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THE ARAB REPUBLIC OF EGYPT

MINISTRY OF SUPPLY AND HOME TRADE

FINAL REPORT

ON

FEASIBILITY STUDY

FOR

COLD STORAGE CHAIN DEVELOPMENT PROJECT

(MAIN REPORT)

FEBRUARY 1984

JAPAN INTERNATIONAL COOPERATION AGENCY

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PREFACE

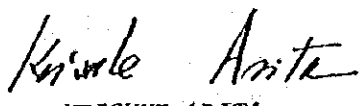
In response to the request of the Government of Arab Republic of Egypt, the Japanese Government decided to conduct a survey on the Cold Storage Chain Development Project and entrusted the survey to the Japan International Cooperation Agency (JICA). The JICA sent to the Arab Republic of Egypt a survey team headed by Mr. Daizo Iseno from August 6 to September 19, 1982.

The team exchanged views with the officials concerned of the Government of Arab Republic of Egypt and conducted a field survey in Cairo, Alexandria, Port-Said and Suez. After the team returned to Japan, further studies were made and the present report has been prepared.

I hope that this report will serve for the development of the Project and contribute to the promotion of friendly relations between our two countries.

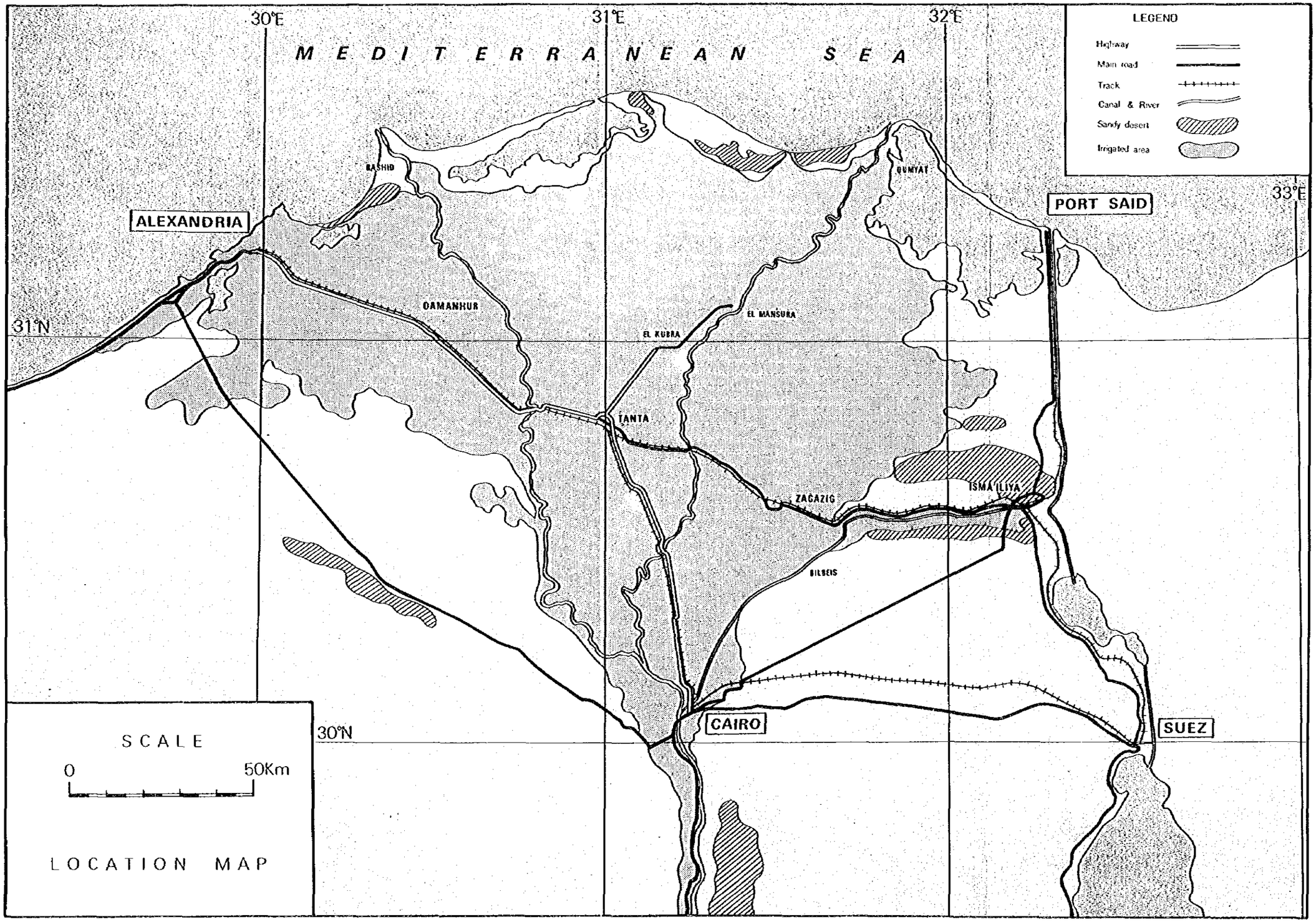
I wish to express my deep appreciation to the officials concerned of the Government of Arab Republic of Egypt for their close cooperation extended to the team.

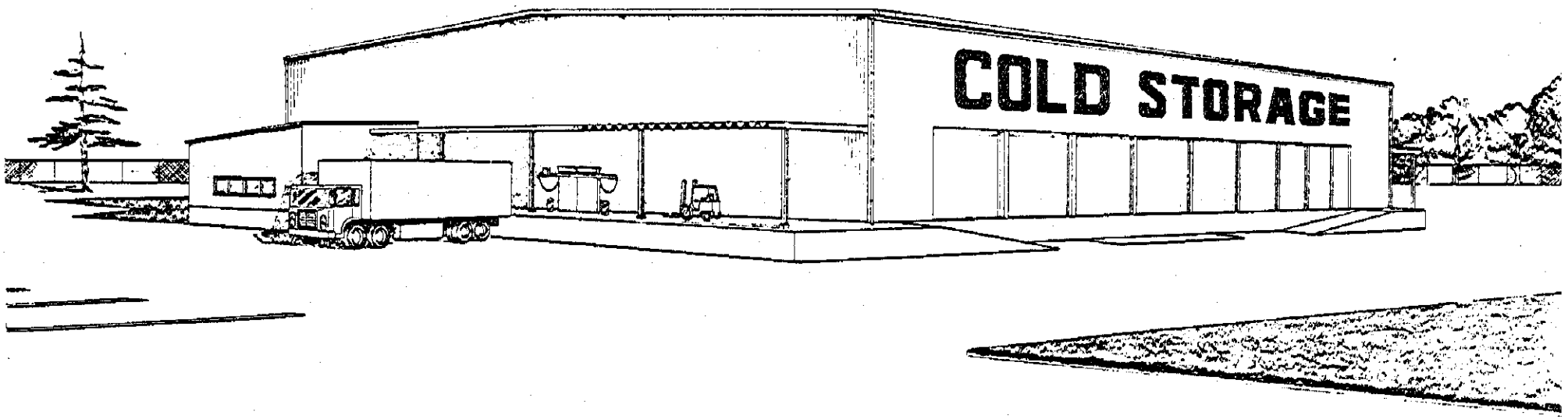
February 1984



KEISUKE ARITA
President
Japan International Cooperation Agency

COLD STORAGE CHAIN DEVELOPMENT PROJECT





COLD STORAGE CHAIN DEVELOPMENT PROJECT

PROPOSED PLAN OF A COLD STORAGE

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ABBREVIATIONS AND GLOSSARY

ARE	:	Arab Republic of Egypt
B/C	:	Benefit Cost Ratio
CIF	:	Cost, Insurance and Freight
EIRR	:	Economic Internal Rate of Return
FAO	:	Food and Agriculture Organization
FC	:	Foreign Currency
FOB	:	Free on Board
FY	:	Fiscal Year (July 1st to June 30th)
GDP	:	Gross Domestic Production
GERCO	:	General Engineering & Refrigeration Co.
IBRD	:	International Bank of Reconstruction and Development
JICA	:	Japan International Cooperation Agency
LC	:	Local Currency
LE	:	Egyptian Pound = 1.22 US$ = 300 Japanese Yen
MOA	:	Ministry of Agriculture
MOP	:	Ministry of Planning
MOS	:	Ministry of Supply and Home Trade
O & M	:	Operation and Maintenance
R.T.	:	Refrigeration Ton = 3,320 Kcal/hr
$, US$	:	Dollar, US$ = 0.82 LE
TTT	:	Time Temperature Tolerance

Units of Measurement

Length

mm	:	millimeter
cm	:	centimeter
m	:	meter
km	:	kilometer

Area

sq.cm, cm^2	:	square centimeter
sq.m, m^2	:	square meter
sq.km, km^2	:	square kilometer

Volume

l, lit	:	liter
c.m, m^3	:	cubic meter
MCM, $10^6 m^3$	:	million cubic meter

Weight

g	:	gram
kg	:	kilogram
ton, m.t.	:	metric ton

Others

EL	:	Elevation above mean sea level
MSL	:	mean sea level
Sec	:	second
min	:	minute
hr, hrs	:	hour or hours
Min	:	minimum
Max	:	maximum
%	:	percent
P	:	packs
PPM	:	parts per million
r.p.m.	:	revolutions per minute
No.	:	Number
°C	:	degrees centigrade
°F	:	degrees fahrenheit
Cl	:	Chlorine
HP, PS	:	Horse Power
lit/sec	:	liters per second
m/s	:	meters per second
Kcal/hr	:	kilo calories per hour
KVA	:	kilo volt amperes
KW	:	kilo watts

Conversion Factors

Unit	Comparison
Units of Length	
Millimeter (mm)	0.001 meter
Centimeter (cm)	0.01 meter
Meter	100 cm
Kilometer (km)	1,000 meters
Units of Area	
Square centimeter (sq.cm)	0.0001 sq.m
Square meter (sq.m)	
Hectare (ha)	10,000 sq.m
Square kilometer (sq.km)	1,000,000 sq.m
Feddan	4,200 sq.m
Units of Volume	
Cubic centimeter (cu.m)	0.001 cu.m
Liter (1,000 cu.m)	0.001 cu.m
Cubic meter (cu.m)	1,000 liters
Units of Weight	
Gram (g)	
Kilogram (kg)	1,000 g
Metric Ton (mt)	1,000 kg

Miscellaneous

1 cu.m per sec	= 1,000 liters per second (l/s)
	= 35,3145 cu.ft per second (cfs)
	= 15,850 gallons per minute (gpm)
1 horsepower (metric)	= 75 kg-m per second
	= 550 ft-lb per second

SUMMARY

THE STUDY

1. The study aims to determine the optimum capacity of cold storage plants to be constructed in the designated areas under this Project and to secure smooth and successful importation, distribution and consumption of the cold foods to be imported.

