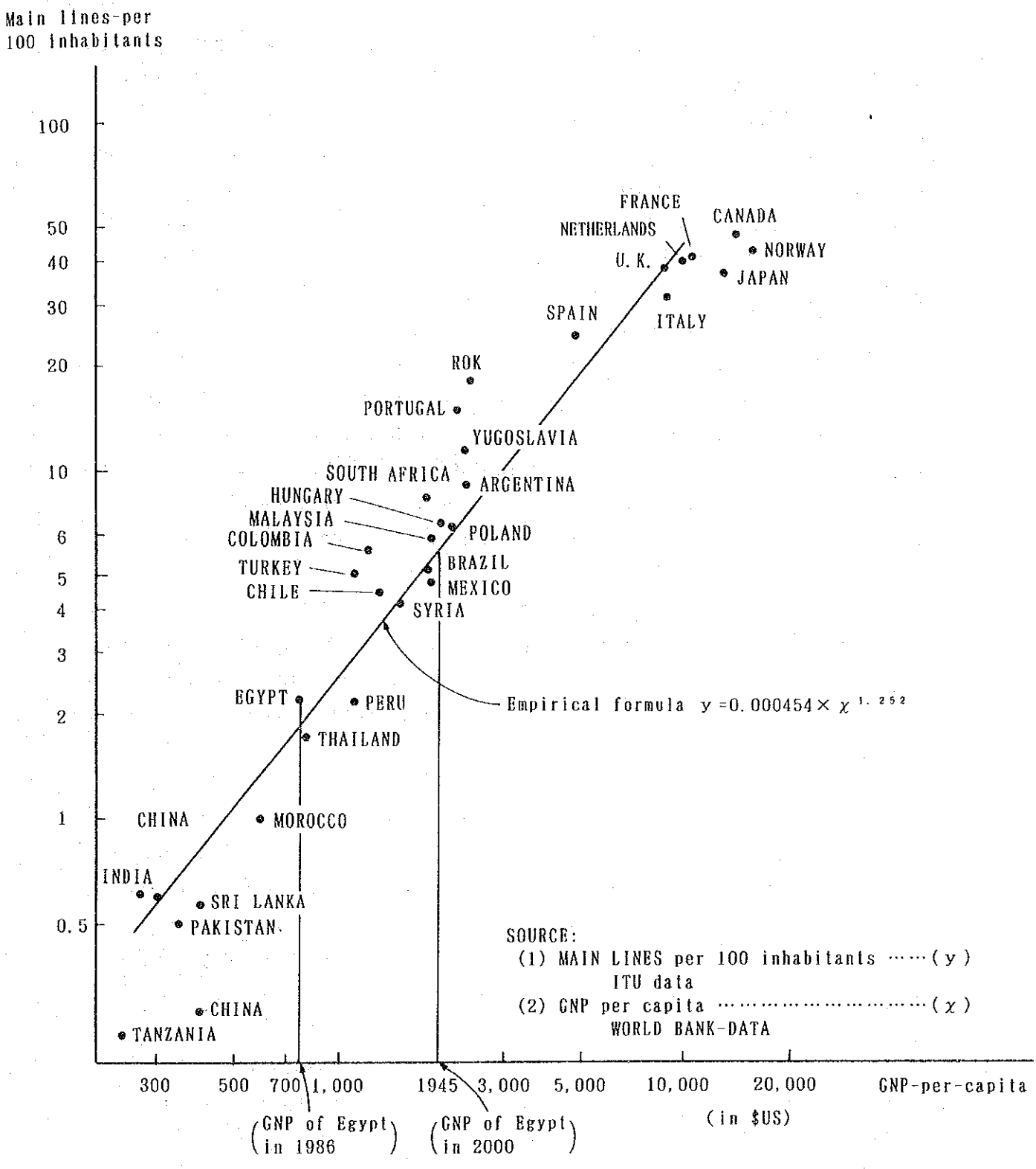


Fig. 2.2 Relation Between GNP per Capita and the Number of Main Lines per 100 Inhabitants in 1986

(2) Telephone networks

In June 1876, Egypt had a total of 2,384 telephone offices, with an exchange capacity of 1,455,000 lines. There are four office ranks in Egypt: district center (DC), zone center (ZC), group center (GC), and terminal exchange (TE). The toll telephone network is organized into three ranks. At present, there are five DCs - Cairo, Tanta, Alexandria, Ismailia, and Assiut - and 15 ZCs (excluding the same offices as the DCs). Figures 2.3 to 2.6 show the geographical distributions of DCs and ZCs; and trunk transmission lines in the country of Egypt. In the basic configuration of toll telephone networks as shown in Figure 2.7, no traversal direct lines are set from a terminal exchange, and all toll calls are connected by way of a GC. In the toll office ranks above GC, alternate switching from a traversal line group to a trunk line group is used. Charging is centralized at GCs and calculations for billing are processed at the Cairo center, though the telecommunications networks are still immature and many GCs may have their functions accommodated in a ZC.

The Cairo local telephone network is split into two local tandem areas, east and west. The east tandem area has tandem exchanges installed in the Abbassia office, the east tandem area, in the Ramsis office. Figure 2.8 shows the configuration of the tandem local telephone network in the city of Cairo.

Table 2.10 gives the number of telephone offices by exchange type. In exchange capacity terms, 93% of all the terminals have been automated. In terms of the number of telephone offices, 2,026 offices, or 85% of the total, still use manual exchanges, and automated exchange offices, including smaller offices using PABXs, account for only 15%, or 358 offices.

Figure 2.9 shows the distributions of exchange offices by scale (capacity). Each office has about 87,000 terminals on the average - a relatively small exchange configuration.