For this purpose, the study estimated the cold food import requirement to fill the gap between the total amount of the growing demand for cold foods and the gross amount of domestic production of such foods.

2. The proposed site for cold storage in El Dekihla of Alexandria has been tentatively decided.

As the geological data of the sites for the cold storage and the ice-making plant are not available, the cold storage and the ice-making plant have been dealt with to a preliminary study depth.

The preliminary design and the cost estimates based on the specifications in the document for the Prefabricated Cold Store of 4,000 tons capacity in Alexandria presented by GERCO in February 1983 have been compiled in the Appendix.

PRESENT CONDITION

3. In 1980, the estimated total amount of the demand for meat and poultry was approximately 560,000 tons, 200,000 tons for fish, 260,000 tons for cheese, and 100,000 tons for butter. The estimated total amount of domestic production for meat and poultry was 440,000

tons, 150,000 for fish, 240,000 tons for cheese and 70,000 tons for butter. This means that the 220,000 ton shortfall was met by imported cold foods.

4. Procurement of imported meat is presently being performed by the General Authority for Supply Commodities. GERCO Co. for Refrigeration and Engineering and the other three public agencies are engaged in receiving the imported cold foodstuffs at the ports as well as storing and transporting. Retail sales to consumers are performed by the cooperative Societies Company.

5. The cold storage facilities under the management of GERCO and Alexandria Company (public sector), are as follows:

Location	No. of Cold Storages	Total Capacity (ton)
Alexandria	3	5,500
Port Said	2	1,950
Suez	4	5,400
Cairo	3	14,600
Total	12	27,450

In addition to the above, three cold storages (one in Alexandria with a capacity of 2,500 tons, one in Port-Said with a 2,000 tons capacity, and one in Suez with a 2,500 tons capacity), are now under construction.

6. . There are two meat processing plants under the public sector in Egypt. One is attached to Ramada Cold Storage in Cairo, and the other to Wardian Cold Storage in Alexandria. The capacity of each meat processing plant is 10-30 tons per day. The total capacity of the two plants is extremely small to meet the whole requirement for processed meat.

7. The current total capacity of ice-making plants in Alexandria in the public sector is shown below:

Plant	Capacity (ton/day)
Mahmoudia	210
Kabbary	160
Labban	60
Moharrem Bey	70
Marsa Matrouh	10
Kafr El Sheikh	30
Shebin El Kom	25
Total	565

In addition, two ice plants with a capacity of 50 ton/day each will be constructed.

With some exceptions, the facilities of these ice making plants are rather old.

8. Cold foods imported at ports (Alexandria, Port Said and Suez) are hauled to the consumers mainly through the road networks.

The imported cold foods are unloaded from the ships to the wharf directly or to barge and then to the wharf. Recently, the latter case which has the lower unloading capacity is increasing.

The cold foods are then either transferred to cold storage at the port or transported to the inland cold storages close to the consumption area by trucks. Since the cold foods on the truck are merely covered with a tarpaulin sheet, its temperature may go up considerably even though they are usually transported at night.

They are unloaded by hand from the lorry onto the platform and then manually transferred from the platform to the cold room of the cold storage in almost all cases except some where forklifts are used.

DEVELOPMENT PLAN

9. The Limited Domestic Production of Food

The population of Egypt was 42 million in 1980 and will reach 65 million by the year 2000.

The domestic production of food is limited because of the low availability of agricultural land and it cannot meet fully the increasing demand. Consequently, the importing of foods, and especially the animal protein foods such as meat, fish and dairy products, is increasing rapidly year after year.

10. Rapid Increase in Importation of Cold Foodstuffs

The importing of cold foodstuffs increased suddenly in 1976 and reached 214,000 tons in 1980. It is estimated to have exceeded the level of 300,000 tons in 1981.

In particular, imported meats including chicken increased from about 60,000 tons in 1978/79 to 128,000 tons in 1980, and further to 225,000 tons in 1981.

This rapid increase in imported cold foodstuffs necessitates the construction of a considerably large capacity of cold storages, since the cold storage capacity operating in August 1982 was less than 30,000 tons.

11. Food Import Requirement Forecast

The study has been conducted to forecast the demand and the domestic production of meat, fish, cheese and butter over the years up to 2000.

The forecast of the food import requirement made on the basis of the above study is as follows:

(Unit: 1,000 tons)

1985	1990	1995	2000
286 - 353	486 - 563	721 - 814	1,012 - 1,126

12. Target Volume of Imported Cold Foodstuffs

The amount of cold foods imported by Arab Republic of Egypt has been fluctuating widely year by year. From the viewpoint of efficient investment, the Project has been formulated to cover a reliable forecast for import requirements in the near future.

In other words, the Project has been planned to establish a cold storage chain in the public sector by 1986 so that the Ministry of Supply and Home Trade will be able to deal with the target amount of 300,000 tons, by that year. This figure is almost equal to the lowest forecast figures.

13. Basic Concept in Planning Cold Storage Chain

In principle, the Study has been carried out to determine the main features of various facilities as well as the transportation means for smooth distribution of the target amount of imported cold foods determined in the Study. The marketing system planned for the Project will be developed as a "closed system".

14. Project Components

The main components of the Project consist of the following four items:

(1) Construction of cold storages for imported meat, chicken, fish, and dairy products in the three port areas of Alexandria, Port Said and Suez as well as in Greater Cairo.

(2) Construction of meat processing plants in Alexandria and the Greater Cairo for efficient distribution to consumers. The meat processing plant will be attached to the proposed cold storages in consumption areas.

(3) Improvement and strengthening of the transportation means to connect the port areas with Cairo which is the biggest consumer area of imported cold foods in Arab Republic of Egypt.

(4) Construction of an ice-making plant in Alexandria for cooling fresh fish and other consumables.

15. Considerations to be paid in planning the Cold Storages

Cold storages at ports have been planned aiming at accommodating as large a quantity of imported cold foods as possible. The big capacity of cold storages at ports has many merits.

The cold storages in the consumption areas will be provided with meat processing plants to meet the daily demand for foods in the consumption areas through their stable supply to consumers.

16. Capacity of the Cold Storages at Ports

The cold storage capacity under the Ministry of Supply and Home Trade would amount to 27,450 tons in August 1982 and this capacity is expected to grow to about 43,000 tons in 1986.

With a five times rotation of all these cold storages, cold foods of about 215,000 tons will be distributed through the public marketing system, and the difference of about 85,000 tons between 300,000 tons to be imported and 215,000 tons still remains to be dealt with by the public sector.

On the assumption of a five times rotation of the cold storages per year, the capacity necessary to accommodate this quantity is computed to be 17,000 tons.

A total cold storage capacity of 17,000 tons is allocated to each of the three ports as follows:

Name of Port	No. of Storage	Capacity (tons)
Alexandria	1	6,000
Port-Said	2	5,000
Suez	1	3,000
Cairo	1	3,000
Total	5	17,000

17. Cold Storages and Meat Processing Plants in Consumption Areas

Meat processing plants are planned to be constructed in the consumer areas.

Alexandria is a big area of consumption of cold foods. A GERCO reveals that half of imported foods stocked at cold storages in this city are locally consumed in Alexandria and the area along agricultural road leading to Cairo. Therefore, a meat processing plant will be attached to the proposed cold storage at port of this city.

Cairo is one of the largest areas of consumption of processed meat. A meat processing plant will be constructed in RAMADA. A cold storage of 3,000 ton capacity will be constructed in RAMADA for the smooth operation of the meat processing plant.

Both meat processing plants, one in Alexandria and the other in Cairo, have capacities of 25 tons per day.

18. Ice-Making Plant

In view of the increasing demand for ice for both fishery and home use in Alexandria in the future, the construction of an ice making plant with a capacity of 100 tons per day has been planned at a site near the fishery port.

19. Site Selection for Cold Storage, Meat Processing and Ice Making Plant

The site for the cold storages at the port have been selected from the closest place possible to a wharf taking such conditions as water supply, availability of electricity and labour force, foundation, shape of site, transportation and so on into consideration.

The sites and capacity for each of the cold storages, meat processing and ice making plants are as follows:

	Cold Storages	Meat Processing Plant	Ice Making Plant
Port Said -			
Abbas	2,000 tons		
Sherif	3,000 "		
Suez -			
Ataqa	3,000 "		
Cairo -			
Ghamra	3,000 "		
Ramada	3,000 "	25 tons/day	
Alexandria -			
El Dekihla	6,000 "	25 tons/day	100 tons/day
Total	20,000 tons	50 tons/day	100 tons/day

20. Transportation Plan

The transportation from cold storages at ports to those in Cairo will be changed. At present, the means of transportation are by ordinary trucks which are driven at night only, but will change to transport throughout day and night using refrigerator vans after the implementation of the Project.