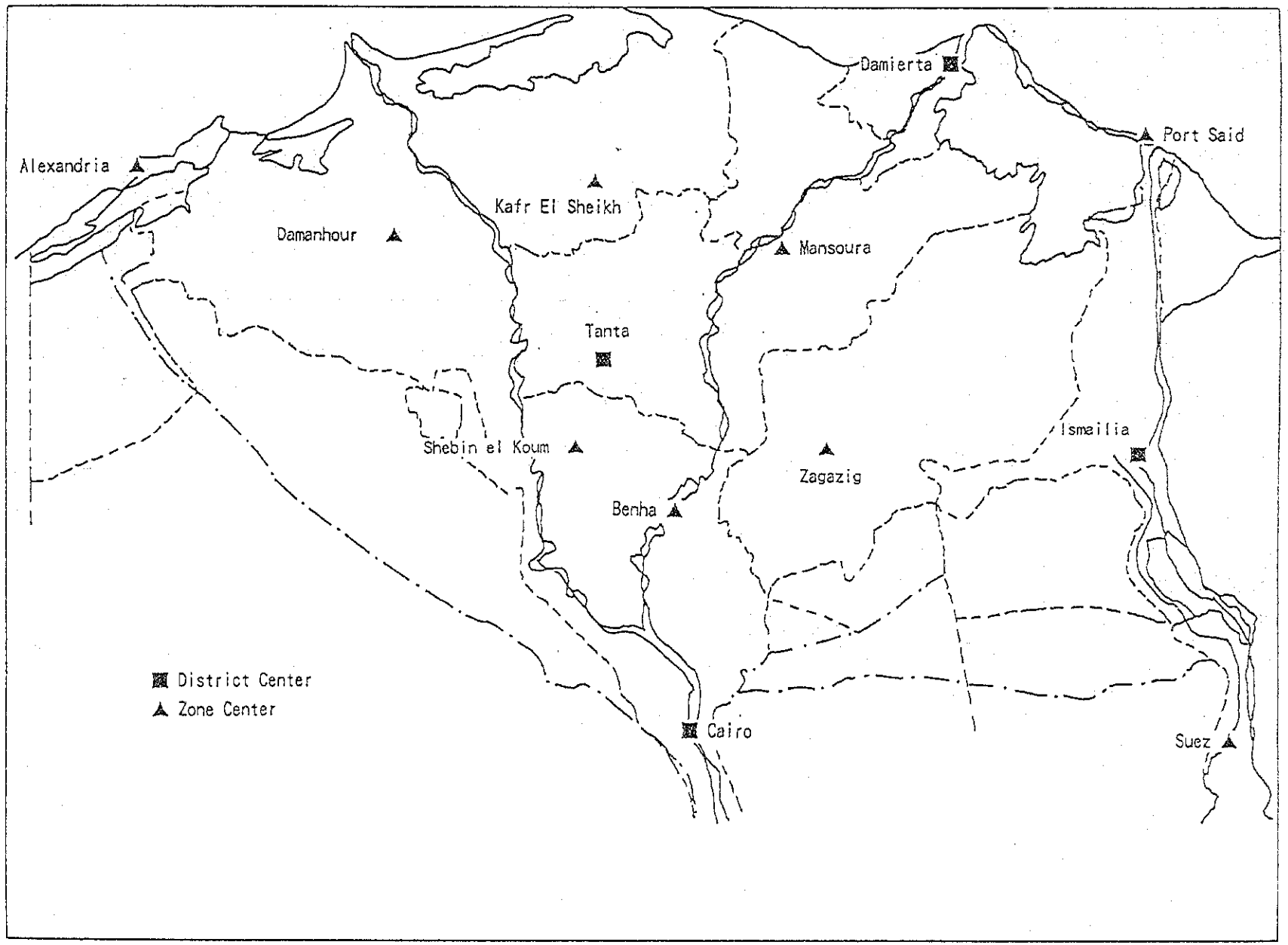


Fig. 2.3 Lower Egypt District and Zone Centers

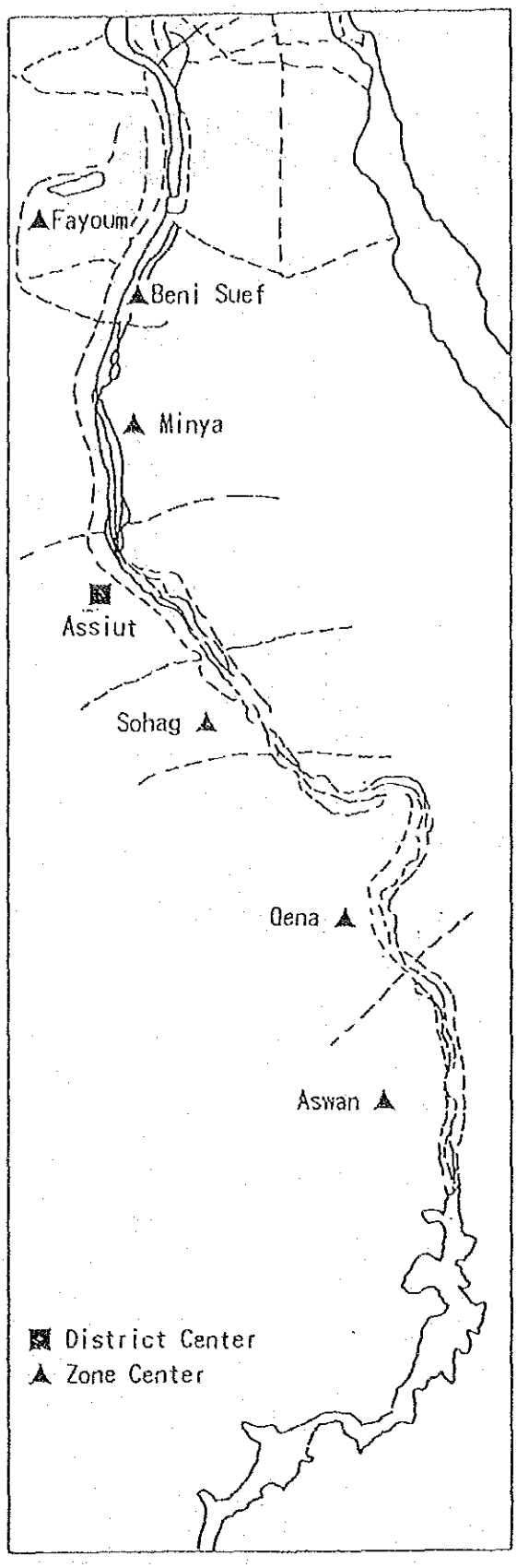


Fig. 2.4 Upper Egypt District and Zone Centers

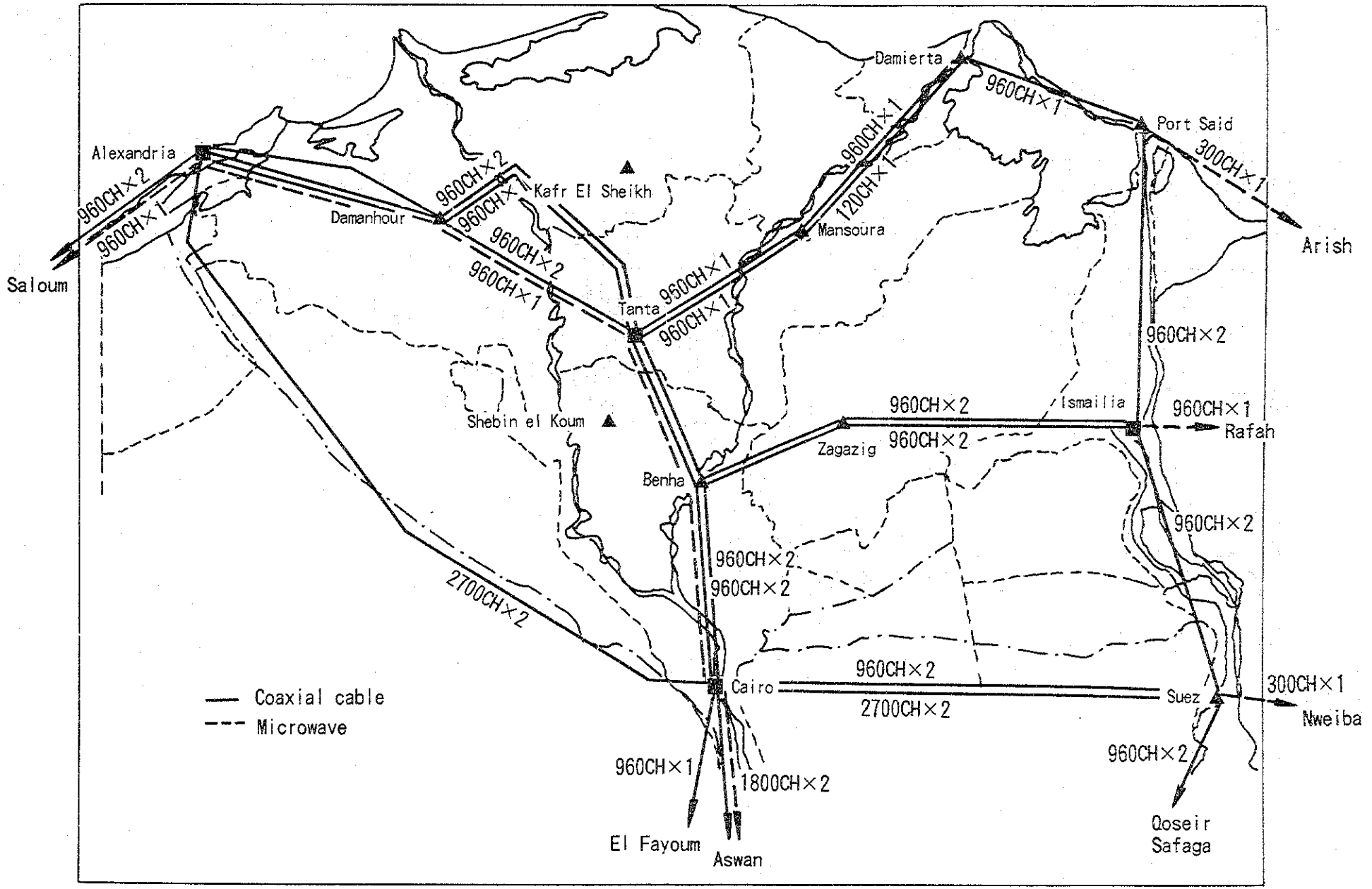


Fig. 2.5 Lower Egypt Trunk Transmission Lines

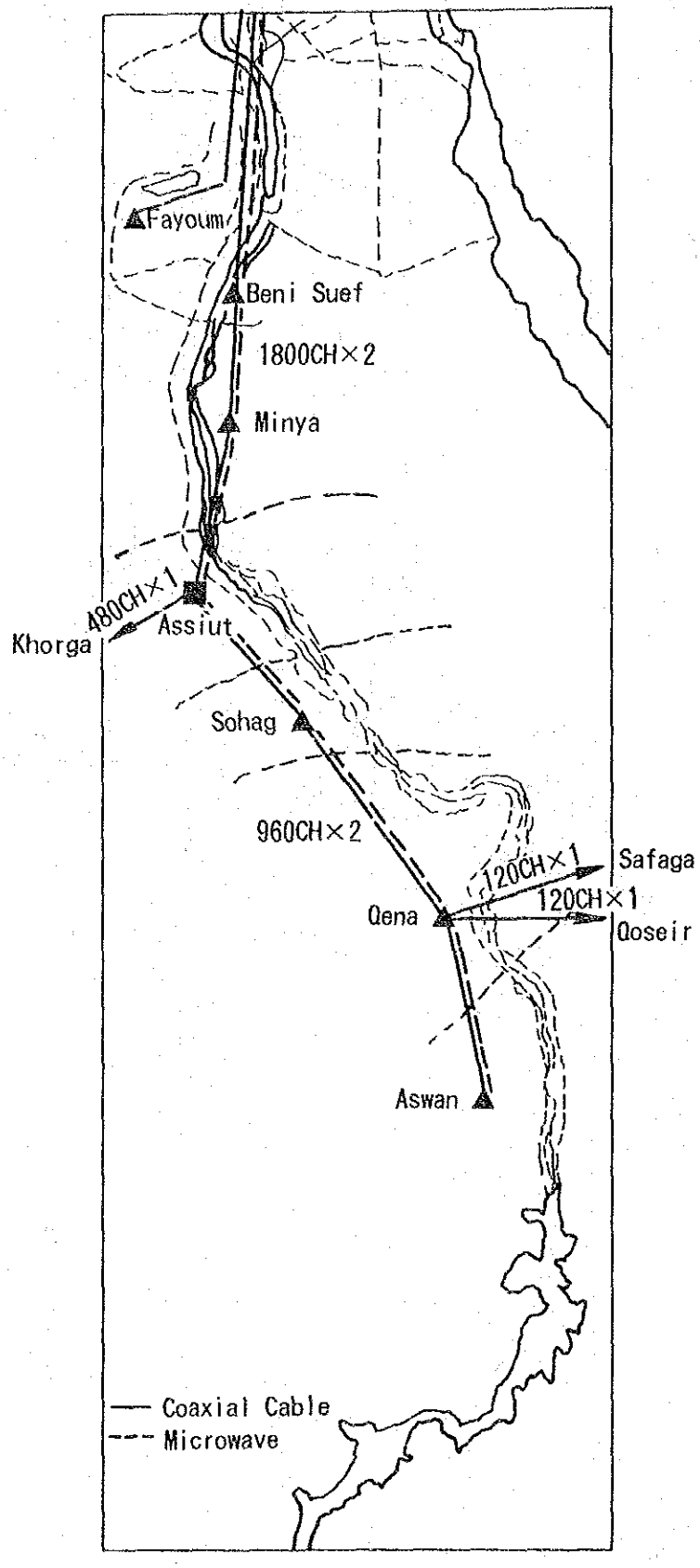


Fig. 2.6 Upper Egypt Trunk Transmission Lines

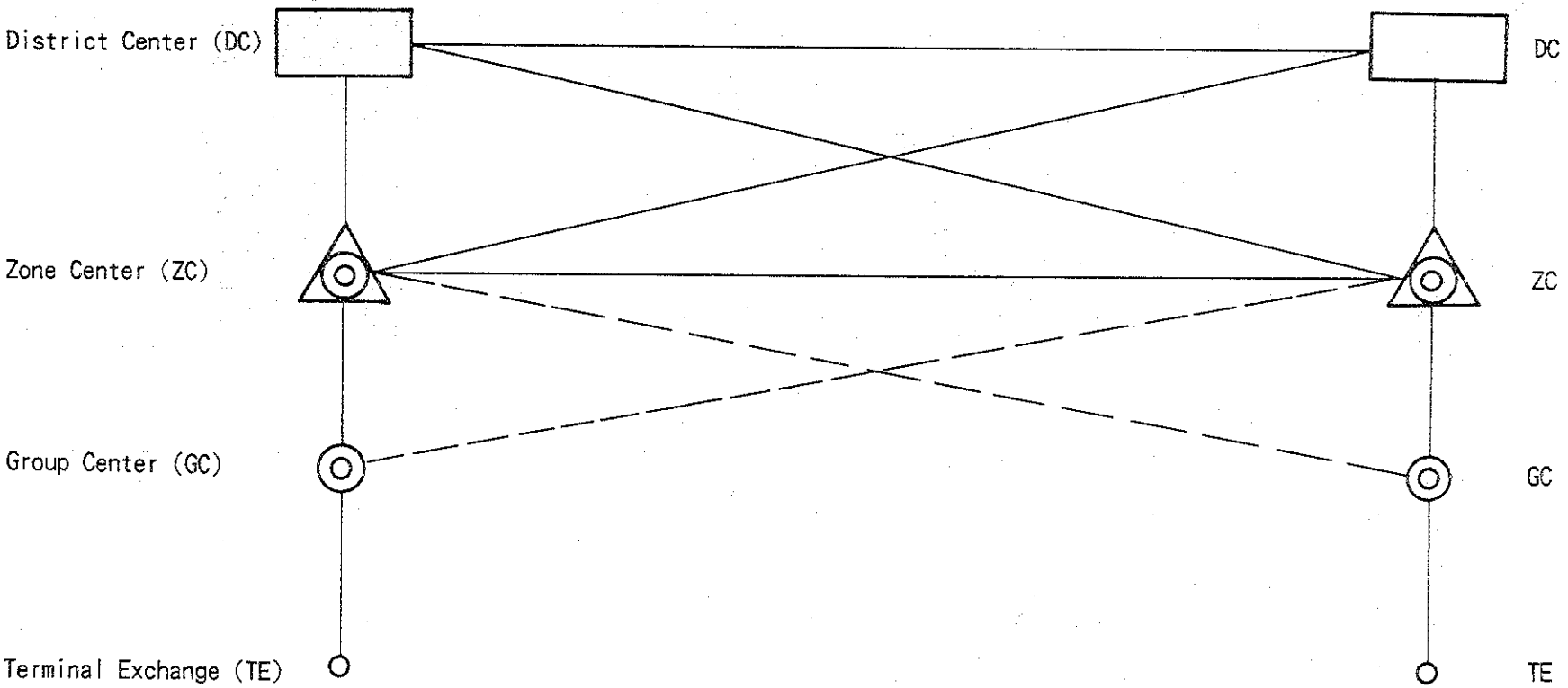
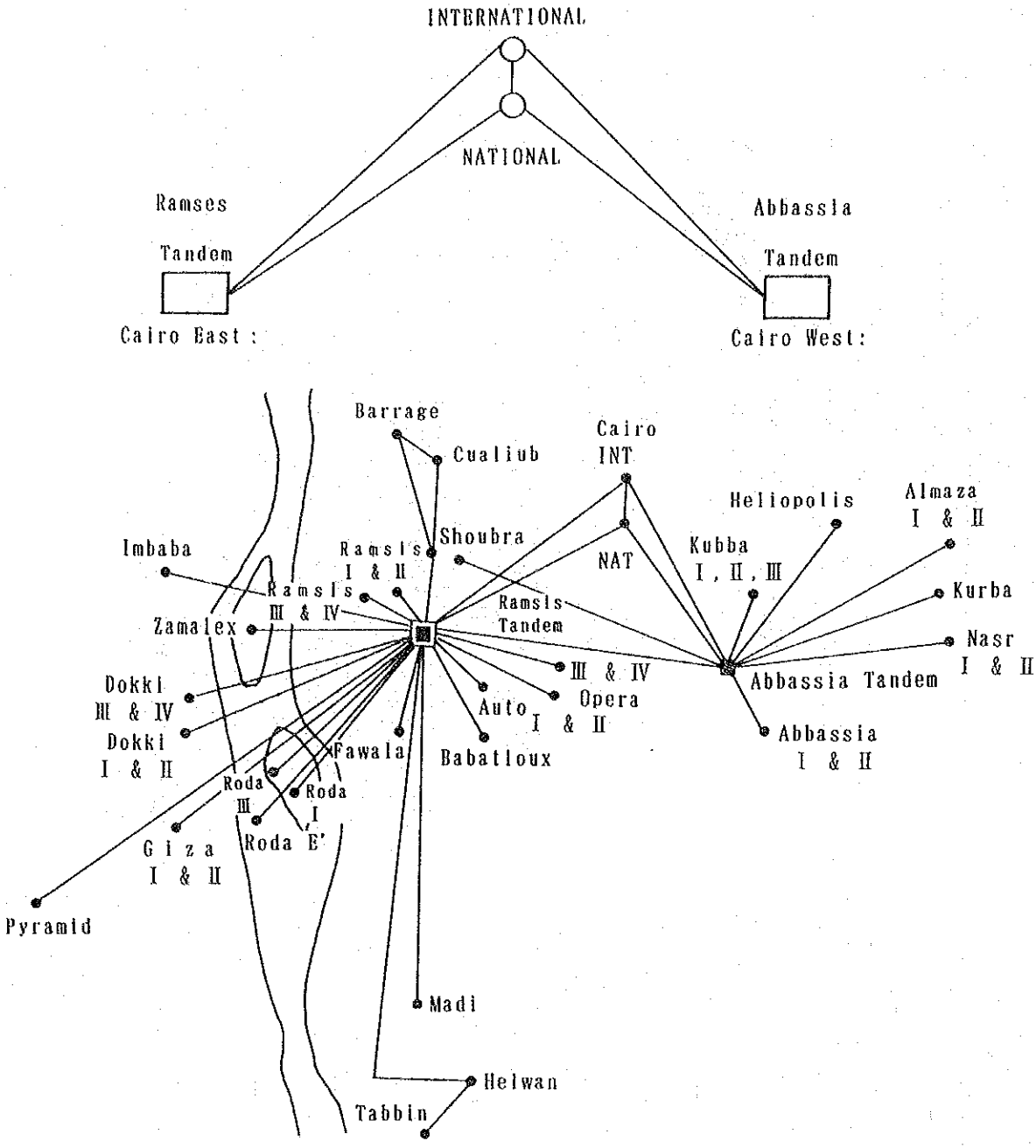


Fig. 2.7 Egyptian National Switching Hierarchy



Area Zone 1		Area Zone 2	
* Ramsis Zone	Capacity (lines)	* Abbassia Zone	Capacity (lines)
Ramsis Exchange	40,000	Abbassia Exchange	50,000
Shoudra Exchange	35,000	Heliopolis Exchange	65,000
Opera Exchange	40,000	Almaza Exchange	40,000
Fawala Exchange	40,000	Nasr Exchange	56,000
Bab El-Louk Exch.	25,000	Kurba Exchange	
* Giza Zone		Kubba Exchange	40,000
Giza Exchange	20,000		
Roda Exchange	40,000		
Dokki Exchange	40,000		
Imbaba Exchange	40,000		
Zamalek Exchange	30,000		
Pyramid Exchange	10,000		
Helwan Exchange	10,000		
Maadi Exchange	29,000		

Fig. 2.8 Cairo Tandem Zoning

Table 2.10 Number of Exchanges and Lines by Type of Switching system

Type of switching system		1982	1987	1988 (Estimated)
Manual exchanges	Exchanges	1602	2026	----
	Lines	65,558	105,165	131,805
Small PABX	Exchanges	96	212	
	Lines	40,770	81,320	
Electromagnetic exchanges	Exchanges	49	49	----
	Lines	394,048	507,000	554,000
Analog electronic exchanges	Exchanges	6	55	----
	Lines	19,000	649,000	700,000
Digital electronic exchanges	Exchanges	9	42	----
	Lines	21,000	113,210	176,710
Total	Exchanges	1,762	2,384	2,621
	Lines	540,676	1,434,695	1,562,515
Digitalization ratio	Exchanges	-	-	-
	Lines	4%	8%	12%

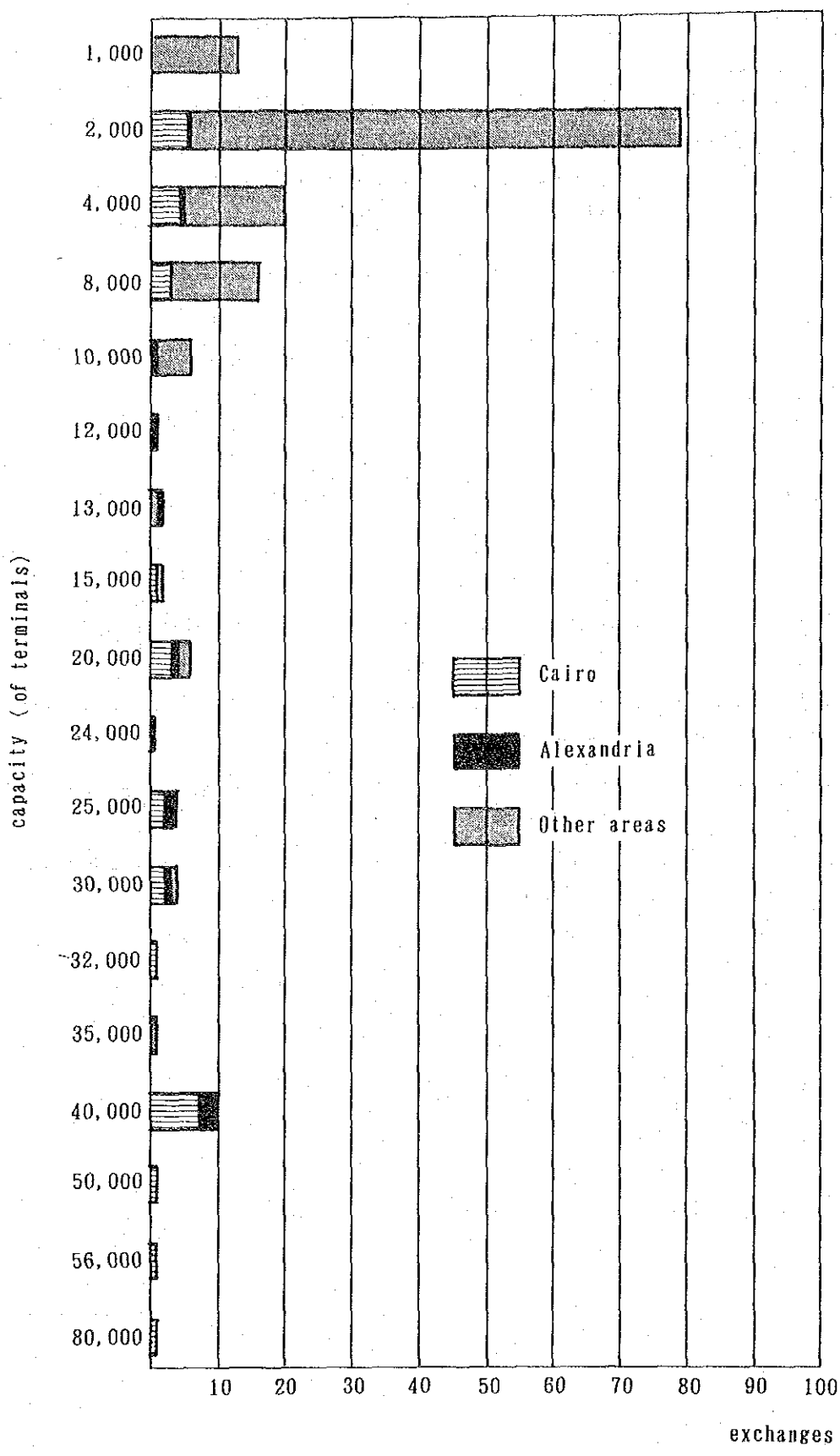


Fig. 2.9 Size (Capacity) Distribution of Exchanges

(3) Digitalization of telecommunications networks

Since the initial installation of E10A exchanges in the city of Alexandria in 1981, digital exchanges have penetrated major cities in Egypt. Their full-scale installation did not come until 1987. As summarized in Table 2.10, the ratio of digital exchanges is still as low as 12% in terminal terms. Since the local production of digital exchanges in Egypt has already been approved in the second five-year program, about 200 thousand terminals will be installed per year in the country of Egypt as standard exchanges when the local production is started, accelerating the tempo of exchange digitalization.

Egypt's primary transmission lines are presently analog, built of coaxial cable and microwave transmission systems. Among the nation's digital transmission are digital urban microwave systems based on a 24-channel North America hierarchy in the cities of Cairo and Alexandria, 2G digital microwave systems implemented in the Delta and Suez Canal zones, 30-channel PCM cable transmission systems based on a 30-channel CEPT system, implemented in the city of Cairo and rural cities, such as Tanta and Zagazig, a 24-channel North America PCM cable system, North American type, in the city of Cairo, local fiber-optic cables system installed for trunk lines in the cities of Cairo and Alexandria, a long-distance fiber-optic cable project in Zagazig, and so on. Though the construction of digital transmission channels has only begun and available digital channels have a limited scale, digital transmission lines are expected to grow in pace with the escalating introduction of digital exchanges as key transmission media of the future.

(4) New services and new technology

Cellular mobile telephone and packet switching services are among the new evolving services and technologies in Egypt. Coming into operation in 1987 first in the cities of Cairo and Alexandria and in the desert road between them, the cellular mobile telephone service was extended to Ismailia in 1988, with a schedule for further extension to the Suez Canal zone in 1989.

ARENTO has decided to construct data communication networks of packet exchanges as a result of its investigation into the possibility of computer utilization. The construction of packet switching networks has already been started. Packet switching services are scheduled to start in Cairo in May 1989 and in 1990 in Alexandria and the Suez Canal zone.

(5) Reality of computer utilization at ARENTO

Table 2-11 shows the state of affairs at ARENTO introducing computers and the corresponding applications. From today, applications subject to computerization are outside plant design, issue of telephone directories, traffic management, and long-distance toll network management. To promote computerization, training and education of software engineers is the most important theme prevailing in this field.

Table 2.11 Computer System in ARENTO

Applications	Computer	Year of introduction
Telephone directory service system	ACOS	1985
Local telephone billing system	VRX	1974
Telex and international telecom. billing system	PDP11 VAX	1981
Project management system	WANG VS80	1983
Payroll and personnel management system	WANG VS80	1987
Stores and purchase job system	WANG VS 80	1984
Service order system (Cairo)	WANG VS 80	1986
Traffic forecasting system	WANG VS 80	1988

(6) Service Quality

According to a research report compiled by ARENTO, trunk call loss probability in the city of Cairo is 2% to 30%. Since that probability is usually designed to set within 0.5% to 3%, the high percentage indicates that there may be lack of trunks and trunk failures, equipment failures in the switching system, lack of common equipment, and so on. Also, according to different research data, the overall call completing rate from a subscriber call origination to call termination to the called party at the most congested time period is 30%. In Japan, the local call completing rate is 70% on the average, so the value 30% is too low compared to that in Japan. The value includes cases where the called party's line is busy, and calling party's renunciation of dialing on the way. However, the causes for the low value may be other problems involved, such as no dial tone sending because of lack of registers, failures in subscriber lines and telephones, etc., in addition to failures on the line side.

According to the statistics by ARENTO, monthly trouble amounted to 1496 cases in the domestic communication network in Egypt in June 1988. In calculating trouble occurrence rate per 100 subscribers, the rate is approximately 0.12 case per month, which is almost the same in Japan. However, service quality cannot be discussed by simply comparing data between both countries because detailed statistical data on troubles have not been obtained and statistical counting methods on troubles, peculiarity in subscriber's trouble notification, maintenance technician's ability for trouble recognition (especially their recognition ability for troubles that often occur) are all different.

The non-recovery trouble rate that means they are not recovered within a day is one of criteria to evaluate maintenance service level. According to the data of ARENTO, this rate is approximately 34%, which is three times as high as the rate of 12% in Japan, indicating that measures to improve the maintenance service are necessary.

Since sufficient research data could not be obtained, it is difficult to conclude on the telecommunications service quality in Egypt based on detailed analysis results. However, judging from the experience that the study team had on the situation of telephone service in Egypt, the call completion rate seems to be 20% in the most busy period including cases where no dialing tone is sent or no tone is heard. Therefore, appropriate measures to improve the service quality are definitely necessary.

2.3 Objectives of Inauguration of National Telecommunication Institute and Background of the Request

2.3.1 Objectives of Inauguration of National Telecommunication Institute and its Services

In commencing the First Five-Year Plan for Socioeconomic Development, the Egyptian government issued a Presidential Decree of the Arab Republic of Egypt Concerning the Incorporation of the National Telecommunication Institute (Presidential Decree No. 193) in 1983 to dissolve the Telecommunication Research Center affiliated to ARENTO and inaugurate NTI as a research, training, and information service structure in the telecommunications fields so as to achieve drastic improvement in the nation's telecommunications facilities and services and upgrade the technical levels in the telecommunications fields.

The Presidential Decree prescribes the objectives of inauguration of National Telecommunication Institute (NTI) to prepare specialists in the field of Telecommunications who are University qualified and improve the scientific level of those working in the communication sectors and others working in any related sectors, and also to perform studies and researches, organize scientific and practical activities, and carry out training courses in these fields. In short, NTI aims at enhancing the nation's technical capabilities in the telecommunications fields and training telecommunications manpower.

NTI's services prescribed in the Presidential Decree are as follows:

a) To train senior telecommunications engineers in associated technical skills as telecommunications specialists.

b) To provide practical and scientific training for workers in the telecommunications and associated fields to support their work and deal with technical advances.

c) To conduct researches/surveys in the telecommunications fields to provide solutions and advice for the problems facing telecommunications agencies and associated entities.

d) To collect and analyze information, data, and literature concerning the telecommunications fields and compile them into a data bank, thereby functioning as a scientific or technical information center in the telecommunications fields.

e) To administer research, training, and cooperation jointly with associated agencies in the telecommunications fields, promoting above things and exchange with Arab and neighboring nations.

2.3.2 Organization and Administration of National Telecommunication Institute

Figure 2.10 shows the organizational chart of NTI. Supervised by the Director and the Deputy Director, NTI is organized into five technical departments - Switching and Traffic, Transmission, Network Planning, Computer & Systems, and Electronics - and one clerical department, that is, Administration Department.

The Management Board is the top executive organ in NTI, chairman of the Board being taken by the Minister of Transport, Communications and Maritime Transport. The 11-member Board comprises an advisor of the Ministry appointed by the Chairman, the Director of ARENTO, the Vice Minister for Education, representatives of the Academy Science and Technology, university professors, NTI executives, and others.

NTI is financed by the national budget and by revenues obtained through research/survey contracts. Its budgets and appropriations are subject to the approval of the Minister of Transport, Communications and Maritime Transport.

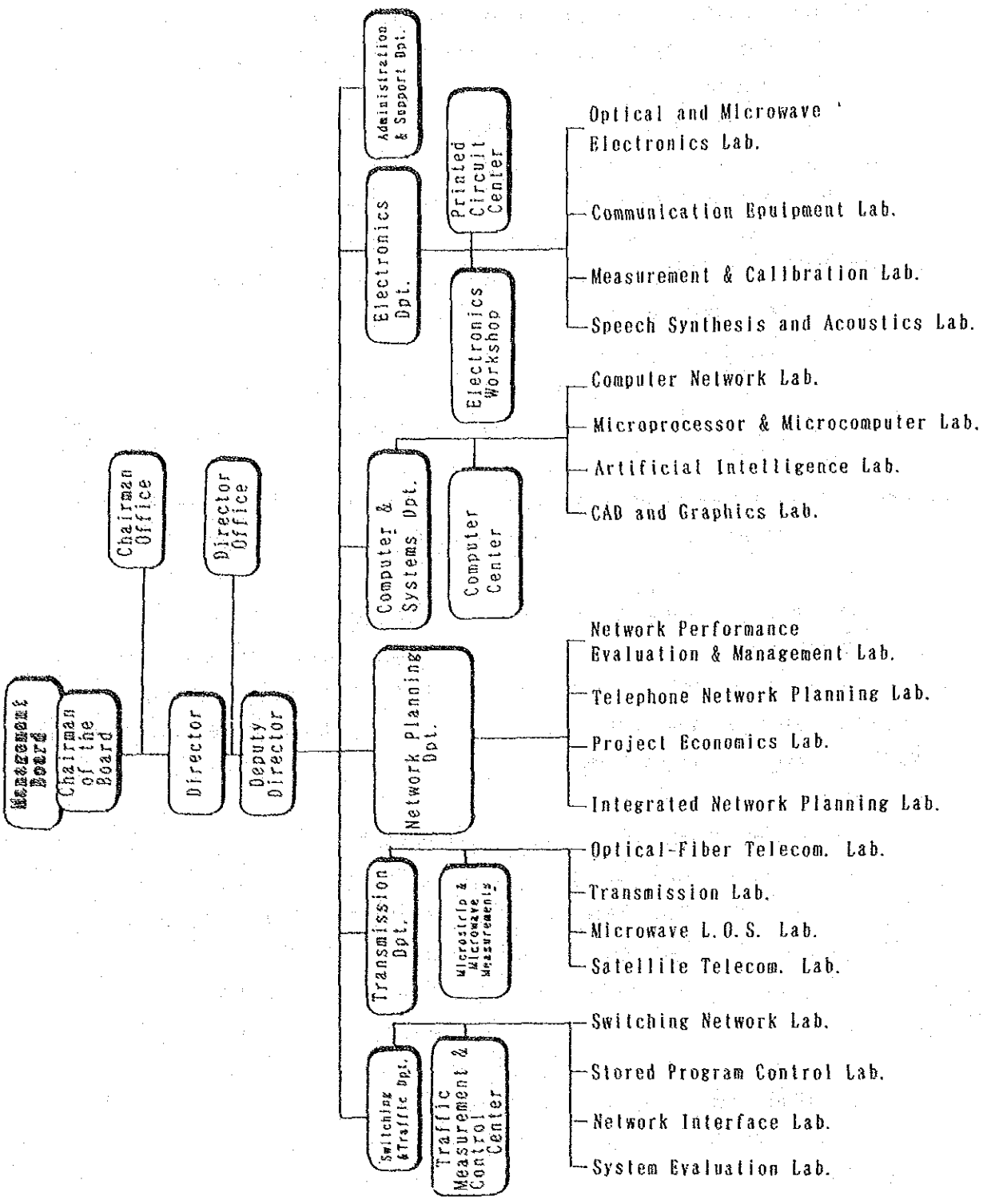


Fig. 2.10 NTI Organization

2.3.3 Present Status of National Telecommunication Institute Training and Technical Assistance Activities

The primary function of NTI is educating senior engineers to play leading roles in the expanding and increasingly modernized telecommunications fields. The second function is conducting researches/surveys jointly with associated telecommunications agencies and providing technical assistance or advice to solve problems facing the agencies.

(1) Training activities

Because a new NTI building is presently under construction, NTI is conducting training sessions in a former TRC building on the premises of the ARENTO training center. Full-scale training activities are to be started after the new building is completed and required training facilities are available. During fiscal 1987/1988 and fiscal 1988/1989, NTI conducted training courses in the Continuing Education Program, which it has implemented since its inauguration, and ARENTO Special Program. Starting out in 1984 with four courses and 106 trainees in the Continuing Education Program, the program received 198 trainees from Egypt's telecommunications agencies and the telecommunications sectors of various enterprises concerned in 16 of its 18 courses available in fiscal 1987/1988. Figure 2.11 shows the development in the number of trainees and that of courses conducted so far. Table 2.12 summarizes results of training for fiscal 1987/1988. The contents of each training course in Table 2.12 are described in the columns of training course in Annex 6 "NTI Training Courses and Necessary Equipment".

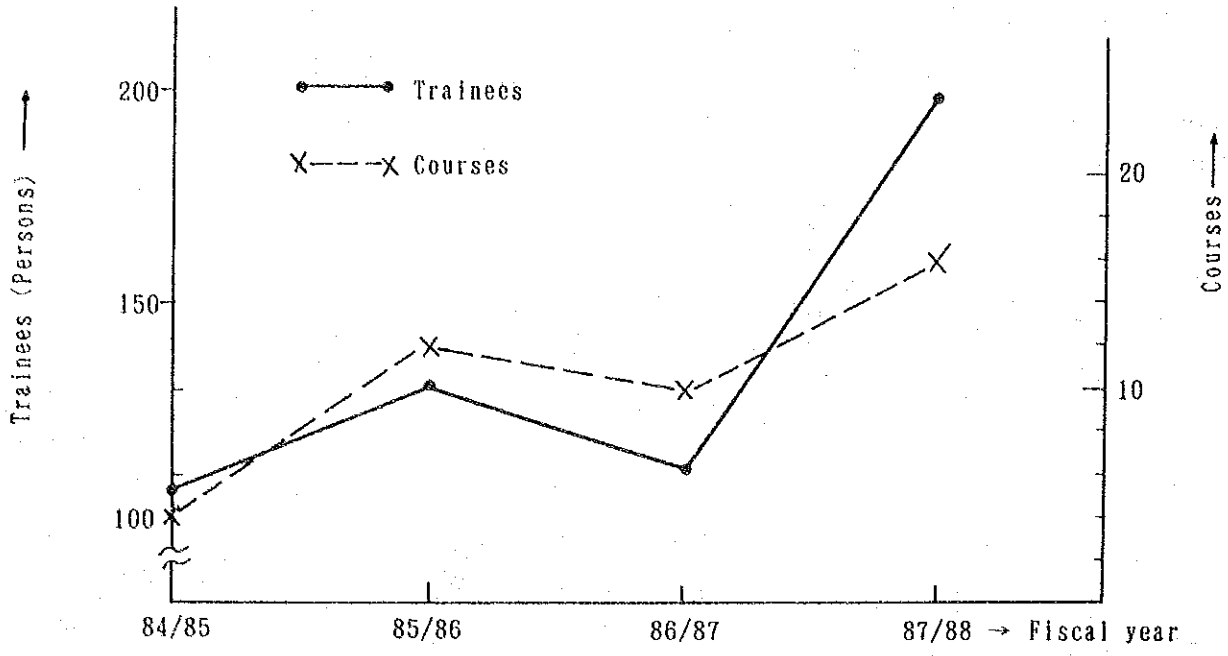


Fig. 2. 11 Transition of the Number of Courses Executed and Trainees

Table 2.12 Results of Continuing Education Program

Course name	Capacity			A	B	C	D	E	F	G	H	I	J	Total
	psn	crs	total											
(1) Digital electronics	20	1	20						2		1	1		4
(2) Digital signal processing	20	1	20		1	4			2	1				8
(3) Microprocessors and their applications	20	2	40	8		5			3		6	3		25
(4) Basic communications	20	1	20	4	1					2	2			9
(5) Digital communications	20	1	20	1					3	4				8
(6) Electronics measurement and instrumentation	20	1	20	1	2				2	3	1			9
(7) Measuring techniques in telecommunications	20	1	20	4	2	2						2		10
(8) Microwave engineering	20	1	20	5	1	1			1	3		1		12
(9) Data transmission (I)	20	1	20	1	2	2			2	2	1	1		11
(10) Data transmission (II)	20	1	20		1	2			2	2	2	1		10
(11) Satellite communication systems	20	1	20	1	3	3				1				8
(12) Electronic exchange (A)	20	2	40	12	5	7			1	3	4			32
(13) Electronic exchange (B)	20	2	40	13	5	3			1	1	2			25
(14) Analog LOS microwave communications	20	1	20	7	2	3			1	3				16
(15) Optical fiber communication systems (I)	20	1	20	1	2				2	2				7
(16) Optical fiber communication systems (II)	20	1	20	1					2	1				4
(17) Data base systems														
Total	320	19	380	59	27	32	0	0	24	28	19	9		198

psn : person crs: course
A : ARENTO
B : Governmental organization
C : Petroleum sector
D : Radio & TV Union
E : Egypt Electricity Authority
F : Presidency of Republic
G : Aviation sector
H : Industrial sector
I : Others
J : Foreign countries

(2) Technical assistance activities

NTI's research and technical support activities are conducted on request from associated agencies and jointly with these agencies. These activities fall into three categories: a) advice and researches/studies relating to the solution of technical problems that face ARENTO or other agencies having customer-owned-and-administered networks; b) technical consulting services relating to the implementation of new technological facilities/services or communication network plans; and c) researches/surveys in coordination and cooperation with colleges and universities.

1) Advice and researches/studies relating to the solution of technical problems

To aid in the solving of working problems facing ARENTO or other agencies, NTI performs trunk junction traffic simulations and circuit requirement predictions, evaluation of subscriber line characteristics for data communication in the city of Cairo, fading surveys in the ARENTO radio links and in micro wave links owned by pipeline companies, advisory service concerning the renewal of oil companies' telemeter equipment, and so on.

2) Technical consulting services

As technical consulting services relating to the implementation of new technological concepts or services or communication network plans, NTI accepts consultation from ARENTO and users on data communication by packet switching networks to be soon implemented.

3) Coordination and cooperation with colleges and universities

For researches/surveys in coordination and cooperation with colleges and universities, NTI has rendered its cooperation in the development of a prototype PABX in a Cairo University project or in a computer software Arabization project.

2.3.4 Request Background

As stated earlier, NTI came into existence in 1983 as Egypt's key training, research, and information center in the telecommunications fields in accordance with Presidential Decree No. 193, but its building and facilities are those taken over from TRC and are not adequate to train engineers in the latest telecommunications technologies and conduct technical assistance activities to full satisfaction.

In the meantime, the Egyptian government had embarked on drastic maintenance and modernization of its telecommunications facilities with major investment in the telecommunications fields in the first five-year socioeconomic development program.

The government has recognized in this background that the training of senior engineers will be urgently needed to provide the nation with sound telecommunications services by using quantitatively expanded and qualitatively upgraded telecommunications facilities. Out of this recognition, Egypt's Ministry of Transport, Communications and Maritime Transport has thought of the expansion of NTI as a top priority in the second five-year program and started constructing a building for NTI. And it is in this context that the Egyptian government has requested the Japanese government, a nation with advanced expertise in telecommunications technology, to provide the necessary materials and equipment to enable NTI to fulfill training sessions and technical assistance activities through Japanese grant aid.

Equipment and facilities requested by NTI are those which are used for training and technical consultation activities in the following six departments of NTI.

(1) Switching and Traffic Department
(2) Network Planning Department
(3) Transmission Department
(4) Electronics Department
(5) Computer and Systems Department
(6) Administration and Support Department

Equipment and facilities requested by NTI include those requested to the project formulation team in October 1988 and to this basic design team, and the equipment and facilities listed on "Study Report on the Expansion Project of the National Telecommunication Institute in the Arab Republic of Egypt" prepared by Egypt in June 1986 as well. The contents of the requested equipment and facilities are referred in Section 3.2.7.2 "Requested Equipment" in Chapter 3.

CHAPTER 3 CONTENTS OF THE PROJECT

CHAPTER 3 CONTENTS OF THE PROJECT

3.1 Objective of the Project

The objective of the Project is to expand the capability and functions of National Telecommunication Institute (NTI) in order to ensure NTI's executing the tasks assigned by Presidential Decree No. 193. One of the main tasks of NTI is to provide advanced post-graduate engineering education in the field of telecommunications to meet the great demand for highly qualified engineers in ARENTO, governmental organizations, public sectors and various private sectors. Other main tasks are to provide technical consultation and advice about the introduction of advanced telecommunication facilities and services, and to solve technical problems in maintenance and operation of telecommunication systems currently in use.

Using the new equipment and facilities acquired through the Project, NTI will contribute to the development of modern telecommunication services and establishment of technological fundamentals in the field of telecommunications in Egypt as well as to the development of telecommunications in neighboring countries through training provided for these countries and technical exchanges between them.

3.2 Outline of the Project

3.2.1 Implementation Organization

The Ministry of Transport, Communications and Maritime Transport is responsible for administrating the Project and the Project is implemented by NTI under the supervision of the Ministry.

3.2.2 Project Site

The project site is the new building located at 5, EL-Mokhayam El-Dayam Street, Nasr City area, Cairo city. The location map is attached in Figure 3.1 and Figure 3.2 shows the progress of the new building construction.

The main construction of the new building has been completed and the interior finish work is now in progress. The building construction fee is paid on a monthly basis according to the progress of construction during the month. The present paid amount at the end of March 1989, shows that 85% of the total work has been completed. Completion of building A and B where the equipment and facilities will be installed is expected by the end of August of this year and the hand over date of the entire building is scheduled for the end of 1989. The disbursement results in the past six months is shown in Table 3.1.

3.2.3 Budget Plan

As shown in Table 3.2, the total budget for the NTI project of the second five year plan (1987/88 to 91/92) is L.E. 7,355,000. Of this, L.E. 3,500,000 is allocated to building construction and L.E. 2,955,000 is allocated to NTI operation and administration. The operational budget for NTI is appropriated from the government's annual budget. The transition of the NTI operating budget in the last five years is shown in Table 3.3. The amount of budget is steadily increasing in accordance with the increase of the number of the staff. NTI will also receive some funds from ARENTO, MOTC, Academy of Science and Technology and others for the execution of researches and investigations on a commission basis, and have income from technical cooperation projects and training services. In order to use such funds for maintenance and repair of NTI equipment and facilities and for the purchase of spare parts, NTI is now negotiating with the Egyptian government.