21. Basic Concept in Physical Planning

(1) Cold Storages

Recently, almost all of the cold storages in Egypt are one-storied prefabricated buildings with a steel truss structure. The reason is that these buildings are much more advantageous than the conventional buildings because of their shortened construction period, high quality and accuracy of construction, considerably long durable life of construction materials against heat and condensation, and the securing good hygienic conditions. The Project adopted this type of building, with the height of 8 m for piling up pallets in four layers by forklifts.

The storage capacity of cold storages has been computed in accordance with the Egyptian criterion of 3.5 cu.m/ton.

Reinforced concrete slabs were considered for the foundation except that for the GHAMRA site in Cairo, is to be supported by pile, after consideration of the bearing capacity of the ground in each site on the basis of the data provided.

The design of the building is to have clear compound traffic, a compact and simple plan, functional entrances, economic energy, ease of operation and maintenance and so on.

After alternative studies on the use of freon (R-22) as refrigerant and the indirect refrigeration method employing brine, the direct expansion method using ammonia as refrigerant was adopted.

(2) Meat Processing Plant

The meat processing plant will be attached to the consumption-area type cold storages. The physical plan of the meat processing plant has been formulated aiming at efficient and hygienic processing works in accordance with the basic concepts presented in the Report.

(3) Ice Making Plant

The plant shall be equipped with an ammonia refrigerator, an ice making can, evaporation coils and so on for manufacturing 25 kilogram crystal block ice.

22. Operation and Maintenance Plan

For the purpose of maintaining the proper quality and hygienic condition of foods, it is necessary to give sufficient knowledge of the basic TTT concept to the persons concerned and to prepare the following manual for adequate training and education. Reading of these manuals should be made compulsory for the sake of strict quality control.

(1) Manual for hygienic control of plant
(2) Manual for processing
(3) Manual for receiving and forwarding of products
(4) Manual for cold storages office work

23. Schematic Plan of Facilities by Sites

(1) Cold Storages

	Compound Area	Floor Area	Cold Room Capacity	No. of Cold Rooms	Storage Temperature
Port Said -					
Abbas	2,475 m^2	1,864 m^2	500 tons	4	-25°C, 0°C Convertible
Sherif	3,270	2,444	750	4	-do-
Suez -					
Ataqa	10,000	2,350	750	4	-do-
Cairo -					
Chamra	5,140	2,605	750	4	-do-
Ramada	16,000	4,741	750	4	-do-
Alexandria -					
El Dekihla	20,000	7,656	1,500	3	-do-
			750	2	-do-

(2) Meat Processing Plant

	Meat Processing Capacity		Freezing Capacity	Capacity of Product Stockroom
	Bone Meat	Boneless Meat		
Alexandria - El Dekihla	5 tons/day	20 tons/day	4.25 tons	15 tons
Cairo - Ramada	10 tons/day	15 tons/day	8.5 tons	35 tons

(3) Ice Making Plant

	Compound Area	Floor Area	Ice-Making Capacity	Ice-Storage Capacity
Alexandria - El Dekihla	5,200 m^2	1,066 m^2	100 tons/day	200 tons

24. Project Evaluation

(1) Economic Benefit

- Cold Storage

(i) The prevention of cold food quantity loss and quality deterioration.

(ii) The import of large quantity of cold foods at times of relatively low international prices.

(iii) The stable supply of imported cold foods.

(iv) The reduction of demurrage of cargo ships for imported cold food.

It is difficult to quantify the benefit of the above (i) to (iii) because of the limited availability of data. Therefore, the expected reduction of demmurage "with project" can be counted as the primary benefit.

- Reduction of Demurrage -

	Port Said	Suez	Alexandria	Total
Total overstay (day)/1	233	243	171	647
Demurrage (L.E/day/day)	10,000	10,000	10,000	10,000
Total demurrage (L.E 1,000)	2,333	2,430	1,710	6,470

/1 --- See Table-27.

- Meat Processing Plant

(i) Part of meat processing works is saved at the retail stage.

(ii) Loss in the quality of imported cold meat is reduced because meat can be processed without thawing and preserved for long periods.

(iii) In case meat is imported in 2-3 kg bags instead of the current practice of importing in 30 kg boxes, expansion of storage capacity is necessary. Reduction of the increased cost of expansion is regarded as a benefit.

(iv) Value added to the final products through meat processing.

The price mechanism of imported cold foods in Egypt is characterized by what is called "backspread" or selling at the price lower than that purchased, however, the data are hardly

obtainable on the rate of government subsidy for imported cold foods. It is also quite difficult to quantify the items (i) and (iii) above. This study attempts to enumerate the project benefit assuming the cost of meat processing equal to the value added.

- Additional Cost of Meat Processing -

(Unit: L.E 1,000)

	Total Cost	Annual Cost
Initial Cost/1		
F/C	3,881	129
L/C	851	28
Sub-total	4,732	157
O & M Cost/2	-	635
Total	-	792

/1 --- See Table-28.
/2 --- See Table-29.

- Ice Making Plant

The benefit has been comptued based on the selling prices of the products multiplied by the volume of the yearly production.

- Incremental Production of Ice -

Capacity (ton/day)	100
Annual Operation (day)	300
Annual Production (ton)	30,000
Unit Price (L.E/ton)	10
Production Value (L.E/year)	300,000

Project benefit is summarized as below:

Source	Benefit (L.E 1,000/year)
Cold storage	6,470
Meat Processing Facility	792
Ice-making Plant	300
Total	7,562

(2) Economic Cost

Initial economic cost of the investment is estimated by multiplying the local currency portion of the initial financial cost of investment by the standard conversion factor.

- Initial Investment Cost -

(Unit: L.E 1,000)

	Initial Financial Cost (less price contingency)			Initial Economic Cost
F/C	26,915	x	1.00	26,915
L/C	15,053	x	0.80 (SCF)	12,042
Total	41,968		-	38,957

The annual operation and maintenance cost for the Project is estimated at L.E 1,441,600 as given in Table-30.

(3) Economic Internal Rate of Return

EIRR is calculated based on the economic benefit and cost estimated as above for the project life of 30 years. EIRR is also estimated for both cases without an ice-making plant at Alexandria and without an ice-making plant and cold storage at Alexandria. The summary is given below.

Case	EIRR (%)
- All Facilities Constructed	14.0
- Without Ice-Making Plant	14.5
- Without Ice-Making Plant and Cold Storage at Alexandria	15.3

(4) Sensitivity Analysis

The sensitivity analysis is conducted for cases where all the facilities are constructed and there is the result shown below.

Case	EIRR (%)
- 10% increase in Project Cost	12.4
- 10% decrease in Project Benefit	12.3
- Delay of 1 year in Construction Period	12.9

CHAPTER I. INTRODUCTION

I-1. Background

In response to the request of the Government of ARE for technical cooperation in Cold Storage Chain Development Project (hereinafter referred to as "the Project"), the Government of Japan decided to dispatch a study team to ARE for the feasibility study on the Project and for the transfer of technical knowledge to the Egyptian counterpart personnel in the field works.

The study team dispatched through Japan International Cooperation Agency (JICA), executing agency of technical cooperation programs by the Government of Japan, carried out a feasibility study in close cooperation with the Government of ARE, and with the Ministry of Supply and Home Trade and GERCO in particular.

I-2. Study

The Study on the Project consisted of the field works in ARE and the home works in Japan. In the preparatory home works begun on August 2, 1982, the data and information collected by the preliminary survey team, which was dispatched to ARE through JICA in June 1982 were analyzed to have an overview on the current demand for cold foods and on the existing conditions of cold storages and related facilities in this country inclusive of their operations.

The field works were carried out from August to September to work out a preliminary plan of cold storages, meat processing facilities, an ice plant, and the transportation means of cold foods necessary for the Project based on the forecasted demand for cold foods, the local food production, and the estimate of imported cold foods as well as the food supply policies of the Government of ARE. In addition, the chemical and physical properties of the water to be used were examined at a laboratory recommended by GERCO. At

the end of field work, an interim report was submitted to the Government of ARE (GERCO).

The home works were conducted from September to December, 1982 to formulate the Project plan based on the following analyses and studies;

a) Demand and supply trend of cold foods until the year 2000;
b) Capacity requirement of cold storages until the year 2000;
c) Capacity requirement of an ice plant in Alexandria until the year 2000;
d) Capacity requirement of transportation means for cold foods until the year 2000;
e) Selection of appropriate sites and priorities of cold storage construction;
f) Preliminary designs for cold storages, an ice plant, and meat processing plants for deboning, cutting, and packaging;
g) Economic evaluation of the Project;
h) Implementation plan of the Project;
i) Management of the cold storages; and,
j) Training program for the management personnel of cold storage.

1-3. Advisory Committee and Survey Team

Advisory Committee

The following are the members of the advisory committee and survey team who participated in the Project Study:

1. Chief Advisor

Mr. Hironobu Taguchi	Technical Advisor, Japan Meat Conference

2. Advisor		
	Dr. Takeo Tanaka	Chief of Frozen Food Section, Tokai Regional Fisheries Research Laboratory, Fisheries Agency, Ministry of Agriculture, Forestry, and Fisheries
3. Advisor		
	Mr. Akimune Ukai	Deputy Manager, Meat and Poultry Dept., Animal Industry Bureau, Ministry of Agriculture, Forestry, and Fisheries
4. Advisor		
	Mr. Yoshiyuki Ban	Deputy Manager, 2nd Technical Appraisal Div., Economic Research and Technical Appraisal Dept., The Overseas Economic Cooperation Fund (OECF)

Survey Team		Period of Field Survey
A. Field Survey		
1. Leader	Mr. Daizo Iseno	6 Aug - 20 Sept, 1982
2. Transportation System	Mr. Tsuyoshi Sasaki	6 Aug - 20 Sept, 1982
3. Marketing Economy	Mr. Ken Sakurai	6 Aug - 20 Sept, 1982
4. Livestock Marketing	Mr. Kensuke Iriya	21 Aug - 20 Sept, 1982
5. Fish Production	Mr. Yo Matsuzaki	21 Aug - 20 Sept, 1982
6. Cold Storage & Ice Plant Facilities	Mr. Mutsumi Ito	6 Aug - 20 Sept, 1982
7. Architecture	Mr. Tokio Oda	6 Aug - 20 Sept, 1982
8. Architecture	Mr. Tatsuro Shiobara	21 Aug - 20 Sept, 1982
9. Meat Processing	Mr. Junichi Tsujii	21 Aug - 20 Sept, 1982
10. Cold Storage Maintenance	Mr. Go Murayama	21 Aug - 20 Sept, 1982
11. Economic Evaluation	Mr. Yoshitomo Miyanishi	6 Aug - 20 Sept, 1982
B. Explanation of the Draft Final Report		
	Mr. Heijiro Yoshihara	7 Nov - 16 Nov 1983
	Mr. Ken Sakurai	-ditto-

I-4. Counterpart Personnel

The following are the Egyptian Government officials and the counterpart personnel who cooperated in the Project study:

1. Mr. Ahmed Ahmed Nouh	Minister of Supply and Home Trade
2. Mr. Hussein Fahmy	Chairman, GERCO Co. for Refrigeration & Engineering
3. Mr. Kamal Hamed Farag	Chief of Commercial Sector, GERCO Co.
4. Mr. Ahmed Nashar	General Director of Suez District, GERCO Co.
5. Mr. Amin Dabbous	Technical Director Alexandria Co.
6. Dr. Nessim Bashra	Chief Engineer, Alexandria Co.
7. Mr. Ahmed Mohamed El Kashuli	Staff, Alexandria Co.
8. Eng. Mahmound Fousad Ismail	Counterpart, Cold Storage Food Technologist, GERCO Co.
9. Mr. Saleh Aiyad	General Director for Ramada Cold Storage
10. Mr. Galal Ab El Mouty	Chief of Climate, the Egyptian Meteorological Authority
11. Mr. Moh Eissa	General Director of Port-Said District GERCO Co.

CHAPTER II. NATIONAL ECONOMY

II-1. General Description

II-1-1. Land

ARE is located in the northeastern corner of the African Continent, and is contiguous to Western Asia through Sinai and to the European Continent across the Mediterranean Sea.

ARE borders upon Sudan to the south at 22° N. Lat., Libya to the west at 25° E. Long., the Mediterranean Sea to the north, and the Red Sea to the east. The total national land is about one million square kilometers and is in a desert which stretches over the Arabian Peninsula to Northern Africa.

The areas presently developed and utilized as arable land or for permanent residences account for only four percent of the total national land, or about 36,000 square kilometers, and most of this is situated along the Nile river valley, in the Nile delta, and in oases scattered throughout the country.

II-1-2. Population

A series of population censuses was taken in ARE in 1937, 1947, 1960, 1966, and 1976.

The total population as revealed in the 1976 census was 38.20 million, of which Egyptians account for 36.51 million, foreigners 0.11 million, Sinai people 0.15 million, and migrant Egyptians abroad 1.43 million. The estimated population of 1981 is 44.00 million, which is 2.9 times as large as that of 1937 (15 million) (the population in 1882 was 6.71 million).

The population of the Eastern Nile Delta Region exclusive of the Greater Cairo urban area (6.7 million) is only 17.5 percent of the total population of ARE.

The following are the populations of the major cities;

(Units: 1,000 persons)

City	1976	1981(Forecast)
Greater Cairo	6,500	7,500 - 8,000
Alexandria	2,320	2,800
Port Said	263	300
Suez	194	230

Remarkable rural-urban migration in the recent years is reflected in the proportion of urban population in the respective censuses, the rate of which increased from 37.4 percent in 1960, to 40.5 percent in 1966, and to 43.9 percent in 1976.

In terms of religion, Muslims occupy 93.8 percent of the total population and the rest are Copts, Christians, Judaists (1,631 persons), and others (4,625 persons).

II-1-3. Administration

ARE is administratively divided into 25 governorates and each governorate is subdivided into districts. The study area covers the four governorates of Alexandria, Port Said, Suez, and Cairo.

II-2. Economic Situation

II-2-1. General

Since the introduction of the "Open-Door Policy" in 1972, the Egyptian economy has grown to a considerable extent owing to both the production of petroleum and the increased output in such

industrial sectors as metal goods, textile goods, foods, and so on. On the other hand, in spite of the increased investment through import of capital and intermediate goods, the growth rate of production remains comparatively low and so does the export growth rate. Furthermore, the increasing demand for public welfare along with the annual population growth rate of 2.5 percent calls for more imports of consumer goods, and therefore, the foreign trade deficit worsens.

II-2-2. Gross Domestic Product

Table-1 shows that GDP in 1977 was L.E. 7,341 million at current prices(L.E. 5,780 million at 1975 constant prices). The real average GDP growth between 1973 and 1977 was 6.3 percent per annum. The GDP per capita in 1977 was L.E. 149.2 or US$381 using the 1977 market exchange rate, and its real growth in the same period was 4.1 percent per annum.

Table-2 presents the output by sector at current prices where the total output grew by 22.2 percent per annum and the agriculture by 15.3 percent per annum between 1973 and 1979.

II-2-3. Price Indices

Price indices inclusive of both consumer prices and wholesale prices appear in Table-3. The annual increase in these indices between 1973 and 1980 is summarized as follows:

Prices	Annual Increase (%)
Consumer Prices(urban)	12.1
Consumer Prices(rural)	13.1
Wholesale Prices	12.0

Table - 1. National Accounts

(Unit: L.E. Million)

	1973	1974	1975	1976	1977
At Current Prices					
Exports	531	890	894	1,034	1,470
Government Consumption	1,020	1,101	1,213	1,571	1,576
Gross Fixed Capital Formation	462	640	1,228	1,385	1,769
Increase in Stocks	40	90	100	195	281
Private Consumption	2,339	2,871	3,281	3,863	4,505
Imports	-729	-1,395	-1,831	-1,772	-2,260
Gross Domestic Product	3,663	4,197	4,886	5,276	7,341
Net Factor Payments Abroad	-29	-112	-148	-158	-202
Gross National Expenditure	3,634	4,085	4,738	6,118	7,139
At 1975 Constant Price					
Gross Domestic Product	4,530	4,674	4,886	5,386	5,780
(Rate of Increase (%))	-	3.2	4.5	10.2	7.3
Per Capita G.D.P. (L.E.)	127.2	128.3	131.2	142.2	149.2
(Rate of Increase (%))	-	0.9	2.3	8.4	4.9
Population (million)	35.62	36.42	37.23	37.87	38.74

Source: IMF-IFS October 1980

Table - 2. Development of Production(At Current Prices)

(Unit: L.E. Million)

	1973	1974	1975	1976	1977	1978	1979
I. Commodity Sector							
Agriculture	1,486.2	1,846.6	2,052.1	2,407.2	2,840.5	3,472.8	3,726.0
Industry	2,642.2	2,939.7	3,404.1	3,773.1	4,248.6	4,929.8	6,164.0
Petroleum		290.3	385.7	574.8	696.1	854.8	2,476.0
Electricity	56.7	60.7	577.0	662.0	843.1	128.3	137.0
Construction	277.8	340.0	577.0	662.0	843.1	1,199.2	1,694.0
Sub-total	4,462.4	5,477.3	6,504.9	7,511.9	8,738.1	10,584.2	14,197.0
II. Services Sector							
Transportation & Communication	260.0	291.4	399.3	554.8	673.2	904.4	1,241.0
Finance and Trade	417.8	718.7	1,257.3	1,568.0	1,932.1	2,461.8	3,307.0
Housing	130.8	133.7	216.0	230.0	252.0	271.0	297.0
Public Utilities	23.6	26.7	28.3	31.1	35.0	40.0	47.0
Other Services	1,332.4	1,490.4	1,870.8	2,138.7	2,418.8	2,699.0	3,042.0
Sub-total	2,164.6	2,660.9	3,771.7	4,522.6	5,311.4	6,376.2	7,934.0
III. Grand Total	6,627.0	8,138.2	10,276.6	12,034.5	14,049.5	16,960.4	22,131.0

Source: Statistical Yearbook, July 1979 & July 1981

Table - 3. Price Indices

	1973	1974	1975	1976	1977	1978	1979	1980 1/
Consumer Prices (Urban Area) 2/								
Foodstuffs and Beverages	130.8	152.9	171.5	196.8	225.0	246.5	264.9	335.6
Housing	105.8	106.5	107.6	109.8	109.4	110.1	112.7	116.1
Clothing	113.3	124.2	136.7	145.3	172.7	225.2	246.2	284.3
General Number of Cost of Living	122.4	135.7	148.9	164.2	185.1	205.6	226.0	272.7
Consumer Prices (Rural Area) 2/								
Foodstuffs and Beverages	138.3	162.2	185.4	211.9	234.9	270.6	284.7	362.3
Housing	111.8	116.5	115.4	112.9	111.9	112.2	114.7	134.2
Clothing	125.4	145.9	168.5	189.4	215.2	244.7	275.0	339.1
General Number of Cost of Living	131.2	149.6	167.9	187.8	206.7	234.2	248.7	311.0
Wholesale Prices 3/								
Foodstuffs and Beverages	140.4	162.8	180.1	205.7	225.4	241.4	270.9	329.3
Petroleum and Fuel	128.0	136.5	143.5	154.3	159.1	168.6	190.3	230.6
Medicines	107.9	107.9	108.6	110.2	148.1	158.3	158.3	178.2
General Number of All Items	128.8	147.2	158.3	170.7	186.6	214.1	234.6	285.3