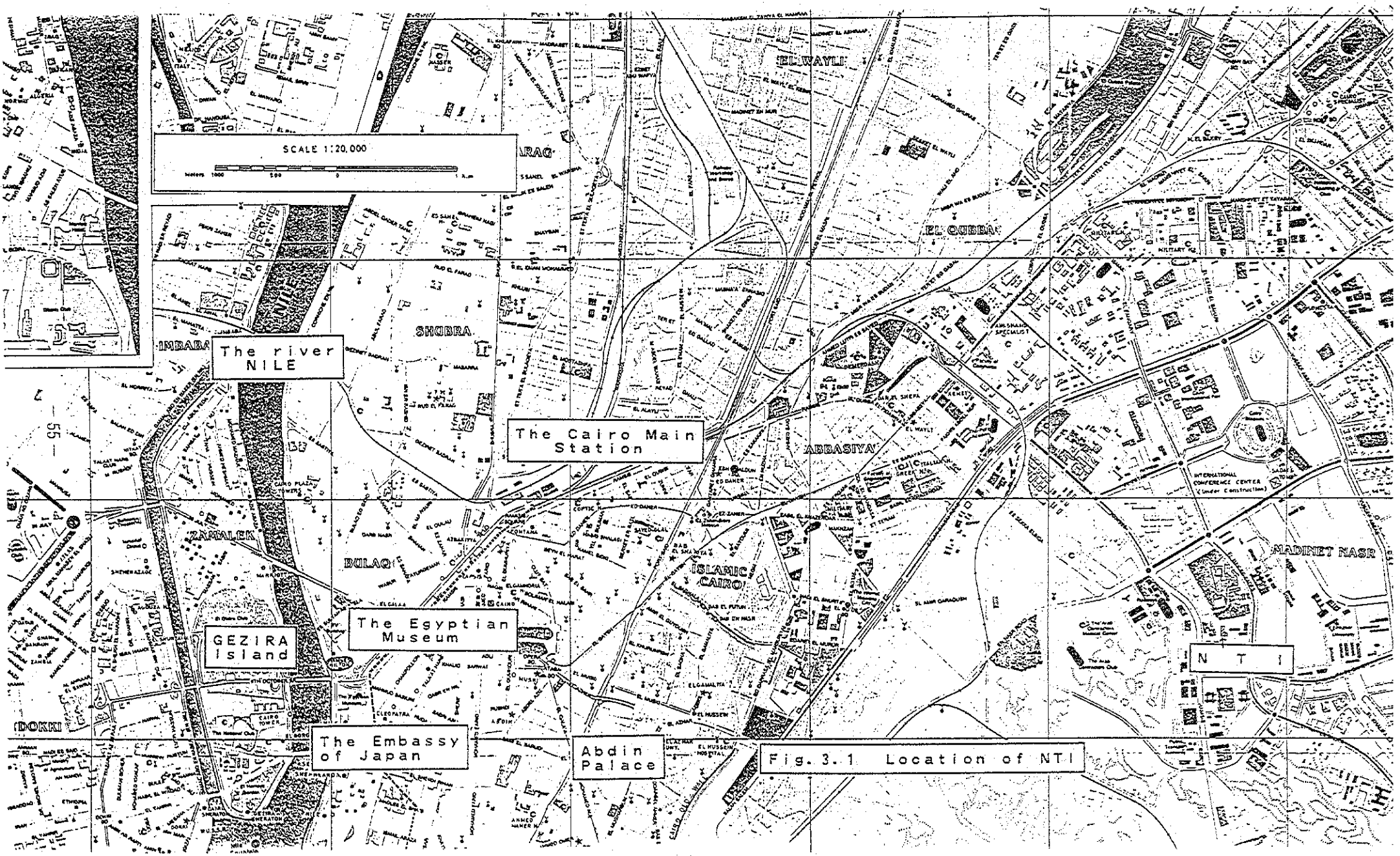


Fig. 3.1 Location of NTI

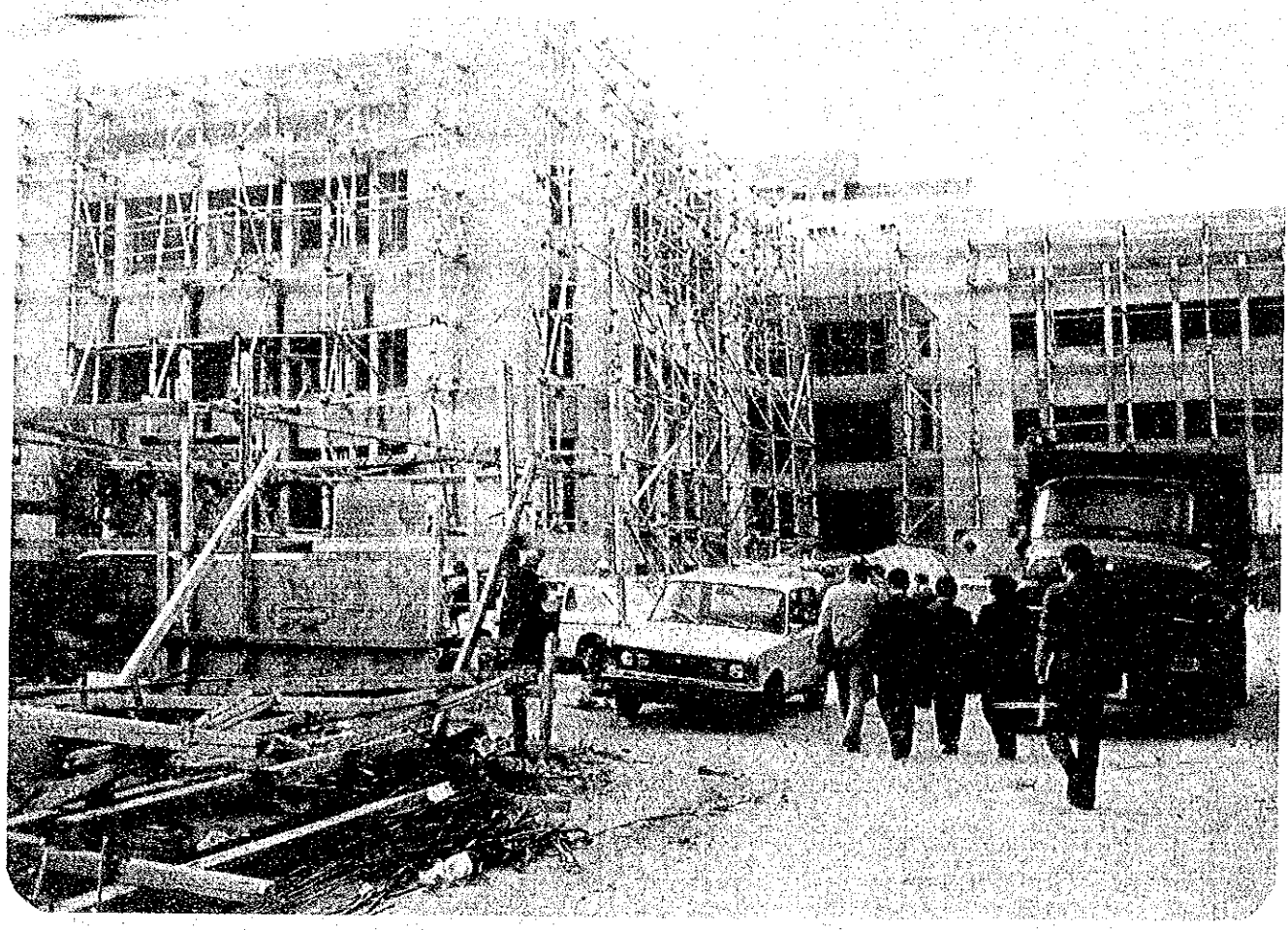


Fig. 3.2 NTI New Building Construction Site
(Feb. 1989)

Table 3.1 Disbursement Results of NTI Building Construction Cost

Month and Year	Monthly Payment	Accumulated Payment	Percentage of Payment
End of June 1988	--	1,598,978	44
October 1988	22,312	1,850,697	51
November 1988	358,111	2,208,803	61
December 1988	305,344	2,514,147	70
January 1989	199,688	2,713,835	75
February 1989	226,093	2,939,928	82
March 1989	125,403	3,065,331	85

Note: Total budget of building construction: L.E. 3,600,000.

Table 3.2 Budget for Investment in NTI Second Five-Year Plan (1987/88 - 1991/92)

(Unit: L.E. 1000)

Item	Amount
Building construction	3,500
Equipment	2,115
Wages	900
Researches/studies	500
Others	340
Total	7,355

Table 3.3 Transition of NTI Operating Budget

(Unit: L.E.)

Year	1985/86	1986/87	1987/88	1988/89	1989/90
Budget	193,074	211,034	263,501	323,509	(325,000)

Note: Requested amount for 1989/90.

3.2.4 Organization and Staffing Plan

The transition of the number of the NTI staff in the last five years is shown in Table 3.4. Presently, there are 51 NTI engineers who are in charge of training activities, technical consultation services and research activities including senior staff members. All staff members are graduate engineers, with 19 members holding advanced degrees: 11 Doctorates and 8 Masters. The training courses are conducted by NTI engineers and other lecturers recruited from universities and/or other institutes if training subjects require. Also, NTI has 20 technicians as assistants in experimental courses and keepers/operators of the facilities.

Table 3.4 Transition of the Number of the NTI Staff

Classification	1984/85	1985/86	1986/87	1987/88	Present (1988/89)
Training & Research staff	24	30	32	42	51
Experimental Assistant (technician)	16	18	22	18	20
Technical staff Subtotal	40	48	54	60	71
Other staff	67	70	78	77	85
Total	107	118	132	137	156

NTI plans to increase the engineering staff for expanding its training capacity in the fiscal year of 1991/92, when the equipment and facility expansion project shall be completed, in order to activate the training services and accomplish its mission. The staffing plan of NTI is shown in Table 3.5.

Table 3.5 NTI Staffing Plan

Year / Staff	Present (1988/89)	1989/90	1990/91	1991/92
Training & Research Staff	51	69	81	91
Experimental Assistant (Technician)	20	24	28	32
Total	71	93	109	123

3.2.5 Training Plan

3.2.5.1 Organization of Training Program

NTI will implement the following six training programs in this projeot.

1. Continuing Education Program
2. ARENTO Special Training Program
3. Telecommunication Diploma Course Program
4. Trainers Training Program for ARENTO training center
5. Training Program for new recruit engineers in ARENTO
6. Custom-made training package for organizations other than ARENTO

In addition to the above training programs, NTI holds seminars on current topics of telecommunication technology and services to provide knowledge for trainees and enhance their ability. Table 3.6 shows the themes of the seminars which have already been conducted. NTI plans to hold seminars for the trainees of the Telecommunications Diploma Course which will start in fiscal 1989/90. Subjects of the seminar in Telecommunications Diploma Course are listed in Table 3.7.

Table 3.6 Seminars Conducted in NTI

No.	Theme	Number of participants
(1)	Latest trends of telecommunications system	40 to 60 participants for each theme
(2)	Optical fiber communications system	
(3)	Optical integrated circuit	
(4)	Microcomputer network	
(5)	Voice signalization techniques	
(6)	Practical use of ISDN in France	
(7)	Satellite communications system	
(8)	Optical fiber measuring techniques	

Note: Participants are NTI trainees, ARENTO engineers and general engineers.

Table 3.7 Subjects of Telecommunication Seminar in Diploma Course (Examples)

No.	Theme
(1)	The Egyptian telecommunication network : present & future
(2)	Telecommunication economics and tariff system
(3)	The international telecommunication organization and its role
(4)	Value Added Network (VAN) services in ISDN
(5)	Future trends in Mobile Communications
(6)	The pathway to ISDN in Egypt
(7)	The telecommunication industry of Egypt
(8)	Modern trends in Satellite Communication System

3.2.5.2 Outline of Training Program

An outline of each training program is summarized in Table 3.8 regarding the course structure, objectives, trainees and duration and frequency of each program.

The details and objectives of each training course can be referred to in the tables of Annex 6 attached at the end of this report. Figure 3.3 shows the number of courses conducted by NTI and their future plans as well as the number of trainees of training courses in each program. As shown in the figure, NTI plans to accept more trainees in the present training courses and also to provide new courses following technological developments in the future. In order to implement the course expansion plan, NTI intends to increase the staffing capability both in its quality and quantity.

All training activities in NTI will be greatly expanded after 1991/92 when the training equipment and facilities should be completely finished. In the continuing education program, 11 new training courses on computer technology will be added to the present 19 courses. As a result of expansion, 1,380 trainees including foreign trainees are expected to attend this training program. In the ARENTO special training program, the capacity of both the telecommunication engineer course and the computer engineer course will be increased to 40 trainees from 20 at present. Telecommunications diploma courses are scheduled to begin in 1989/90. The diploma course on computer and communications technology will begin in 1990/91.

For international cooperation, NTI plans to accept trainees from neighboring countries to the courses in the continuing education program and the telecommunications diploma course program from 1991/92. NTI intends to increase the ratio of foreign trainees up to 50% of course capacity for each course.

Table 3.8 Outline of NTI Training Program

Item	Continuing Education Program	ARENTO Special Training Program	Telecom. Diploma Course Program
Starting Year	* 4 courses started in 1984 * Total 30 courses will be provided in 1991/92	* Started in 1987/88	* Telecom. courses : in 1989/90 * Computer courses : in 1990/91
Program Objectives	* To refresh & enhance technical and engineering knowledge of basic telecommunications & new advanced technology * Trainees who have completed courses are expected to be leading members of projects to resolve various technical problems and to introduce new technology in their home entities.	* To produce core engineers in telecommunication and computer technology qualified with integrated working knowledge of planning & designing, construction, maintenance & operation of modern telecommunication systems in ARENTO * Trainees are developed as telecommunication system engineers or computer systems engineers.	* To create highly qualified and specialized engineering staff in the field of switching system network planning, transmission system, telecommunication equipment and computer & communications. * Trainees succeeding in the courses are expected to be specialists qualified and skilled with theoretical & scientific knowledge and with hands-on experience.
Trainees	* Telecommunication and/or computer engineers dispatched from governmental, public and private entities across the nation and from neighboring countries.	* Telecommunication and/or computer engineers of ARENTO * Trainees are selected from ARENTO engineers and recommended by ARENTO executives.	* Telecommunication and/or computer engineers are recommended and dispatched from domestic entities at large. * Trainees are selected from the above candidates through examinations in NTI for pre-screening. * Engineers recommended by neighboring countries.

(continued)

Item	Continuing Education Program	ARENTO Special Training Program	Telecom. Diploma Course Program
Training Courses	30 courses will be conducted in 1991/92. (Telecommunications) 1. Digital electronics 2. Electronic measurement 3. Measuring techniques in telecommunications 4. Microprocessors and their application 5. Digital signal processing 6. Basic telecom. 7. Digital telecommunications 8. Electronic exchanges I 9. Electronic exchanges II 10. Microwave engineering 11. Analog line-of-sight (L.O.S.) microwave communication system 12. Digital L.O.S. microwave communication system 13. Satellite telecommunication system 14. Optical fiber communication system I 15. Optical fiber communication system II 16. Data communication I 17. Data communication II 18. Mobile communication system	This program consists of two courses: telecommunication engineer course and computer engineer course. 1. Telecommunication Engineer Course (1) Digital electronics (2) Microprocessor (3) Digital switching system (4) Analog/digital transmission (5) Optical fiber transmission (6) Microwave/satellite communication system 2. Computer Engineer Course (1) Computer organization (2) Assembly language (3) BASIC language (4) Operating system (5) Database system (6) Software engineering	Five courses will be provided 1. Switching system engineering 2. Transmission system engineering 3. Network planning and management 4. Communications systems equipment 5. Computer & communication enginnering

(continued)

Item	Continuing Education Program	ARENTO Special Training Program	Telecom. Diploma Course Program
Training Courses	(Computer technology) 19. Fundamentals of computer system 20. BASIC 21. PASCAL (fundamental) 22. PASCAL (advanced) 23. COBOL (fundamental) 24. COBOL (advanced) 25. FORTRAN (fundamental) 26. FORTRAN (advanced) 27. Operating system 28. Software engineering 29. Database system 30. Local area network		
Duration & Frequency	* 2 weeks (60 hrs) per course * 1 to 4 times per course per year	* 30 hrs. one year course for each program. * One year is divided into 3 periods. 3 months (13 weeks) per period. * 6 subjects per program. * 50 hrs./subject per year * Night course	* One year course or two year course is available * 600 hrs./course for one year course or two year course * 20 hrs./week, 30 weeks per course per one year or per two years.

(continued)

Item	Continuing Education Program	ARENTO Special Training Program	Telecom. Diploma Course Program
Course structure	* Lecture : 75% Demonstration & experimental laboratory work : 25% * In computer courses, 50% of total course hours are assigned to practice.	* Lecture : 65% Demonstration & experimental laboratory work : 35% * The grading of trainees is done on the basis of examinations at the end of every semester, a final examination, and the subject study report.	* Lecture : 70% Experimental laboratory work : 20% Research & study project : 10% * The individual study & research project is finalized by a report. * 20 hours/week per course consists of 6 hours for 3 common core courses and 14 hours for 6 specialized courses. * In specialized courses compulsory subjects and optional subjects are arranged.
Number of Trainees	* Capacity of trainees per course : 20	* Capacity of trainees per course : 20 * 40 trainees from 1991/92	* Capacity of trainees per course : 20

(Notes) 1. Regarding the objective of the following three training programs, see next page.

1) Trainers Training Program for ARENTO Training Center.
2) Training Program for New Recruit in ARENTO.
3) Custom-made Training Package for Organizations other than ARENTO.

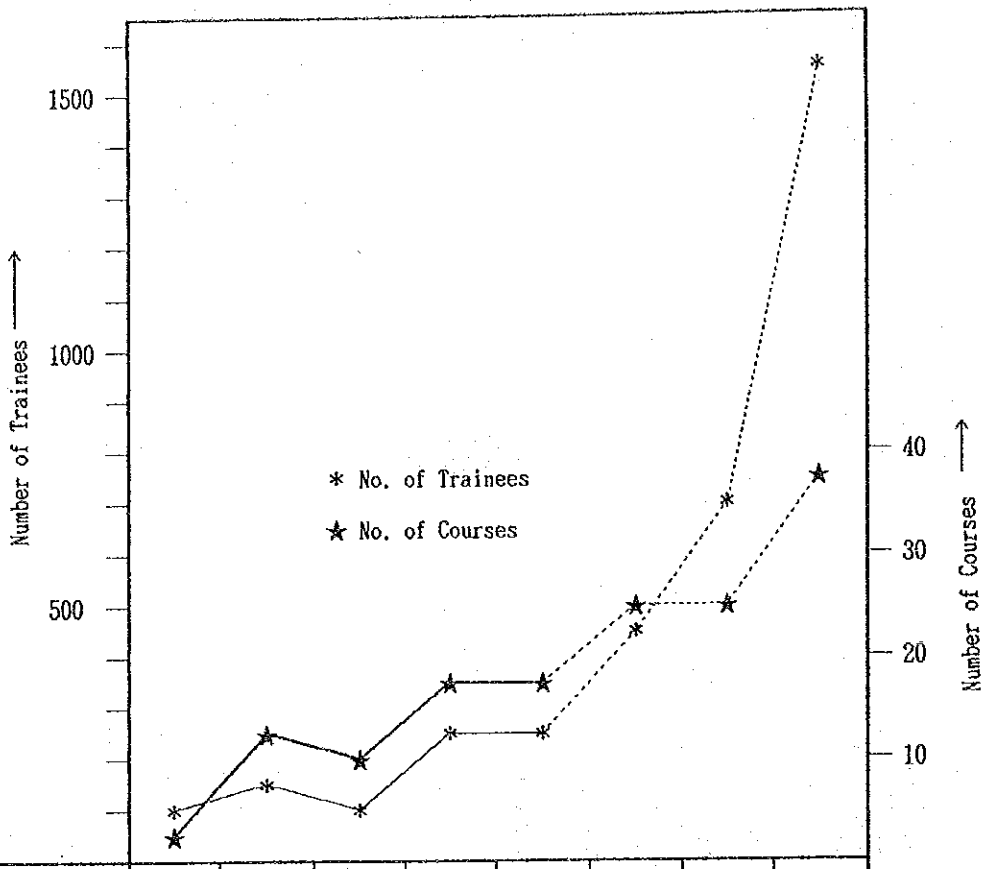
(Notes) 1. Trainers Training Program for ARENTO Training Center
This program aims to introduce and educate instructors of the ARENTO training center on new telecommunication technology and services introduced into the ARENTO network. NTI cooperates with them for organization of their new training facilities on those subjects.