Source: Statistical Yearbook, July 1979 & 1981

Note : 1/ Preliminary Estimate

2/ 1966/1967 = 100, 3/ 1965/1966 = 100

CHAPTER III. THE STUDY AREAS

III-1. General Conditions of the Study Areas

III-1-1. Natural Condition

(1) Topography

a) Alexandria

The proposed site is located at El Dekihla near the site proposed for the construction of the new port. The site has a length of 150 m and a width of 130 m. The ground of the site should be levelled before construction of the cold storage.

b) Suez

The proposed site is about six kilometers from the center of Suez city, and located between the existing Attaqa No.2 and No.3 cold storages. Nearby run the railway and roads. The site is topographically flat, and five existing cold storages operate in the neighborhood.

c) Port Said

The proposed site is located close to the port, and provides a good handling and transoprtaiton network along with the flat topography. GERCO's existing cold storages and private ones are all located in the port area.

d) Cairo

Two sites have been proposed in Cairo; one at Ramada and the other at Ghamra. Two sites are close to the existing cold storages. The Ramada site is about 20 kilometers from the center of Cairo, and located along the agricultural road that connects Cairo with Alexandria.

Ghamra is located north-east to the center of Cairo, close to the fish market and along the Ismailia road that connects Cairo with Port Said. The road conditions from the two sites to Cairo are also favorable and both sites are topographically flat.

(2) Meteorological Conditions

Meteorological data for the three-year period from 1977 through 1979 are available and are shown in Figures 1 to 4. The annual rainfall in the four governorates ranges from maximum of 175.5 mm in Alexandria to a minimum of 35.1 mm in Cairo. Winter falls in the rainy season, but the climate is generally mild. The average maximum temperature in June from 1977 through 1979 was 34.8°C in Cairo, 29.7°C at Port Said, 30.3°C at Alexandria, and 35.4°C at Suez while the average of the minimum was 9.1°C at Cairo, 11.7°C at Port Said, 8.3°C at Alexandria, and 10.4°C at Suez. It is generally dry throughout the year except in July and August.

Egypt can be broadly divided into two climatic zones. The first includes the Delta area and is characterized by a Mediterranean climate - mild and a little rainfall in winter. The climate of Alexandria, Port Said, and Suez can be classified into this type. The second zone including all the areas in and to the south of Cairo has very little rainfall in winter and turns hot in summer. Cairo belongs to this type.

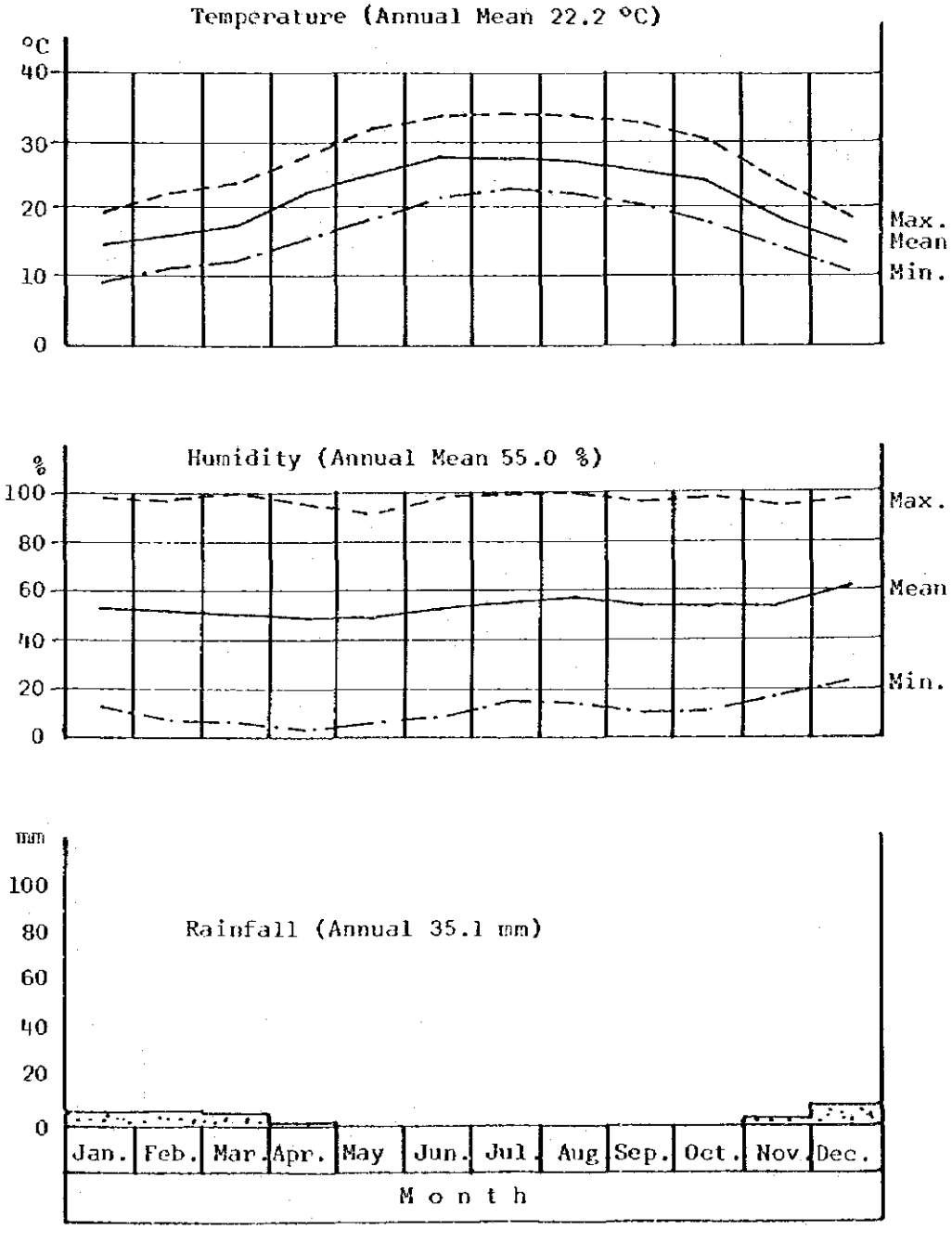
III-1-2. Socio-Economic Conditions

(1) Alexandria

Alexandria is the second largest city in ARE with a population of about 2.5 million, and has the largest port in this country. Facing the Mediterranean Sea, the port is capable of handling about 70 percent of the total imports and exports of ARE. It also plays an important role as a fishing port forwarding fresh fish caught in the Mediterranean Sea and nearby lakes to Cairo.