2. Training Program for New Recruit Engineers in ARENTO

The objective of this program is to give these engineers with different backgrounds a basic knowledge of telecommunications and application of their technology in order to develop their job ability in the ARENTO telecommunication system.

3. Custom-made Training Package for Organizations other than ARENTO

This program provides special training packages for the engineers of organizations other than ARENTO. These program packages are prepared according to requests from those organizations in order to produce most effective training results.



Training Program \ Fiscal Year	84/85	85/86	86/87	87/88	88/89	89/90	90/91	91/92
Continuing Education Program	106 (4)	138 (12)	111 (10)	198 (16)	186 (16)	355 (19)	550 (19)	1380 (30)
ARENTO Special Training Program				40 (2)	40 (2)	40 (2)	40 (2)	80 (2)
Telecom. Diploma Course Program						80 (4)	100 (5)	100 (5)
Total	106 (4)	138 (12)	111 (10)	238 (18)	226 (18)	475 (25)	690 (26)	1560 (37)

Upper: No. of Trainees
Lower: No. of Courses

Fig. 3.3 Transition of Number of Trainees and Courses

3.2.5.3 Trainees by Sector

NTI has been accepting trainees in the Continuing Education Program courses from various sectors in the country: 198 trainees in 16 courses in fiscal 1987/88. Table 3.9 lists sectors and the number of trainees in fiscal 1984/85 to 1987/88.

Table 3.9 Sectors and Number of Trainees by Fiscal Year

(Unit: Person)

Sector	Fiscal Year 1984/85	1985/86	1986/87	1987/88
ARENTO	24	30	65	59
Governmental organization	8	19	8	27
Petroleum sector	30	29	20	32
Egypt Electric Authority	2	27	3	0
Presidency of Republic	7	7	5	24
Aviation sector	20	7	3	28
Industrial sector	14	11	4	19
Others	1	8	3	9
Total	106	138	111	198

Note: The Radio and TV Union is included in the governmental organization.

NTI will continue to accept trainees from various organizations to diffuse new technology and computer technology. NTI plans to accept 427 trainees from ARENTO and 755 from other organizations, that is, 36% from ARENTO and 64% from other organizations, for the fiscal year 1991/92.

Table 3.10 outlines the trainees acceptance plan by course for the fiscal year 1991/92, and Table 3.11 outlines sectors and the number of trainees planned.

Table 3.10 Continuing Education Program Trainees Acceptance Plan
(Fiscal 1991/1992)

Course name	Capacity			A	B	C	D	E	F	G	H	I	J	Total
	psn	crs	total											
(1) Digital electronics	20	2	40	12	6	5		2	1	2	5	1	6	40
(2) Digital signal processing	20	1	20	6	2	2			2		2	2	4	20
(3) Microprocessors and their applications	20	2	40	10	5	5		2	1	2	5		10	40
(4) Basic communications	20	2	40	12	5	5	2	2	1	2	5		6	40
(5) Digital communications	20	4	80	25	8	11	3	3	2	4	8		16	80
(6) Electronics measurement and instrumentation	20	1	20	5	2	2		1		1	2	1	6	20
(7) Measuring techniques in telecommunications	20	2	40	13	4	6	3	2	1	4	1		6	40
(8) Microwave engineering	20	2	40	12	5	5			5		5		8	40
(9) Data transmission (I)	20	2	40	10	5	4	2	1	1	1	4		12	40
(10) Data transmission (II)	20	2	40	11	5	5		1	1	1	5	3	8	40
(11) Satellite communication systems	20	2	40	12	5	5		1	2	1	4		10	40
(12) Electronic exchange (A)	20	4	80	23	11	10	1	3	2	3	10	1	16	80
(13) Electronic exchange (B)	20	4	80	23	11	10	1	3	2	3	10	1	16	80
(14) Analog LOS microwave communications	20	4	80	24	12	10	5	3	2	3	5		16	80
(15) Digital LOS microwave communications	20	4	80	26	11	10	1	3	2	3	7	1	16	80
(16) Optical fiber communication systems (I)	20	4	80	23	11	10	2	3	2	3	10		16	80
(17) Optical fiber communication systems (II)	20	2	40	10	5	4		2	1	2	4	2	10	40
(18) Mobile communication sytem	20	1	20	6	3	2		1		1	2	1	4	20
(19) Fundamentals of computer systems	20	2	40	14	8	5		2		2	5	4	0	40
(20) BASIC	20	2	40	14	8	5		2		2	5	4	0	40
(21) Pascal fundamental	20	2	40	14	8	5		2		2	5	4	0	40
(22) Pascal advanced	20	2	40	14	8	5		2		2	5	4	0	40
(23) Operating system	20	2	40	14	8	5		2		2	5	4	0	40
(24) COBOL fundamental	20	2	40	14	8	5		2		2	5	4	0	40
(25) COBOL advanced	20	2	40	14	8	5		2		2	5	4	0	40
(26) FORTRAN fundamental	20	2	40	14	8	5		2		2	5	4	0	40
(27) FORTRAN advanced	20	2	40	14	8	5		2		2	5	4	0	40
(28) Data base management system(local/distributed)	20	2	40	10	5	4		1		1	4	3	12	40
(29) Local area network	20	2	40	14	8	5		2		2	5	4	0	40
(30) Software engineering	20	2	40	14	8	5		2		2	5	4	0	40
Total	600	69	1,380	427	209	170	20	56	28	59	153	60	198	1,380

psn : person crs: course
A : ARENTO
B : Governmental organization
C : Petroleum sector
D : Radio & TV Union
E : Egypt Electricity Authority
F : Presidency of Republic
G : Aviation sector
H : Industrial sector
I : Others
J : Foreign countries

Table 3.11 Sectors and Number of Trainees Planned

(Unit: Person)

Sector	Fiscal Year 1991/92	Note
ARENTO	427	36 %
Governmental organization	209	18 %
Petroleum sector	170	14 %
Radio and TV Union	20	2 %
Egypt Electric Authority	56	5 %
Presidency of Republic	28	2 %
Aviation sector	59	5 %
Industrial sector	153	13 %
Others	60	5 %
Subtotal	1,182	100 %
Foreign countries	198	North Africa and Middle East
Total	1,380	---

3.2.5.4 Foreign Trainees Acceptance Plan

NTI plans to accept foreign trainees according to the Presidential Decree for promoting technical cooperation with neighboring countries. This will commence in the fiscal year 1991/92, by which time the training facilities will be ready.

NTI schedules that the objective countries are 11 neighboring Arab and African countries. NTI plans to accept around 20% of each course capacity for the time being, and increase this to around 50% as the future goal. Table 3.12 outlines the foreign trainees acceptance plan.

Table 3.12 Continuing Education Program Foreign Trainees Acceptance Plan
(Fiscal year 1991/1992)

(Unit : person)

Course name	Capacity			EGT	Foreigners												Total
	psn	crs	total		BH	IRQ	JO	KE	OM	QA	SAU	SO	SU	UAE	YAR	Total	
(1) Digital electronics	20	2	40	34				2 0		0 1			2 0		0 1	4 2	40
(2) Digital signal processing	20	1	20	16		0 2	0 1				0 1					0 4	20
(3) Microprocessors and their applications	20	2	40	30	0 2		0 2	2 0					2 0	0 2		4 6	40
(4) Basic communications	20	2	40	34				2 0				0 1	2 0		0 1	5 1	40
(5) Digital communications	20	4	80	64	2	0 2	0 2		0 2	0 2	0 4				0 2	0 16	80
(6) Electronics measurement and instrumentation	20	1	20	14				2 0		0 1			2 0		0 1	4 2	20
(7) Measuring techniques in telecommunications	20	2	40	34				2 0		0 1			2 0		0 1	4 2	40
(8) Microwave engineering	20	2	40	32		0 2	0 2				0 2				0 2	0 8	40
(9) Data transmission (I)	20	2	40	28	0 2	0 2	0 2				0 2			0 2	0 2	0 12	40
(10) Data transmission (II)	20	2	40	32	0 1	0 2	0 2				0 2			0 1		0 8	40
(11) Satellite communication systems	20	2	40	30	0 2			3 0					3 0		0 2	6 4	40
(12) Electronic exchange (A)	20	4	80	64		0 4	0 2	2 0	0 1	0 1	0 4		2 0			4 12	80
(13) Electronic exchange (B)	20	4	80	64		0 4	0 2	2 0	0 2	0 2	0 2		2 0			4 12	80
(14) Analog LOS microwave communications	20	4	80	64		0 2	0 2	2 0	0 2		0 2		2 0	0 2	0 2	4 12	80
(15) Digital LOS microwave communications		4	80	64		0 2	0 2	2 0	0 2		0 2		2 0	0 2	0 2	4 12	80
(16) Optical fiber communication systems (I)	20	4	80	64		0 4	0 2	2 0	0 2		0 6					2 14	80
(17) Optical fiber communication systems (II)	20	2	40	30		0 4	0 2				0 4					0 10	40
(18) Data base systems	20	2	40	28	0 2		0 2		0 2		0 2		0 2	0 2		0 12	40
(19) Mobile communication	20	1	20	16			0 2				0 2					0 4	20
(Expence A)					0	0	0	23	0	0	0	1	21	0	0	45	
(Expence B)					11	30	27	0	13	8	35	0	2	11	16	153	
Subtotal	380	47	940	742	11	30	27	23	13	8	35	1	23	11	16	198	940
Others	220	22	440	440	0	0	0	0	0	0	0	0	0	0	0	0	440
Total	600	69	1,380	1,182	11	30	27	23	13	8	35	1	23	11	16	198	1,380

Note: As to each column for foreigners, the upper part and Expense A stand for the number of trainees under Egyptian source of expense, and the lower part and B stands for other expenses.

Country name
EGP: Arab Republic of Egypt
BH : Baharain
UAE: United Arab Emirates
YAR: Yemen Arab Republic
KE : Kenya
SO : Somalia
IRQ: Iraq
JO : Jordan
SU : Sudan
OM : Oman
QA : Qatar
SAU : Saudi Arabia

3.2.6 Technical Consultation and Research Plan

Like its training activities, technical consultation and research are NTI's most important activities. The objective organizations of NTI's technical consultation include ARENTO, which is the public telecommunications carrier of the country, the Science and Technology Academy (STA), academic research organizations of universities, private telecommunications network owners, governmental organizations, and private companies.

NTI has close relationships with the Ministry of Transport, Communications and Maritime Transport (MOTC), ARENTO, and STA. Discussions are held on cooperation themes and budget measures, and NTI offers technical cooperation. Table 3.13 lists the technical consultation, technical cooperation, and independent research items. The results of independent research are reflected to ARENTO and other telecommunications organizations, and in the training methodology and contents as well.

Table 3.13 Technical Consultation, Technical Cooperation, and Independent Research Items

Item	Counter organization	Note
Switching and Traffic Department		
(1) Telephone traffic management and control	Cairo University	Methodology
(2) Design of digital switching system prototype	-----	
(3) Design and implementation of a 24/30 Channel transmultiplexer	-----	
(4) Development of card testing systems for switching electronics circuits	STA	

Item		Counter organization	Note
Network Planning Department			
(1)	Study of line impairment in Egyptian telecommunications network and its effect on data traffic	ARENTO	ARENTO budget, measuring of circuit performance & evaluation, 2 years
(2)	Study of optimum system configuration of Pan Arab-African telephone network	ARENTO	
(3)	Research on optimum packet switching network architecture in Egypt	-----	
(4)	Planning and design of practical telephone network in Egypt	-----	
(5)	Evaluation of efficiency and quality of data communication network, and development of evaluation methodology	-----	
(6)	Analysis and research on protocol for various telecommunication systems	-----	
(7)	Research on evaluation methodology of transmission quality and study of optimum loss allocation	-----	
(8)	Research on network degitalization and integration of data communication network and telephone network	-----	
(9)	Designing and establishing database system of telecommunications network	-----	

Item	Counter organization	Note
Transmission Department		
(1) Characterization of multipath fading on L.O.S. microwave links	ARENTO, STA Radio & TV Union	one year 1984-1989 (5 years)
(2) Statistical analysis of selective fading incidence in Egypt and study of its effect on digital microwave links	ARENTO	
(3) Performance analysis of the optical fiber communication network and study of the effect of environmental conditions on it and determination of the optimum procedure for increasing its capacity	ARENTO	1988 - 1990
(4) Interference analysis and development of software for frequency management in the microwave band	ARENTO, STA, RADIO & TV Union	3+2 years
(5) Development of computer assisted software for the design and evaluation of L.O.S. microwave links	-----	
(6) Assessment of the performance of different types of multimode and single mode optical fiber connectors	-----	

Item	Counter organization	Note
Electronics Department		
(1) Study on detection of low level digital signals in noisy environments	-----	
(2) Microprocessor controlled time switching systems	-----	
(3) Microprocessor-based data acquisition system	-----	
(4) Design and implementation of a 24/30 channel transmultiplexer with microprocessor	-----	
Computer and Systems Department		
(1) Development of data base management system of Transmission Department	ARENTO	
(2) Development of telephone subscriber management system (Alexandria)	ARENTO	
(3) Development of an information center system in the field of telecommunication.	-----	
(4) Computerization of administrative and financial work in NTI	-----	Personnel, wages, materials management
(5) Computerization of various business in the Ministry of Communications	MOTC	Personnel, 5-year plan, data base for ARENTO telecommunication network, NTI training, research activity, etc.

3.2.7 Facility Plan

3.2.7.1 Building Construction

The new NTI building is being constructed at a 4,500 m^2 site on the premises of the ARENTO Training Center at Nasr City area, Cairo City. It is a 3-story ferroconcrete building with one basement floor. The total floor space will be around 6,000 m^2.

The construction budget for the building, including power and air-conditioning equipment, is L.E. 5,955,000 under the Second Five Year Plan for Socioeconomic Development. The construction, which began in November 1986, is being undertaken by a local contractor, SOTAIR Co., and is progressing smoothly. The building is scheduled to be turned over to NTI by the end of 1989.

The building consists of four parts: Building A and B, for laboratory and training use; Building C for use as a library and a conference hall; and Building D for the managerial use and for use as an information center. A parking lot, utilities, and workshops will be included on the basement floor. Figure 3.4 shows the general ground plan for the building and Figures 3.5 to 3.10 show the floor layout plan of each building.