Figure - 1. Meteorological Conditions

Cairo

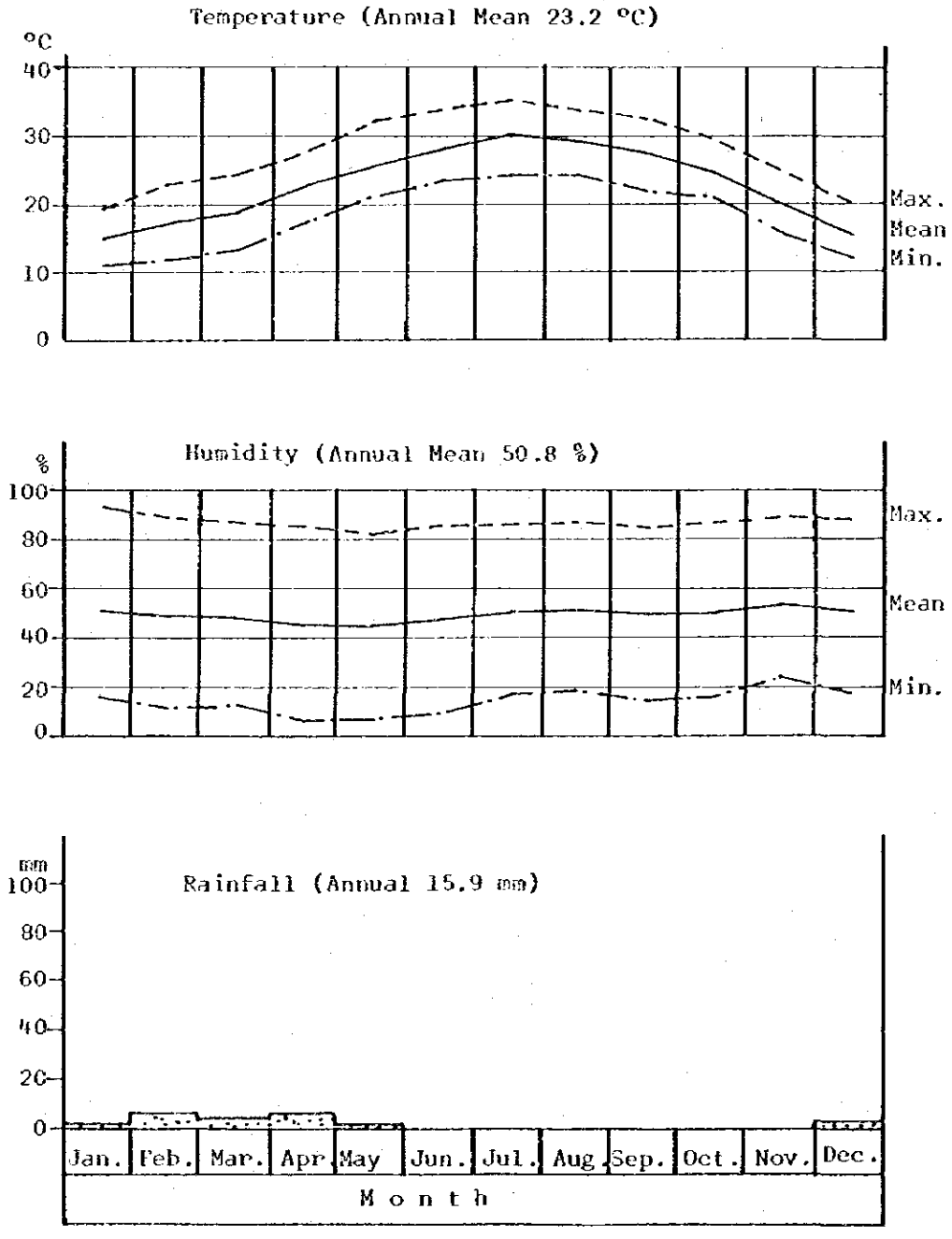


Source: The Egyptian Meteorological Authority

Observation Period: 1977 - 1979

Figure - 2. Meteorological Conditions

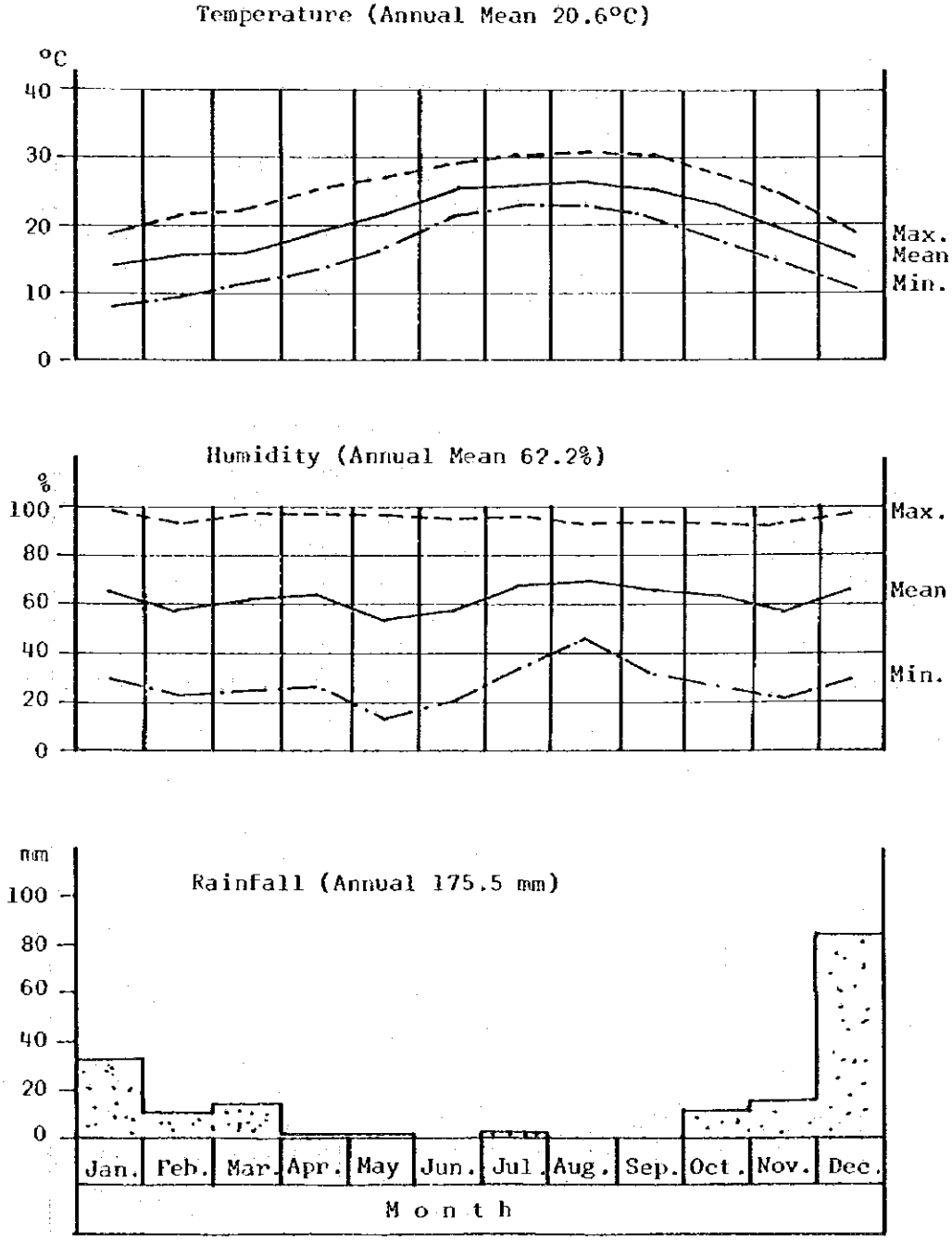
Suez



Source: The Egyptian Meteorological Authority
Observation Period: 1977 - 1979

Figure - 3. Meteorological Conditions

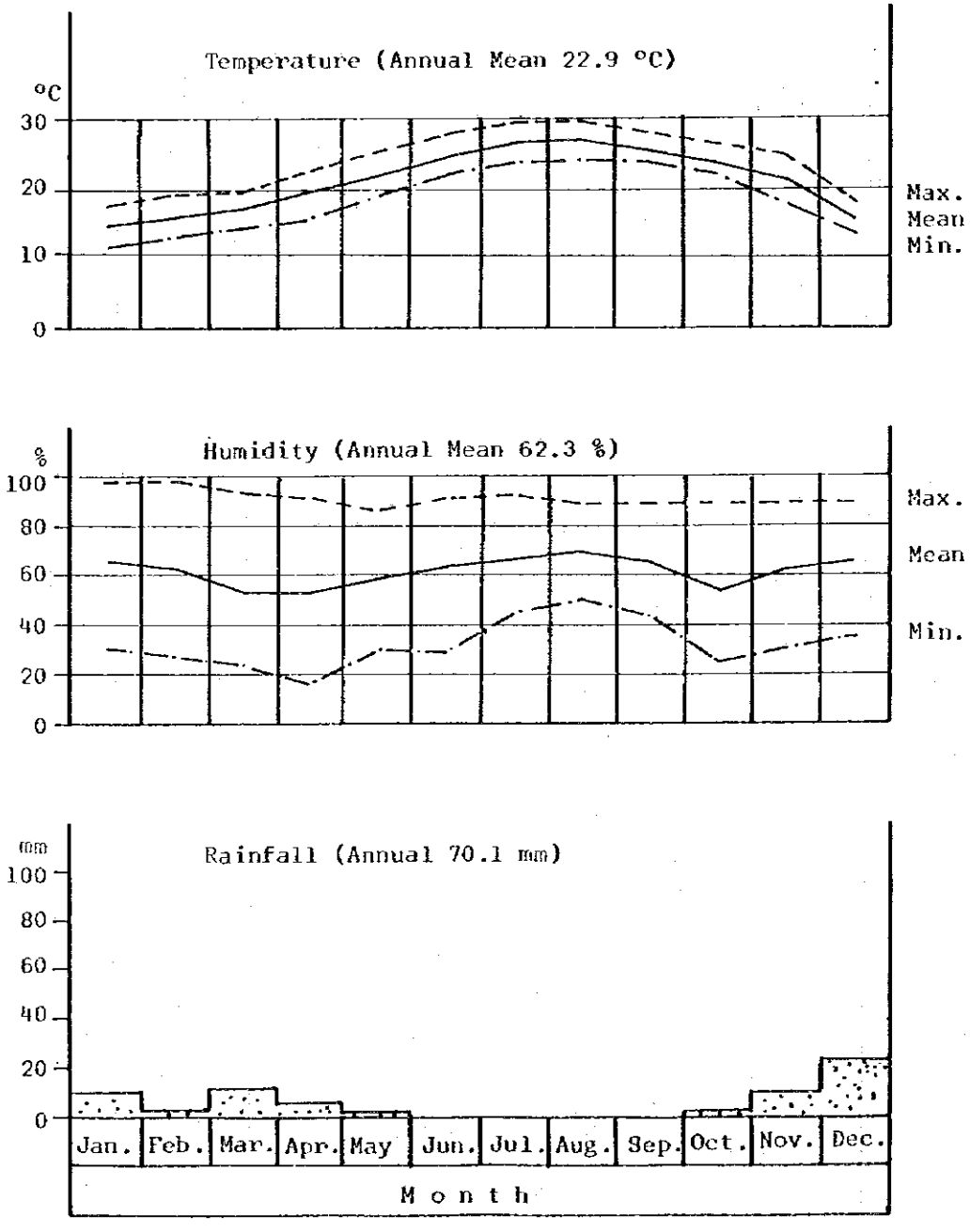
Alexandria



Source: The Egyptian Meteorological Authority
Observation Period: 1977 - 1979

Figure - 4. Meteorological Conditions

Port Said



Source: The Egyptian Meteorological Authority
Observation Period: 1977 - 1979

Alexandria is connected with Cairo by the railroad and by the two main roads of an agricultural road (225 km) running through the granary of Nile Delta and a desert road (221 km).

Blessed with the geographical and moderate climatic conditions of the Mediterranean Sea, Alexandria attracts many tourists throughout the year. Reportedly, its population expands by about 1.5 million during the busy season to result in an increased demand for consumer goods.

(2) Port Said

Port Said is the starting point of the Suez Canal on the Mediterranean Sea side, and is the second largest port in Egypt. The total population was about 285,000 in July, 1980, and most of these were urban dwellers.

Port Said is connected with Ismailia by a truck road, and from to Cairo by an agricultural road and a desert road, which ensures the smooth surface transportation between the two cities.

Port Said has a so-called "free-zone" where the Egyptian Government provides incentives for the encouragement of overseas investment.

(3) Suez

Suez is the starting point of the Suez Canal at the side of the Red Sea and has the third largest port in Egypt. The total population was about 217,000 in July, 1980, and most of these were also urban dwellers.

Suez is connected with Cairo by a desert road, and located closer to Cairo than Alexandria and Port Said.

(4) Cairo

Cairo is the capital city of Egypt and had a population of about 5.5 million in 1980, and plays a major role in political and economic affairs, and is the center for most of the functions of both the public and private organizations.

The total population of Cairo has increased by about two million over the last 10 years, and is forecast to reach over eight million by the year 2000. "The Greater Cairo", as often referred to recently, includes, besides Old Cairo, a part of Giza and Kalyubia Governorates, and forms the country's largest consumer area.

Greater Cairo, like most of the capitals of other countries, faces various urban problems such as unemployment, shortage of housing, traffic congestion, and so on. While the increase in consumer prices remains rather high, those of basic food and daily necessities are controlled by the government through subsidies, which contributes to the stabilization of the livelihood of the nation.

III-1-3. Marketing System of Cold Foods

The population of ARE has increased from 25 million to 42 million in the past 20 years, and is forecast to exceed 65 million by the year 2000. To meet an increasing demand for food is, therefore, a serious concern of the country.

ARE has cultivable lands only in the Nile Delta and strips along the Nile river. Despite a great effort for the increased production of foods, the production index per capita has been constantly decreasing recently, resulting in rising dependence on imported foodstuffs. The self-sufficiency of the staple food of wheat is already below 30 percent. It is noted that recently the import of animal protein such as meat, fish, and dairy products shows a remarkable increase as in Table-4.

Table-4. Imported Cold Foodstuffs

(Unit: ton)

	1978	1979	1980	1981
Beef	46,597	34,277	73,814	115,119
Chicken	8,582	27,453	54,354	110,286
Fish	52,974	23,070	36,144	86,499
Cheese	12,207	15,067	14,146	*
Butter	27,174	22,008	35,207	*
Total	147,534	121,875	213,665	

Note: 1981 data from GERCO records.
* denotes no data are available

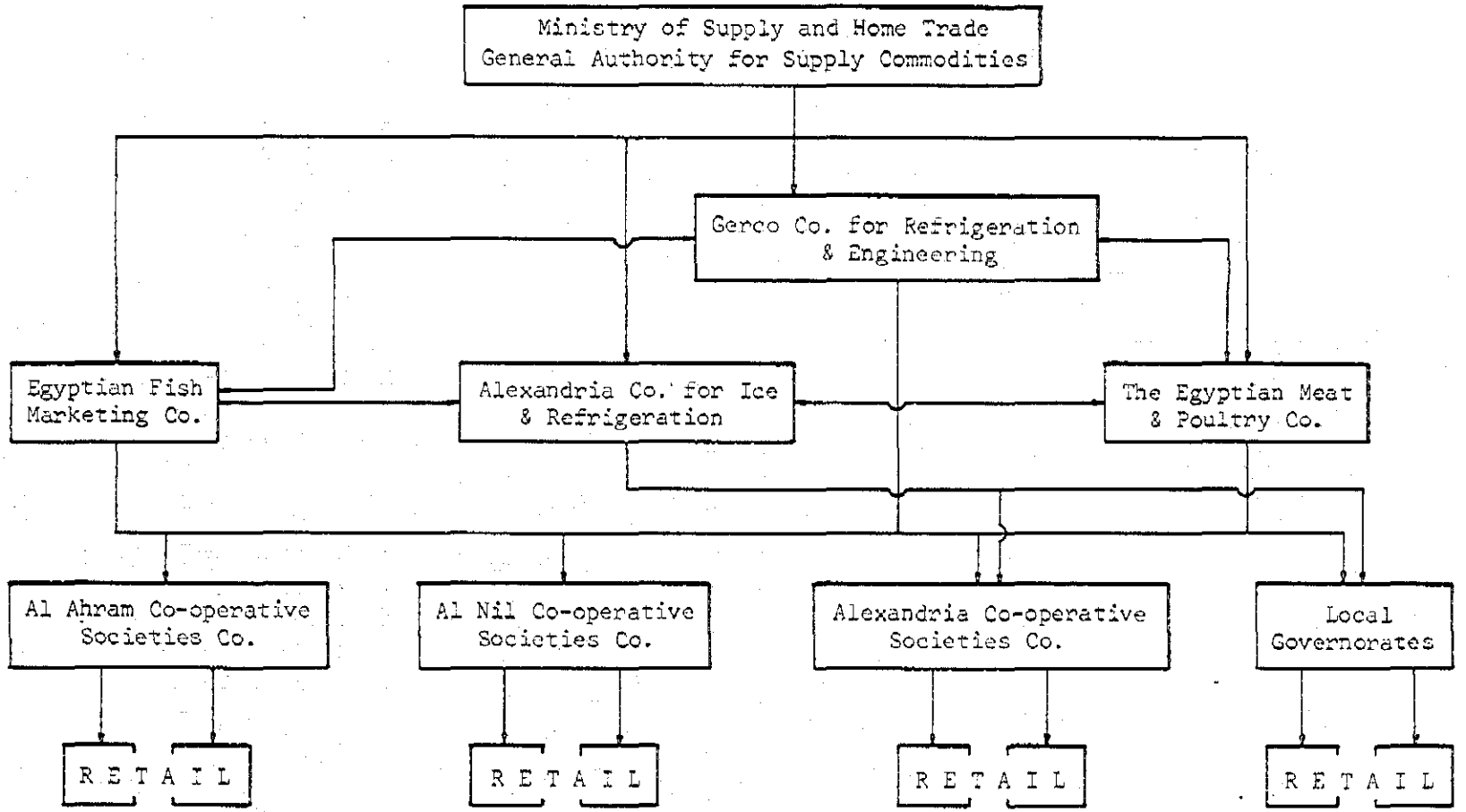
Source: Monthly Bulletin of Foreign Trade, Central Agency for Public Mobilization & Statistics

The Ministry of Supply and Home Trade is responsible for the observation of trend in demand and supply of foods and the control of their importation and distribution. Actual administrative works inclusive of purchasing from abroad are managed by the General Authority for Supply Commodities, a sub-organization of the said Ministry. Under the Ministry's authority, four specialized companies in the public sector are in charge of unloading and domestic distribution of imported meat and fish, etc., and the retail is taken care of by cooperative societies companies. The organization chart appears in Figure-5. Imported meat, fish, and dairy products are supplied to consumers through the above-mentioned marketing system.

The most important thing in the domestic distribution of imported cold foods is to supply them to consumers without deterioration of the quality since valuable foreign currencies are used for their purchase. It will, therefore, be necessary to strengthen the cold storage chain system, the total system for distributing cold foods inclusive of the storage at an appropriate temperature for each food, meat processing, transportation, and marketing, etc.

It was not until 1976 that the marketing volume of imported cold foods showed the rapid increased, as can be seen in Table-5.

Figure - 5. Organization Flow Chart For Cold Foods



Before that year, the majority of imported foodstuffs was living animals, and cold foods imported were only some 10,000 tons per year. It is observed that a noticeable difference took place around 1976 in imported fish and dairy products as well. As was shown in Table-4, a further remarkable increase in imported cold foods has been recorded in recent years. For instance, imported meats including chicken increased from 60,000 tons in 1978/79 to 128,000 tons in 1980, and furthermore to 225,000 tons in 1981. Therefore, the strengthening of the Cold Storage Chain System is indispensable to cope with the dramatic increase in imported cold foods.

Table-5. Imported Foodstuffs from 1970 to 1979

Year	Bovine not for Breeding (head)	Sheep & Goats (head)	Meat chilled or frozen (ton)	Fish chilled or frozen (ton)	Dairy Products (ton)
1970	8,040	19,977	5,653	1,070	7,471
1971	399	-	11,472	-	6,708
1972	7,967	11	11,881	1,382	3,884
1973	29,891	-	11,784	12,449	3,201
1974	9,177	13,954	6,319	18,276	10,440
1975	-	62,529	11,236	25,225	19,161
1976	-	19,465	35,629	40,262	43,581
1977	-	-	46,805	28,400	38,435
1978	-	-	55,659	53,766	59,844
1979	415	-	63,288	25,174	52,310

Source: Monthly Bulletin of Foreign Trade, Central Agency for Public Mobilization & Statistics

On the other hand, meat and fish domestically produced are mostly distributed through private marketing systems. The majority are supplied at slaughterhouses and markets to consumers without being stored in cold storages except part of the fish from High Dam Lake and the fish sold at supermarkets for foreign residents.

Retail stores under the above-mentioned cooperative societies companies also deal with domestically produced meat. To expand the marketing system, the companies have begun the construction of large-scale processing facilities for domestically produced meat. It is considered that the Government of ARE will strengthen its administrative guidance in the distribution of domestically produced meat in the future as part of its commodity price policy.