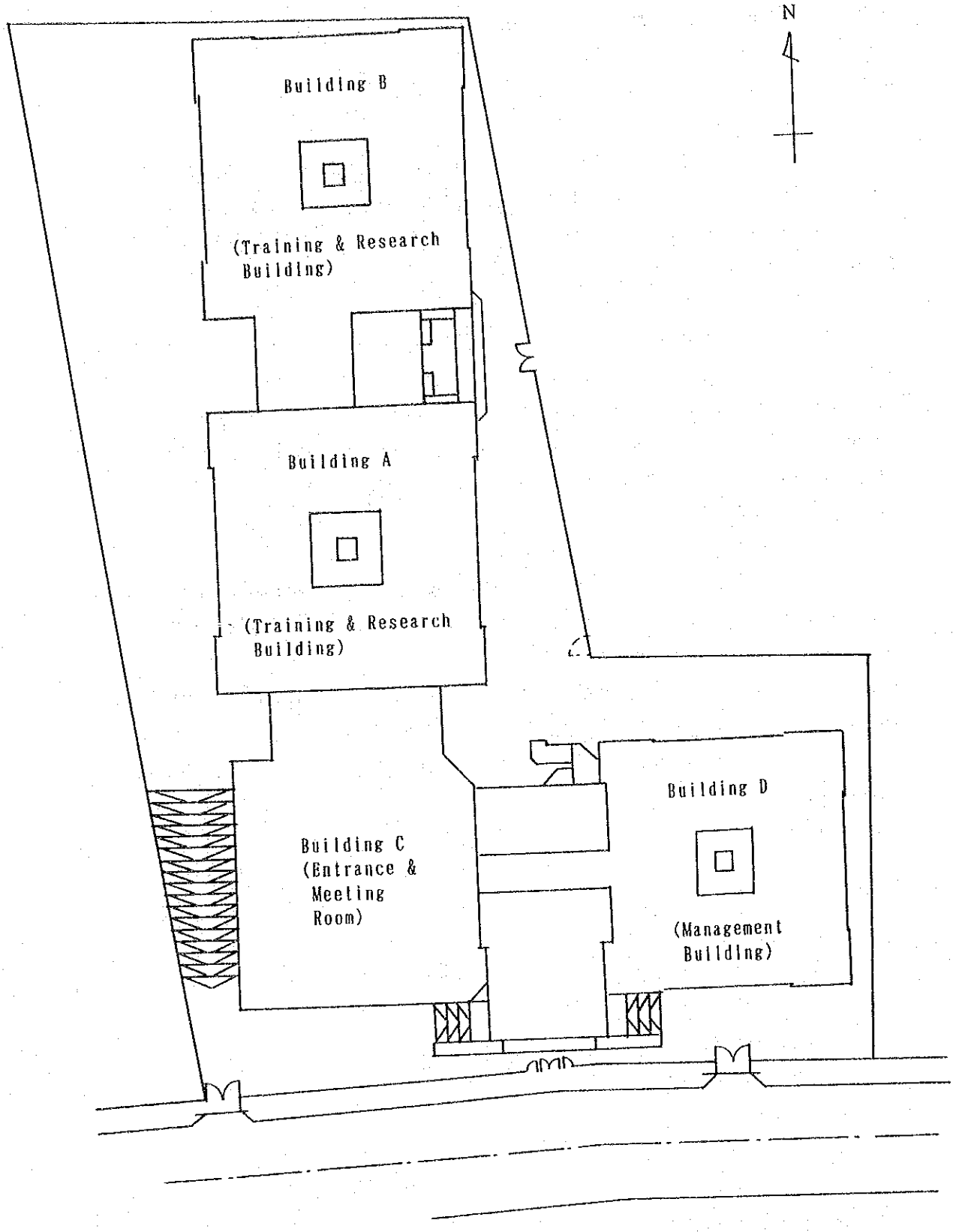


Fig. 3.4 Ground Plan of NTI's New Building

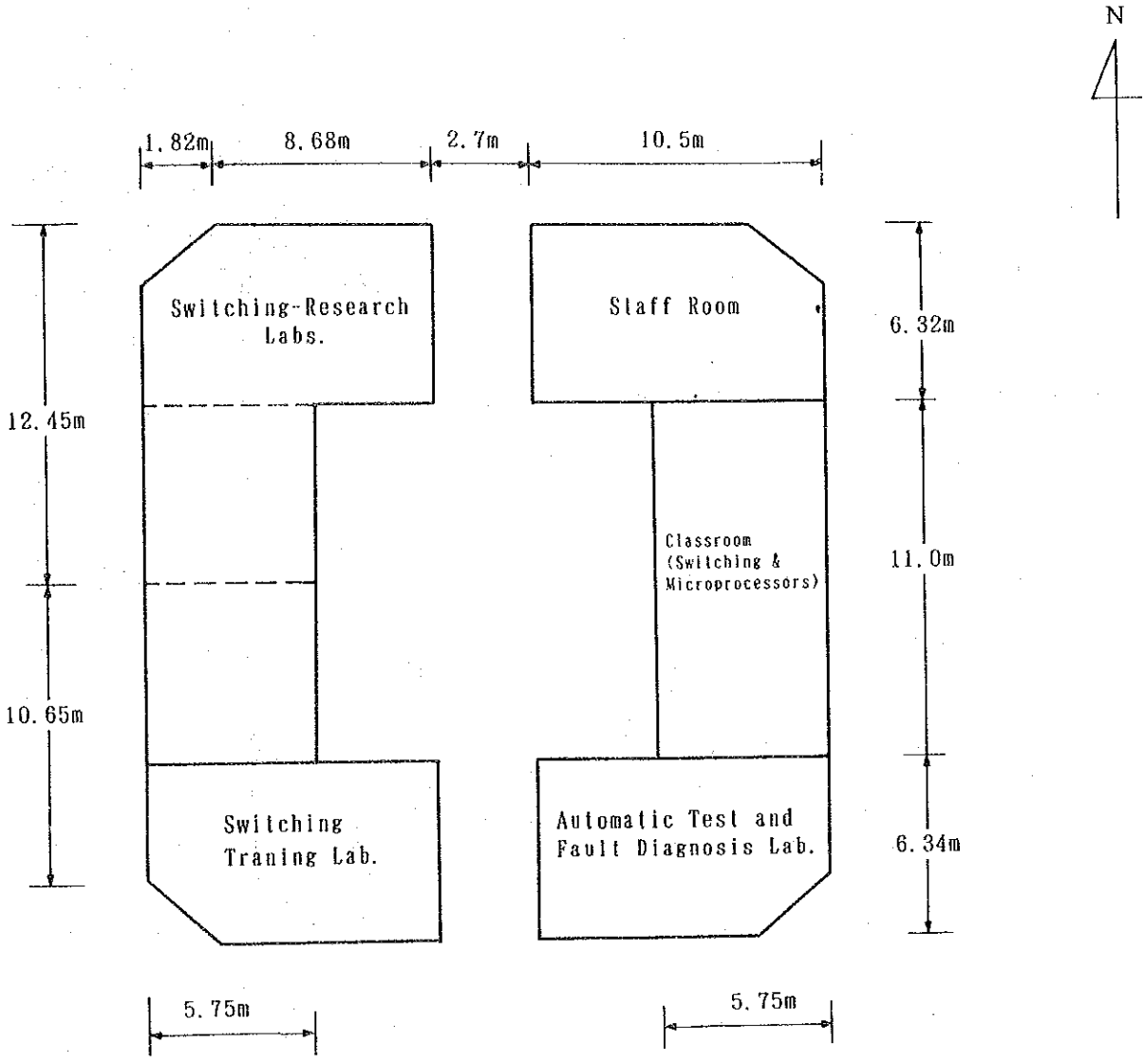
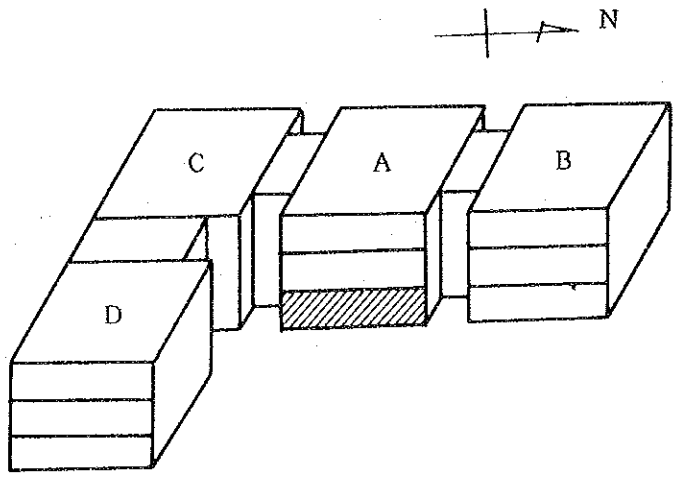


Fig. 3.5 Ground Floor Layout Plan (Building A)



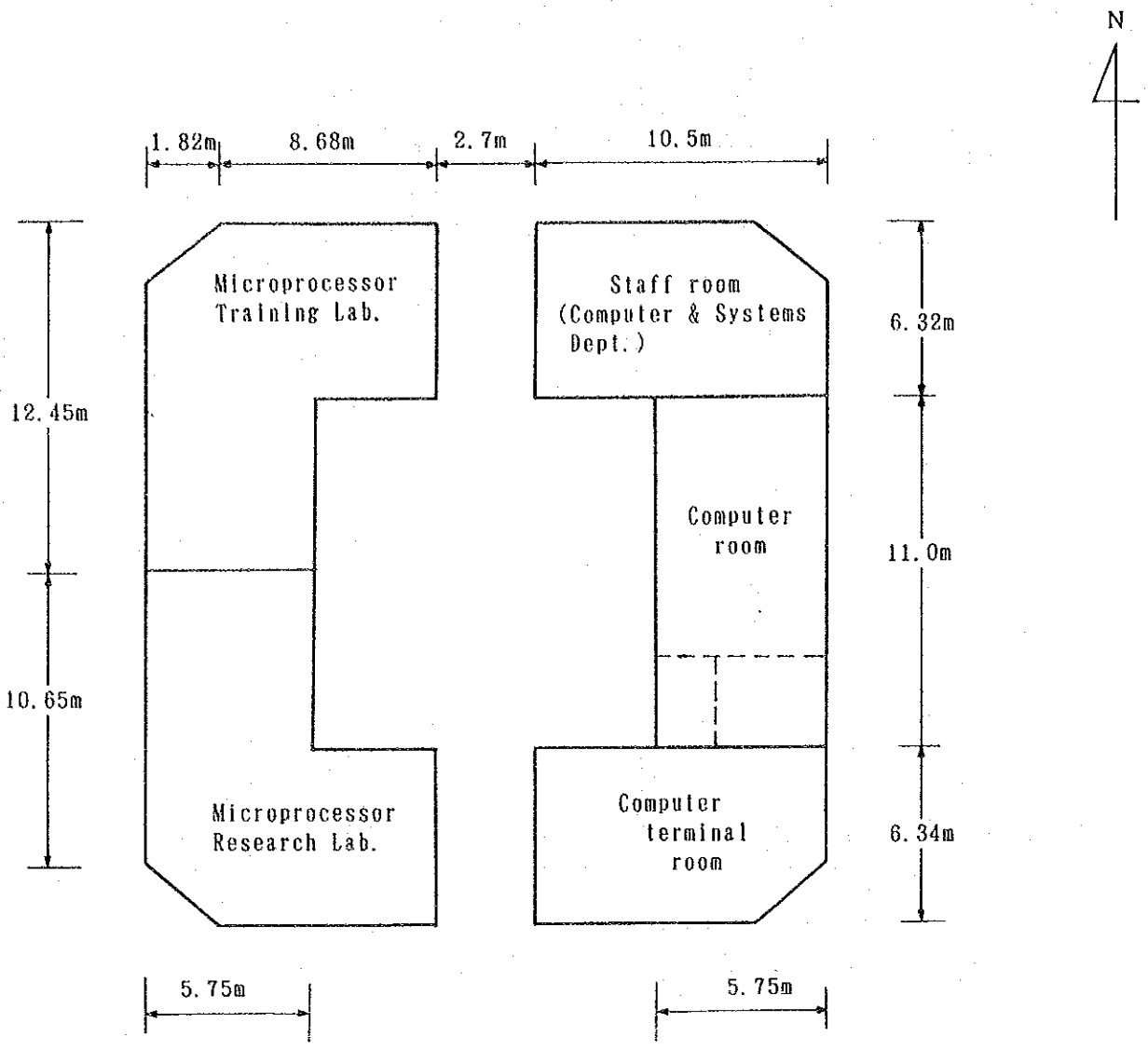
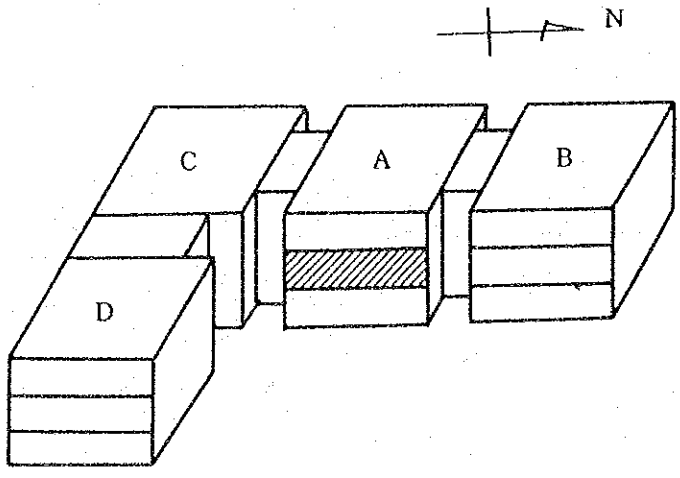


Fig. 3.6 First Floor Layout Plan (Building A)



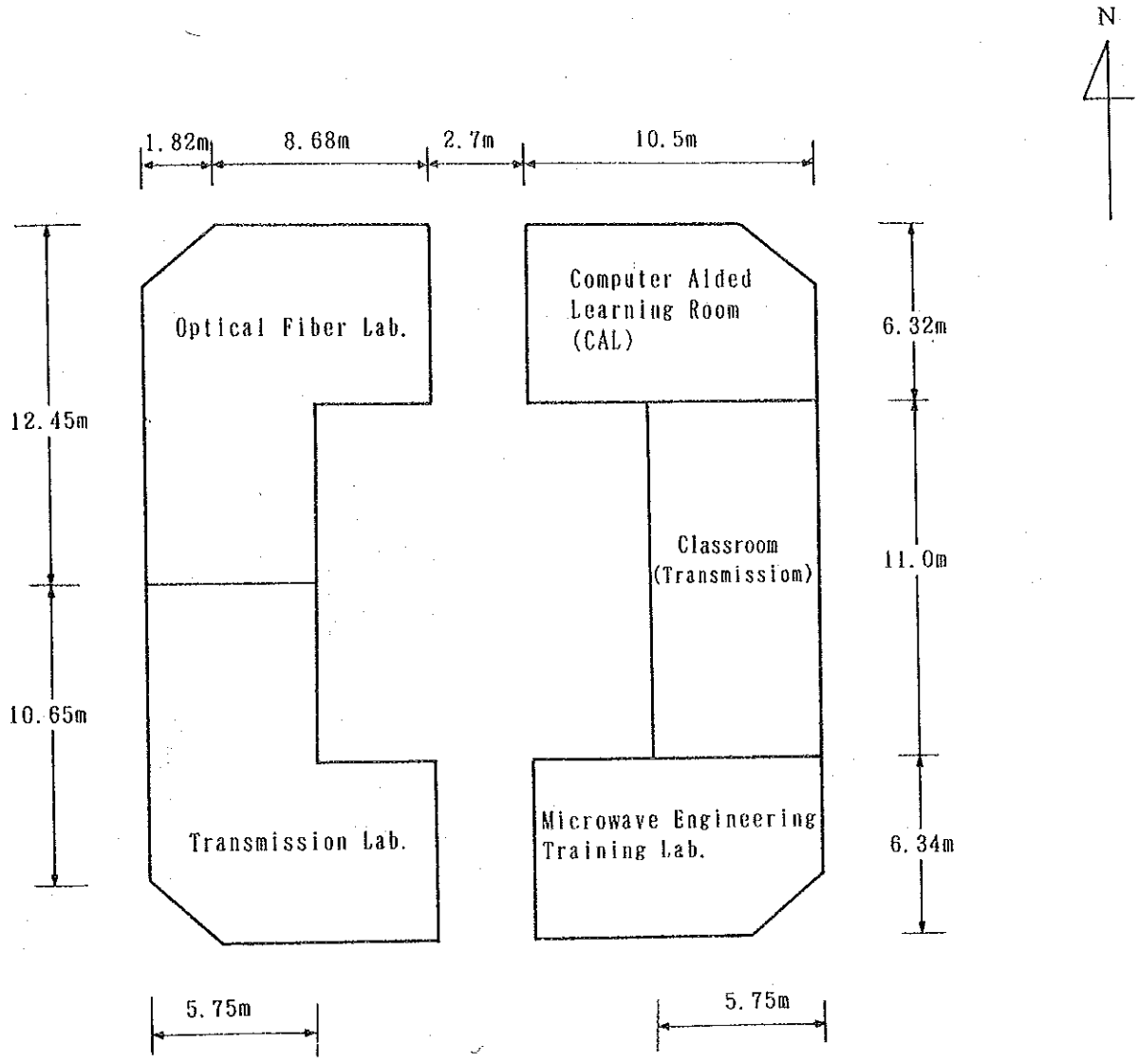
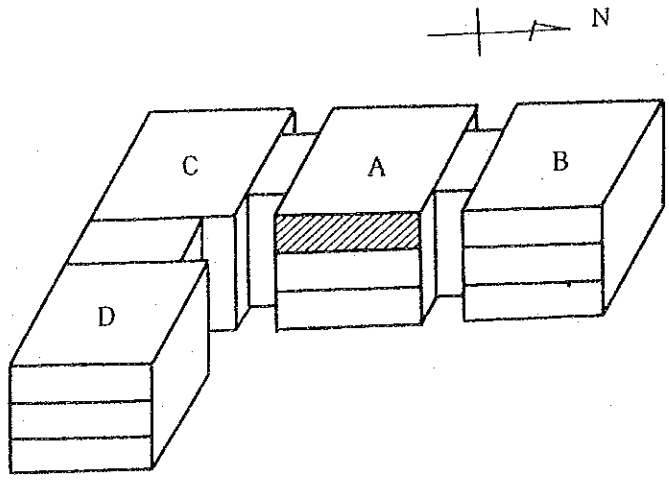


Fig. 3.7 Second Floor Layout Plan
(Building A)



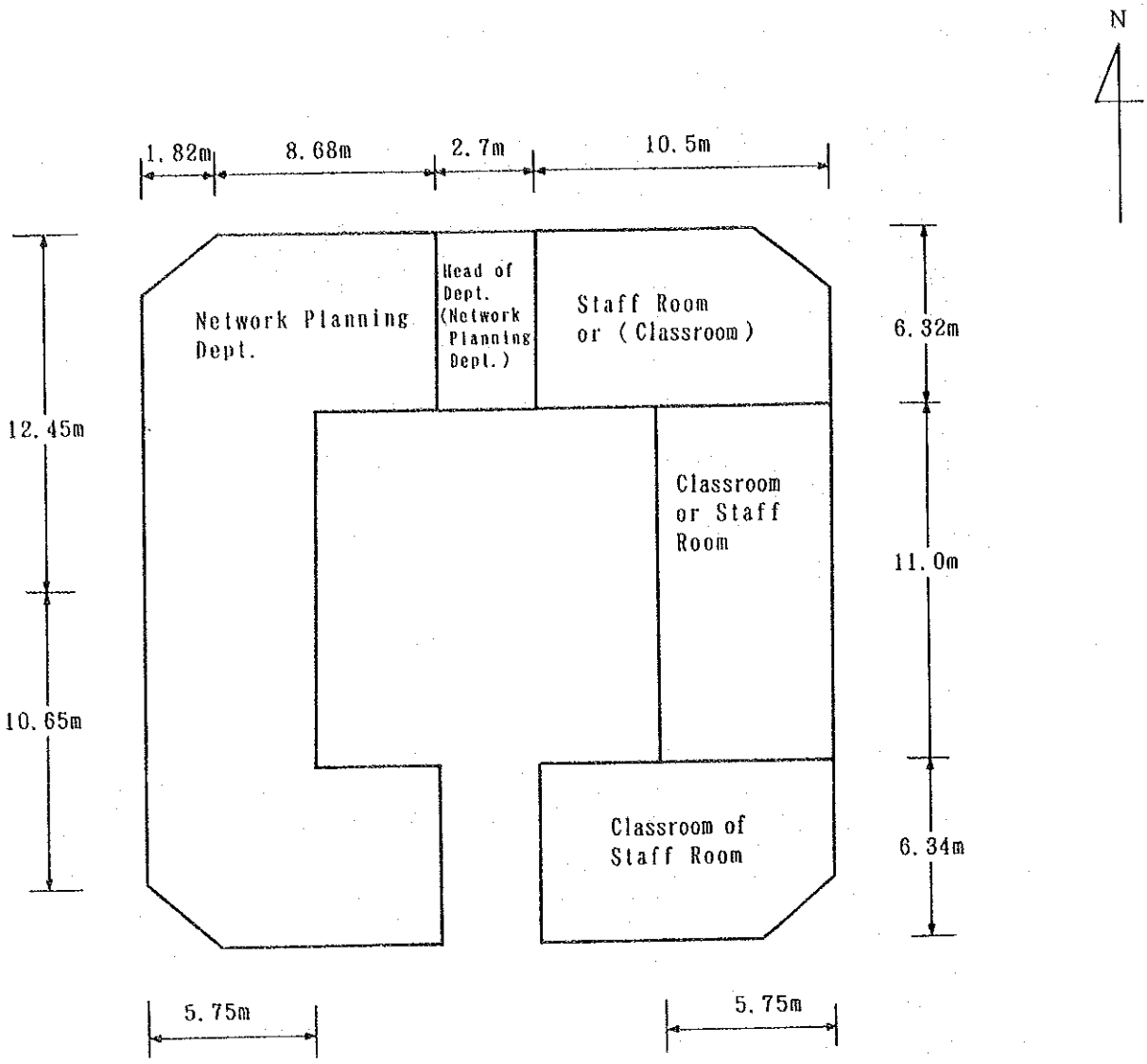
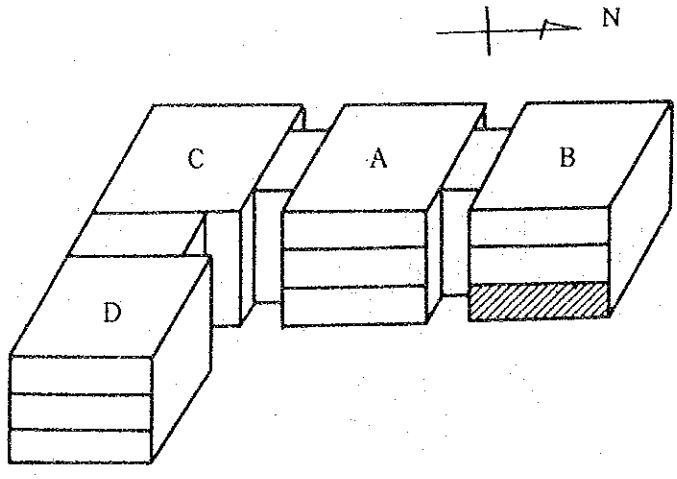


Fig. 3.8 Ground Floor Layout Plan (Building B)



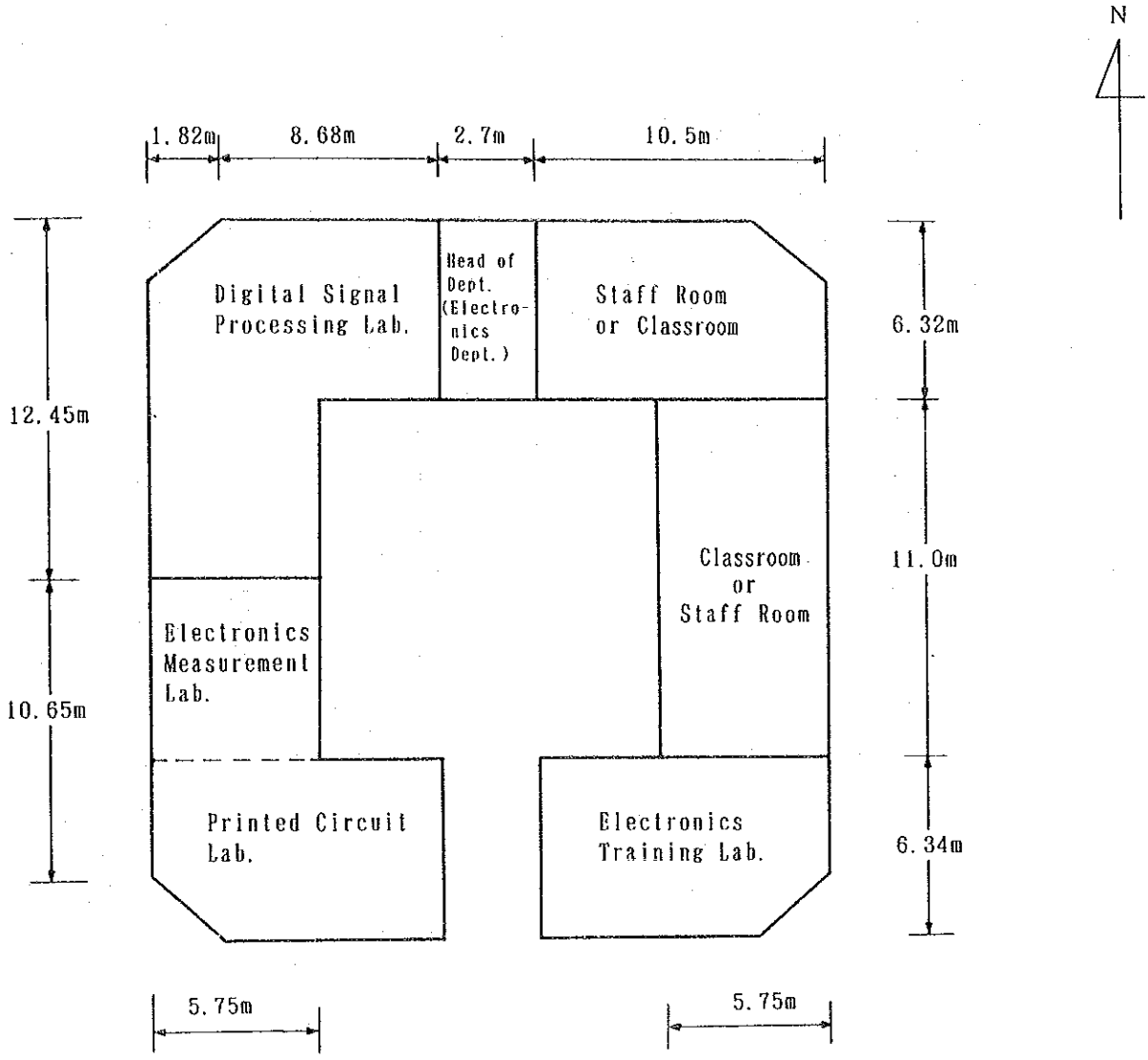
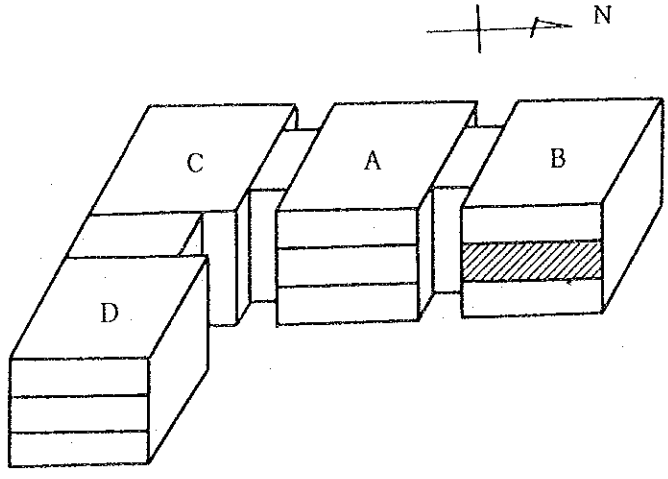


Fig. 3.9 First Floor Layout Plan (Building B)



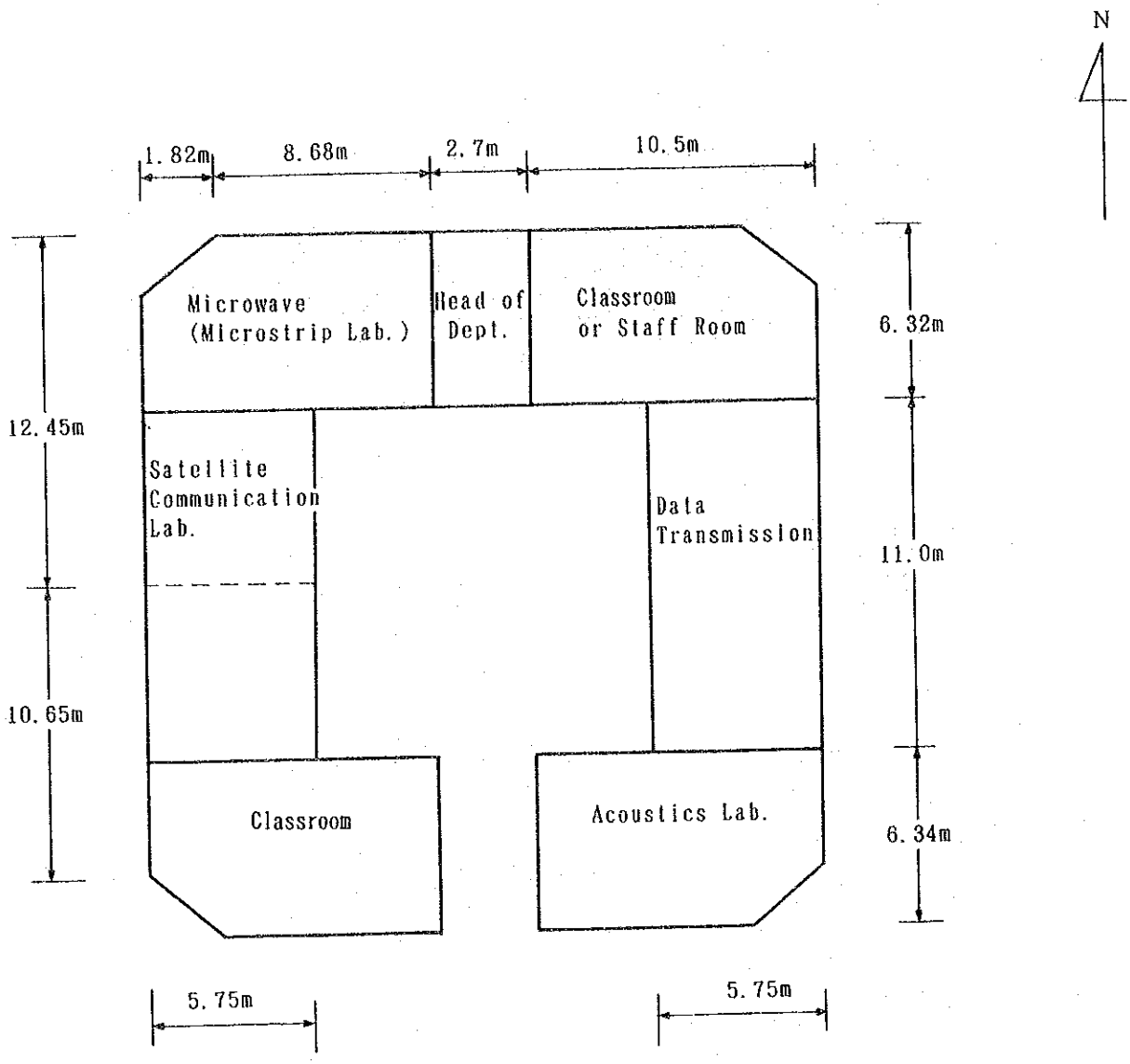
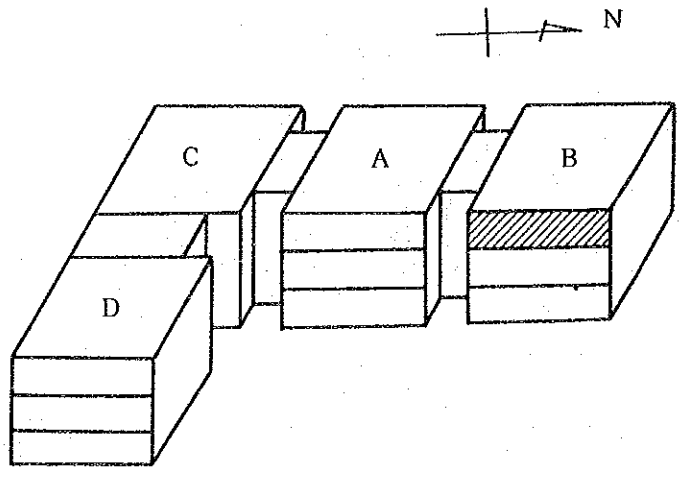


Fig. 3.10 Second Floor Layout Plan
(Building B)



3.2.7.2 Requested Equipment

The equipment requested for this project is for the activities of the following six departments:

Switching and Traffic Department
Network Planning Department
Transmission Department
Electronics Department
Computer and Systems Department
Administration and Support Department

Although basically for training use, the requested equipment can also be used for NTI technical consultation and research activities.

The equipment requested for each NTI department is as follows:

(1) Switching and Traffic Department
- Digital telephone switching system
- Traffic generation equipment
- No. 7 signal monitoring equipment
- Training simulator
- Measuring equipment
- On-line personal computer
- Traffic measuring equipment (for switching system)
- Call procession monitoring equipment
- Diagnostic program of call processing
- Operating system software
- Small PBXs for training

(2) Network Planning Department

- Traffic measuring equipment
- Traffic data processing computer system
- Telecommunication network design support system (with high-level graphic function)
- Computers for network data processing and data base
- Measuring equipment for telephone lines, data transmission line and protocol analyzer, and so on

(3) Transmission Department

- Analog and digital microwave communication system (6-GHz analog systems, 6- and 11-GHz digital systems)
- Remote supervisory and control system for microwave communication system
- Analog and digital multiplexers
- Telegraph circuit multiplexers (VFTG, TDM)
- Optical fiber transmission system (8 Mbps, 34 Mbps, 140 Mbps)
- Remote supervisory and control system for optical fiber transmission system
- Earth station equipment for satellite communication system
- Experimental antenna system for radio propagation
- Experimental kits for microwave communications
- Measuring equipment for microwave, transmission and optical system
- Solar batteries

(4) Electronics Department

- Printed circuit board fabrication equipment
- Computer aided electronic circuit designing system (CAD)
- Analog and digital circuit training kits
- Optoelectronics training kits
- Microprocessor training kits
- Digital signal processing equipment
- Microprocessor development system
- Related measuring equipment

(5) Computer and Systems Department

- Main frame computer
- Peripheral equipment
- Operating and utility systems
- On-line personal computers for training
- On-line graphic terminal equipment for staff
- Local area network system
- Uninterruptible power supply units

(6) Administration and Support Department

- Computer assisted learning (CAL) system
- CAL materials
- On-line personal computers for information center
- On-line personal computers for NTI administration
- Microwave personal video-link system

3.3 Study of the Request

3.3.1 Necessity and Adequateness of the Plan

The Egyptian government performed a big investment during the First Five-Year Plan for Socioeconomic Development in the telecommunications field, taking it as one of the most important infrastructures to promote socioeconomic activities in the country. As a result, the Egyptian telecommunications systems and services have been remarkably developed to satisfy the demand with quantity and improved quality, as stated in Section 2.2.3, Chapter 2.

During the Second Five-Year Plan which followed the first plan, the government pursued, as one of its fundamental policies, absorption of the most advanced technology, its fixing, improvement of productivity and product quality in various sectors, placing the period as an infrastructure improving stage for cultivating animated industries.

The government considered, in line with the above stance, that continuous training for industrial workers and breeding application ability to change of needs are important steps to obtain goals. On that account, the breeding of qualified engineers by providing NTI with necessary materials and equipment and developing of technical support to the telecommunications field of the country were defined as one of the important policies of the Second Five Year Plan.

The First Five-Year Plan resulted in a remarkable growth of telecommunications. However, the telephone density remains still low, that is, 2.3 telephone main lines per 100 inhabitants, at fiscal 1987/1988, and the government settled the goal to raise it up to 6 % with continuous development of the telephone network.

GNP per capita of Egypt can be estimated at around 2,000 US dollars in fiscal 2001/2002, as shown in Figure 3.11, through growth trends in the past 10 years and the planned GDP growth rate in long-term plans of the government.

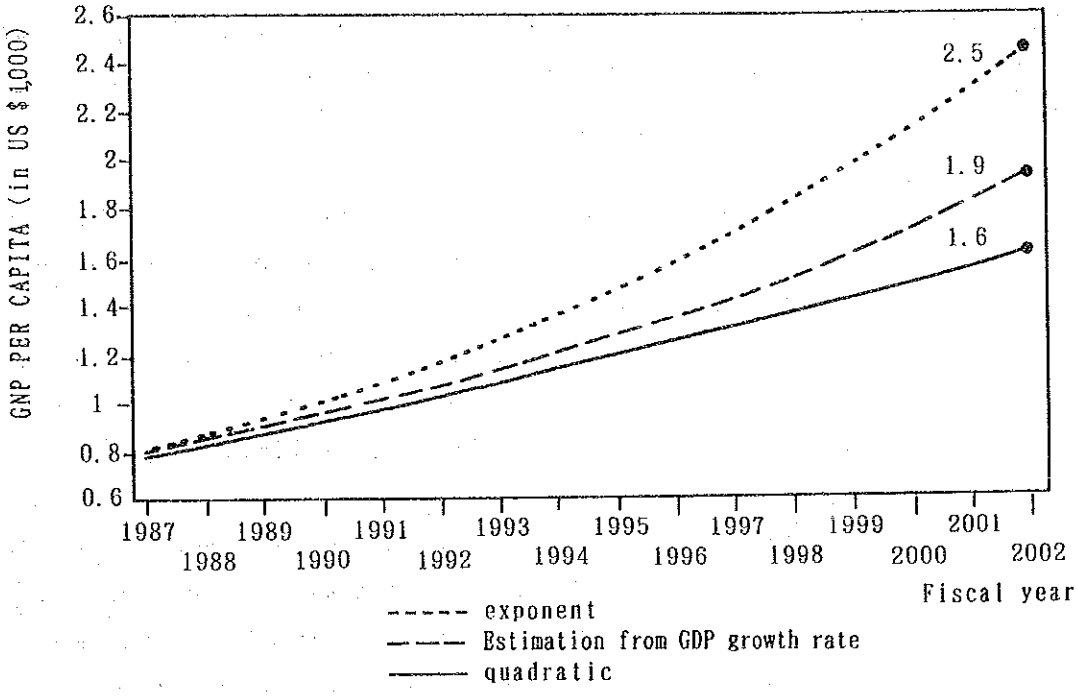


Fig. 3.11 Estimation of GNP per Capita

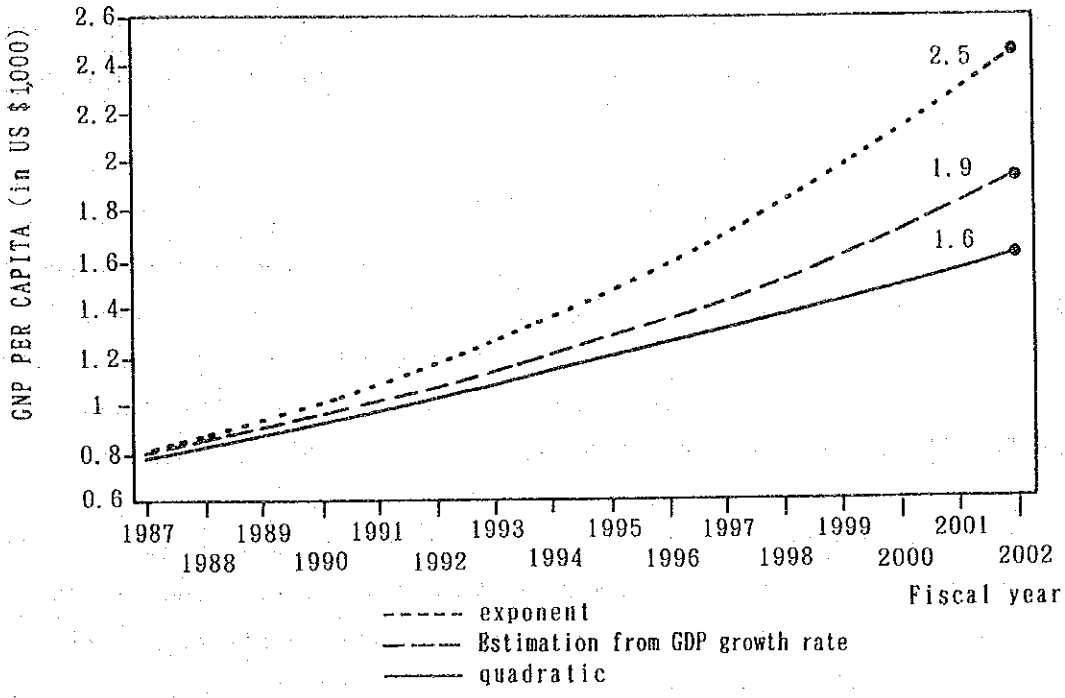
The telephone density, or the number of main lines per 100 inhabitants, is 6 % in the case of around 2,000 US dollars GNP per capita, as calculated according to the correlation between GNP per capita and the telephone density shown in Fig 2.2. Hence, the goal of the government is supposed to be feasible and reasonable.

Figure 3.12 shows the correlation of the number of main lines per technical employee of telecommunications administration to GNP per capita. It is around 40 in the case of ARENTO, being classified to be in Group A in the figure.

When it is calculated to an estimation of 2,000 US dollars GNP per capita in fiscal 2001/2002, a rate of 200 main lines per employee may be possible as it is the average value of Group B. In other words, it is considered substantially possible that around 24,000 employees at present can hold around 4 million main lines in fiscal 2001/2002, provided that technical development and productivity raise are realized.

A bold estimation on the number of engineers necessary for NTI, based on the rate of core staff members in technical employees in Japan and the ratio of main lines in Japan to those in Egypt in fiscal 2001/2002, leads to a conclusion that 1,300 to 1,400 engineers will be necessary for ARENTO in fiscal 2001/2002.

Provided that the existing engineers are refined in quality and productivity, it is possible, in fiscal 2001/2002, to maintain the telecommunications networks by the engineers of fiscal 1988/1989, though a simple and easy comparison does not lead to a very precise conclusion, because of the difference in size, configuration and technology of the networks.



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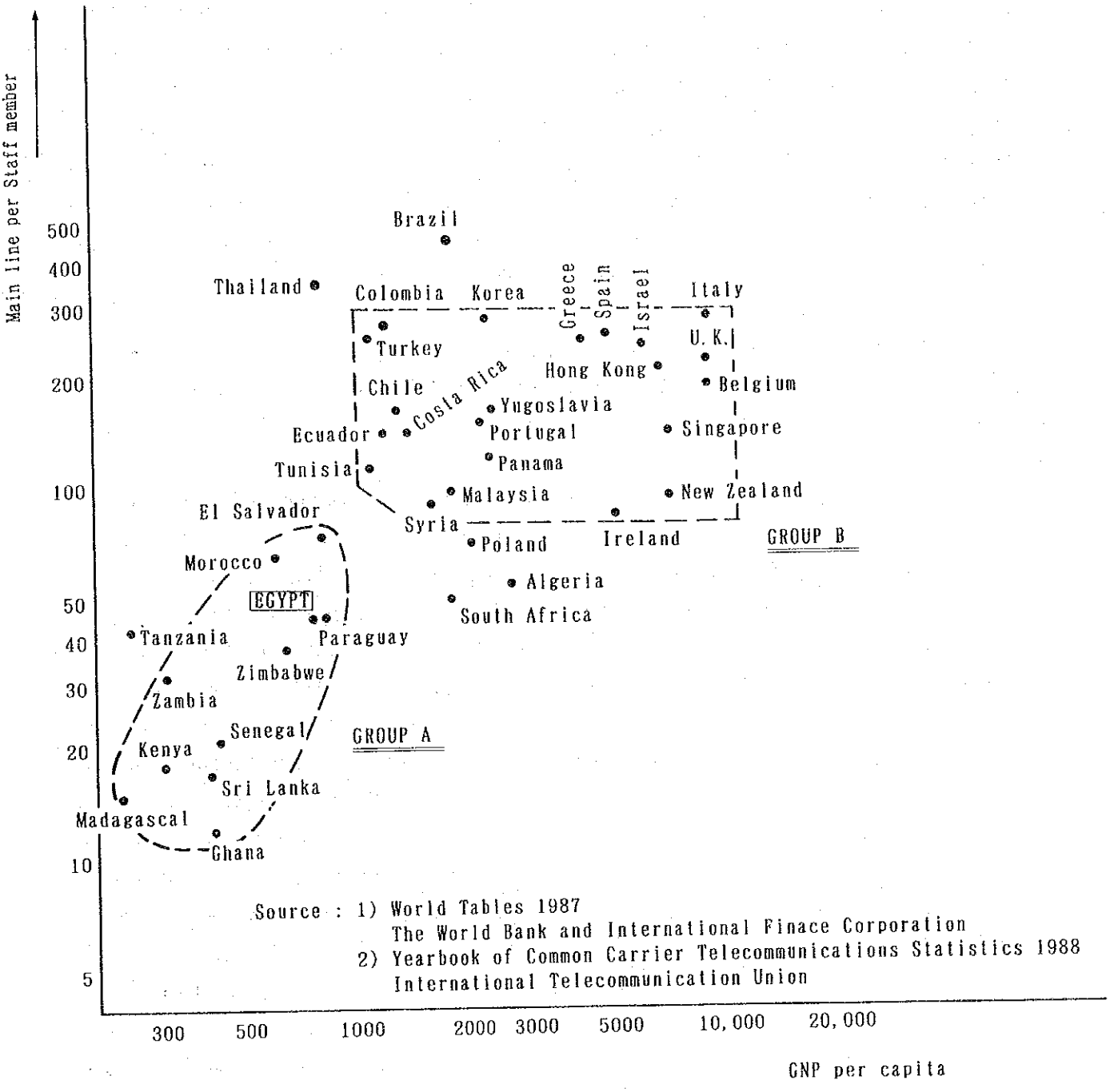

Fig. 3.12 GNP per Capita and Main Lines per Technical Staff Member (Year 1986)

In this case, however, there are some premises as follows. First, the technicians are supposed to have reached a fair technical level; secondly, thorough training to upper engineers in NTI must have been performed; thirdly, the cultivated engineers perform sufficient OJT to technicians; fourthly, knowledge and technique obtained through NTI training must be diffused. Under this context, even the expanding telecommunications networks can be maintained by existing personnel of ARENTO, thus the benefit due to the NTI training is expected really great.

The expectation to NTI training is, in addition to the above-mentioned side of quantity, its measures to reform the quality of the Egyptian telecommunications networks.

Improvement of the Egyptian telecommunications network is now under way absorbing technology ranging over different three generations; that is, steps to the completion of the nationwide automatic toll dial service, transition from the analog to the digital telecommunications network, the integrated service of telecommunications and computers due to the introduction of packet exchange service, as stated previously.

It means that such complex training activities are indispensable, that is, first, the up-grading of the average technical level in the telecommunications field through technology introduction and popularization of training as recognized in the continuing education program; secondly, cultivation of synthetic engineers (system engineers) as targeted by the ARENTO special training courses; and thirdly, cultivation of high-grade specialists in each technical field as targeted by the Diploma course.

Accordingly, it is very significant that an organization having a synthetic training system diffuses thorough recognition of a telecommunications system as a total system, assorting counter-training of different training fields, by means of operating fully equipped training facilities.

As stated before, the Egyptian telecommunications networks comprise those owned by main governmental organizations as well as private sectors in addition to that offered by ARENTO. Not having their own training centers, though there are some exception, their expectation to make use of the NTI's function is great as it offers the opportunity of up-grading technique and obtaining new technology to their staff in charge of telecommunications.

Benefits of NTI training to the whole Egyptian telecommunications fields are greatly expected when cultivated engineers perform their roles at their respective fields, as attendants at the NTI's training courses come out of various governmental and private sectors as stated previously.

NTI intends to keep the training courses open widely to various organizations in the country also in future, with a plan to receive 1,300 trainees a year to the Continuing Education Program courses after the fiscal year 1991/1992, when the facilities will be completed.

The NTI's training demand is supposed to come up to around 6,500 in the number of trainees, as the number of engineers related to telecommunications and computer technology are, according to NTI, about 1,400 in ARENTO, about 500 in the petroleum sector, about 500 in Radio and TV Union, 100 in Egyptian Electricity Authority and 2,000 in other sectors, in addition to 2,000 engineers of university graduates in the telecommunications and computer fields.

One of the most important roles of NTI is to receive trainees from neighboring countries and to function as a core training center among the Arab-African countries.

NTI plans to give access to its functions actively to neighboring countries. It intends to receive around 200 trainees from neighboring countries, that is, 14 % of the capacity of the continuing education program or 20 % of that other than computer technology, at the fiscal year 1991/1992, when the facilities are supposed to have been completed.

From the above mentioned point of view, telecommunications development in Egypt is one of the important basic factors to promote its socioeconomic development. In order to develop telecommunications and establish technological infrastructures in Egypt, it is judged to be necessary to train skilled engineers in the telecommunications fields through providing NTI with necessary equipment. Furthermore, it is considered that the execution of the Project is effective in supporting telecommunications development in neighboring countries.

3.3.2 Validity of Training and Technical Support Program and Necessity of Expansion of Equipment

The major targets of the NTI expansion plan, as explained in Section 3.1 Objective of the Plan, are:

1) Provision of training and education to develop highly proficient engineers with both theoretical and practical ability that will serve as the one for further development of telecommunications in order to promote expansion and modernization of Egypt's telecommunications network and establish a technical foundation for telecommunications.

2) The offering of technical support and concrete plans to solve problems that occur in the existing telecommunications facilities, including technical problems, as well as problems that develop during the introduction of new technology.

3) Provision of training in modern telecommunications technology for neighboring countries.

In the fiscal year 1987/88, NTI provided technical training for 198 trainees in 16 courses in its Continuing Education Program and 40 trainees in 2 courses in the ARENTO Special Training Program. However, there was a shortage of training materials, so most of the training was theoretical training performed at the trainee's desk.

The equipment and materials that NTI possesses at present are primarily pieces of measuring equipment for the laboratory staff. That equipment was inherited from the former Telecommunication Research Center (TRC) and does not include telecommunications training facilities. Experiments and drills are conducted using microwave channel training kits (3 sets), optical devices, microprocessor training kits (10 sets) and measuring equipment, but these are not adequate to accomplish the quality and quantity of training desired.

In order to develop high-level engineers who are well informed about telecommunications and computer technology, as well as theoretical training, training must include individual hardware and software technology, the functions of hardware and software, the interface conditions between different items of equipment, and methods of checking operating conditions and characteristic configurations of equipment and systems.

NTI has set the fiscal year 1991/92 as the target year for the completion of this expansion plan, with a later completion date for its overall training program. However, to provide training for a total of about 1600 trainees through the overall training program, and to develop proficient engineers and provide them with strong foundations in theoretical and practical technology, it is absolutely necessary to prepare telecommunications facilities, computer systems and measuring equipment that provide a system for training practice and actual performance.

The technology fields in the telecommunications sector that public and private organizations in Egypt expect NTI to provide training programs include:

1) Digital telecommunications technology
2) Computer and telecommunications
3) Planning and design technology for telecommunications networks
4) Electronic technology

These are discussed below.

(1) Digital telecommunications technology

As of the end of 1988, the rate of digitalization of the public telecommunications network in Egypt, as shown in Table 2.10, was estimated to be 12% of all switching system terminals. Digitalization of transmission routes, as described in Item 2.2.5-(3), has been promoted, with digital urban microwave systems, local optical fiber transmission systems, and digital microwave radio systems between cities and local areas already being introduced.

Currently, the Ministry of Transport, Communications and Maritime Transport (MOTC) is promoting a plan for domestic production of digital switching systems, with production expected to start in the near future. Since production plans call for the introduction of 200,000 digital switching system terminals per year, this should help further digitalization of the domestic telecommunications network to develop rapidly.

To respond to this movement toward digitalization, ARENTO feels that it is of the utmost importance to develop digital communications engineers. Thus, it is dispatching engineers to NTI for training in the ARENTO Special Training Program and Continuing Education Program to develop high-level engineers that will form the core in such technical sectors as design, construction, maintenance and operation.

In particular, a person who has finished the Telecommunications Engineer Course in the ARENTO Special Training Program is given priority for qualification to participate in manufacturer training courses for digital communication facilities. A person who finishes an NTI training course and gains a wide range of knowledge in general digital telecommunications technology is also expected to absorb the technology for an individual system introduced in Egypt through manufacturer training course and to learn the maintenance and operation technology for that system so that he can be a leader in the individual business field to which he is attached and provide field training (OJT) for other engineers and technicians in order to expand the layer of technicians in that field.

In addition to the digitalization of ARENTO's public telecommunications network described above, major organizations in both the public and private sectors, such as oil companies and electric power agencies, have recently begun planning or execution of the introduction of digital technology and the replacement of existing facilities. Those organizations that possess private telecommunications networks have great expectation that efficient training can be executed using NTI facilities completed by the NTI expansion plan.

(2) Computer and telecommunications technology

The current status of computer application in ARENTO is as shown in Table 2.11; however, ARENTO plans to introduce computers into its major operations in the public telecommunications field, including outside plant design, telephone directory publication, traffic management and control, and long-distance trunk network management. In addition, based on the expansion of its introduction of digital switching systems and the introduction of packet switching services, ARENTO recognizes that development of software engineers is becoming an urgent requirement.

ARENTO has been dispatching 20 engineers per year to the computer engineer training course in NTI's ARENTO Special Training Program since the fiscal year 1987/88. However, most of the current training is performed at the trainee's desk, with only microcomputers and four sets of terminals for

the NTI staff available for use in practical drills. It cannot be said that this allows the obtaining of the desired training effect. Thus, to respond to the demand for training from ARENTO and other organizations, NTI is planning to allot 50% of the practice time for computer technology training primarily to software technology. This will require broad expansion of its computer facilities.

ARENTO is currently constructing a packet switching network, with service scheduled to start in May 1989. Initially, service will only be provided within Cairo. However, in 1990, service will be initiated in Alexandria and the Suez area, followed by sequential extension of service to the entire country.

The introduction and expansion of packet switching service will promote computer application in both public and private organizations, and will greatly increase demand for training in computer technology. Therefore, NTI is planning to complete the expansion of its computer facilities by the fiscal year 1991/92 and, in addition to its current data base system training course, NTI will establish 11 new courses in computer technology in its Continuing Education Program; a total of 12 training courses will be conducted for computer technology in the future.

With the start of packet switching service, NTI is receiving requests for training from various organizations, such as requests for instruction in the application of packet switching network technology by banks that possess an on-line computer system, which usually consists of leased circuits, and requests for technical consultation and training from private organizations that plan to provide data communication service. NTI will provide technical support in response to those organizations' requests, and will expand the existing data communication training courses and establish a "Computer and Communications Course" in the Telecommunications Diploma Course Program in the fiscal year 1991/92.

As described above, the expansion of NTI's computer facilities is an absolute necessity for both expansion of computer applications and the strengthening of the foundation of communications processing technology in Egypt.

(3) Planning and design technology for telecommunications networks

Automation of the telephone exchanges in all municipal cities and introduction of long distance direct dialing service have almost been completed, and automation of all exchanges in Egypt's telephone network is planned for the future. Although the long-distance network is a three-stage star network, most of the Group Center (GC) functions are being handled by the Zone Centers (DC) at the higher level, so this network is yet to be developed as a telephone network.

The increase in number of telephone subscribers, which is expected to expand on a scale of 200,000 lines per year, the automation of all manual exchanges and the promotion of network digitalization will require the improvement and reorganization of the telecommunications network structure. In order to provide economic and efficient handling of large amount of telephone traffic carried through the above network with sound service quality, it is necessary to investigate the traffic structure and study the optimum telephone network architecture that realizes the most suitable relationship between traffic flow and the physical transmission network constitution.

The Network Planning Department of NTI has established three research and study subjects, "Creation of Telecommunications Network Data base", "Optimum Design for Telephone Network in Egypt", and "Network Digitalization and Integration of the Telephone Network and a Data Communication Network", and is planning to jointly promote that work with ARENTO.

To determine the optimum design for the telephone network, it will be necessary to create a data base containing the number of subscribers, facilities data for the switching systems and transmission routes, cost data, traffic data and plans for the future expansion of facilities, and then perform complicated calculations repeatedly to create several alternative plans. As recommended in CCITT GAS 3 "General Network Planning", a computer-aided system is indispensable for obtaining the optimum plan for the domestic telephone network.

NTI has been charged in connection with the Presidential Decree with development of telecommunications network planning engineers with the skill to study the network economy. Therefore, NTI has established a "Network Planning and Management Course" in its telecommunications diploma program, and plans to develop network planning specialists. The course is scheduled to start in the fiscal year 1989/90.

(4) Electronics technology

Current telecommunication facilities are composed of electronic circuit packages and microprocessors that make liberal use of the latest electronics technology. To learn the basic technology for, and how to measure the characteristics of, the digital devices and circuits that make up the hardware for each facility, it is necessary to understand the operating principle for each type of equipment. This also enables fault diagnosis, analysis of fault phenomena, isolation of failures generated during the operation of facilities, and repair of failed circuits without suppliers' assistance.

In Egypt, which purchases its telecommunication facilities from abroad, the most effective way of reducing repair time and maintenance cost is training in these technical areas to develop engineers that have strong practical capability.