For reference, the prices of meat at retail stores under the cooperative societies companies in September, 1982 are given below;

	Price
° Domestic beef (bone meat is cut and sold on the spot)	LE 2.50/kg
° Imported boneless beef (processed cold meat in 1 to 3 kg packages)	LE 1.00/kg
° Imported bone beef (after natural thawing, bone meat is cut and sold in pieces)	LE 0.68/kg

The marketing cost of meat covering the expenses incurred in importing, hauling, storing at cold storages, processing and distribution, etc., are borne by the Government. This is the basic marketing pattern of daily necessities in ARE.

III-2. Existing Cold Storage Chain System

III-2-1. Cold Storages

Information obtained through a series of field surveys on the existing cold storages owned by GERCO Co. and Alexandria Co. is summarized in Table-6.

Several cold storages such as El Kabbary at Alexandria, New Abbas at Port Said, Suez at Suez, and Ramada at the Greater Cairo are equipped with the latest facilities. However, the facilities of

TABLE 6. EXISTING COLD STORAGES

Area	Name of Cold Store	Year of Built	Capacity (tons)	Scale Room Nos. x tons	Temp. °C	Remarks
1. ALEXANDRIA	EL KABBARY NO.2	1982	2,500*	6 x 420	-27	
			2,000	3 x 650	0 - -5	
2. "	EL LABBAN	1937	2,000			Ice Making (60 tons/day)
3. "	EL WARDIAN	1966	1,500	10 x 250	-20	Meat Process (20 ")
4. PORT SAID	SHERIF	1951	1,000	6 x 100	-10 - -22	
		Renew 1976		2 x 100	0 - -4	
5. "	ABBAS	1944	950		-15	
					-5	
6. "	NEW ABBAS	1982	2,000*	4 x 500	-25	
7. SUEZ	ATAQA No.1	19___	1,200	10 x 120	-17	
8. "	No.2	1977	1,500	10 x 150		
9. "	No.3	19___	1,200	10 x 120	-17	
10. "	NEW SUEZ	1960	1,500	10 x 150	-20	
11. "	SUEZ	1981	2,500*	4 x 625	-25	
12. CAIRO	GHAMBRA	1963	1,500	6 x 200	-10	
				2 x 200	-15 - -20	
13. "	RAMADA	1978	12,000	9 x 1,000	-25	Meat Process (30 tons/day)
14. "	RAMLET BOLAK	1978	1,100	4 x 750	0	
TOTAL			34,450			

NOTE: Cold Storages marked with * are under construction and are 7,000 tons in total.

Source: GERCO Co.

others are rather old though some of them are operated well through good maintenance works such as Attaqa No.1 and No.3 at Suez which started operation in the 1920's and 1930's, respectively. It was observed that the room temperature at these storages was not kept at the optimum level due to the age of the facilities. The F-category room temperature ranging from -13°C to -15°C might deteriorate the quality of stored foods. Even if the storage period of food is short, it is desirable that the room temperature be kept at the international standard of below -18°C.

Most of the old cold storages have a storage capacity of around 1,000 tons with a small cold room with a capacity of 100 to 200 tons whereas the latest storages such as the above-mentioned El Kabbary, New Abbas, Suez, and Ramada, etc., are provided with a large cold room with a capacity of 500 tons to 1,000 tons. Except those of El Kabbary and El Labban, most of the cold storages are one-story with superstructure. The old storages are built with bricks or stones and insulated with carbonized cork board on the inside, while the new ones are built with reinforced concrete, and insulated with prefabricated sandwiched panels.

All storages owned by GERCO Co. and Alexandria Co. use ammonium as a refrigerant. The old and the new storages adopt indirect and a direct expansion system respectively. In particular, Ramada Cold Storage adopts a liquid circulation system.

As for the compressors for refrigeration, the horizontal double acting compressors have been replaced with vertical single acting ones, and then with the higher speed multi-cylinders (H.M.C.). Recent cold storages are equipped with the H.M.C. while Suez Cold Storage uses the screw compressors.

III-2-2. Meat Processing Plants

The existing Wardian meat processing plant in Alexandria and the Ramada plant in the suburbs of the Greater Cairo have been

operating for simple works of band-sawing imported cold boneless beef (30 kg/pack) into small loaves of one, two, two or three kilograms, which are then packed in vinyl bags to be forwarded to markets. The vinyl bags containing one kilogram (205 mm wide x 300 mm long), two kilograms (255 mm wide x 344 mm long) and three kilograms (305 mm wide x 473 mm long) are printed in pink, black, and blue, respectively. After weighing, the packed vinyl bags are heat-sealed and put in plastic containers (435 mm wide x 545 mm long x 315 mm high) of about 20 to 24 kg/container, which are hauled to forwarding platforms by manpower.

The present structural design of meat processing plants visited by the Study team require intensive manual labor in hauling. In principle, meat has to be forwarded to markets immediately after processing since additional labor is otherwise necessary for storing it in cold rooms again. Under the circumstances, no further increase in the productivity of labor intensive plants can be expected.

It will be essential to standardize the manual works, to improve management for food hygienic and safety in work operations, and to systematize the quality control inclusive of the efficiency check in processing.

The existing Wardian meat processing plant at Alexandria is of a particularly old-fashioned open-type with an insufficient compound space, and has no belt conveyor system. Even at Ramada plant near Cairo, which was completed four years ago, only one belt conveyor out of two is operated for meat processing. As regards Ramada plant, some structural constraints seem to prevail in attaining the effective production and quality control of products.

Under these conditions, it is strongly desired that modern meat processing plants of the labor saving type will be constructed with a high productivity, upgraded quality control system and a hygienic working environment.

III-2-3. Ice Plants (Alexandria)

At Alexandria, all ice plants produce 25kg block ice. As for the ice making process, a block of ice is produced in an ice making can with the volume of 25kg immersed between the freezing pipes which are installed inside an ice making tank filled with brine. According to the personnel in charge, white ice is used mainly for the storage of fish, and a considerable amount is demanded for home consumption during the summer. The population in Alexandria increases by 1.5 million in summer because of tourists and about 400 tons of ice per day is necessary for the increased population.

The current total capacity of ice plants in Alexandria under the public sector is 565 tons per day as given below.

Plant	Capacity(ton/day)
Mahmoudia	210
Kabbary	160
Labban	60
Moharrem Bey	70
Marsa Matrouh	10
Kafr El Sheikh	30
Shebin El Kom	25
Total	565

In addition, two ice plants with a capacity of 50 ton/day each will be constructed and begin operation by the middle of 1983.

Alexandria is one of the largest fishery bases in Egypt, and handling about 15 percent of the marine fish and about 37 percent of inland fish from Maryut, Bardawil and Idku lakes, etc, or totally 100 to 120 tons per day on the average. In order to keep the fish fresh, about 250 tons of ice is required daily for both

fishing boats and trucks for transportation. However, it seems difficult to secure sufficient ice to maintain the appropriate level of freshness for all fish landed at the port.

III-2-4. Handling and Transportation

(1) Fresh Fish

So far as Ghamra market in Cairo is concerned, fresh fish are mostly hauled by truck. Flat wooden boxes and crates (baskets knitted with coconut palm fiber) are usually used to transport fish. Crabs are mainly held in crates laid with reeds.

When fish are brought to the market, ice is not usually used to keep them fresh. Shrimps are thinly covered with ice. Large kinds of fish such as ray and shark are transported without ice and laid on the floor of the market until the auction is over. Flaked ice is then crushed and spread over the fish in boxes at the market.

Auctioned fish are usually transported by small trucks from the market to the retail stores. Handling of fish in and out of the market is mostly performed by manual labor. Even carts are not used due to the high threshhold across the doorway and the extremely uneven floor inside the market.

(2) Cold Foods

Cold foods imported at ports (Alexandria, Port Said, and Suez) are hauled to the consumers mainly through road networks(see Map of Location). The road distance between Alexandria and Cairo is 221 km, Port Said and Cairo 220 km, and Suez and Cairo 134 km.

The imported cold foods are first unloaded by ship's cranes or derricks directly onto the wharf or temporarily to a barge and then

to the wharf. In the former case the unloading capacity is 500-600 ton/night, and in the latter case about 300 ton/night.

Secondly, the cold foods are either transferred to the cold storage at the port or transported by trucks to the inland cold storages close to the consumer. Almost every truck carries about 700 boxes of meat of 30kg each, to make a load of more than 20 tons. Since the cold foods on the truck are merely covered with a tarpaulin sheet, the temperature may go up considerably even when transported during the night.

Cold foods are unloaded manually from the truck onto the platform. At the old cold storages, foods are manually transferred from the platform to the cold room in almost all cases except some cases where forklifts are used. Some new cold storages use forklifts to carry pallets on which goods are manually loaded.

Thirdly, in case of cold meat, it is cut and packed into three kilogram lots and sent by trucks from the cold storages in the consumer area or near the port to the retail shops. The loading capacity of trucks at this stage ranges mostly from one to four tons.

CHAPTER IV THE PROJECT

IV-1. Objectives and Components of the Project

IV-1-1. Objectives

The Project aims to establish necessary cold storages, meat processing and ice plants in the public sector as well as improving the means of transportation of imported cold foods in the public sector.

With an annual average growth rate of 2.5 percent for the past 20 years, the total population exceeded 42 million in 1980. The population increase might continue in the future despite various efforts of the Government to suppress it. An increase in income per capita generally affects the demand pattern of food, and specially raises the demand for animal protein.

Apart from it, the limited arable land owing to insufficient water resources and the existing agriculture, which attaches high priority to the cultivation of cotton and wheat, have depressed the production of fodder crops, resulting in a shortage of most domestic animal products except chicken.

To meet the increasing demand for animal products, the Government is forced to expand the import of cold foods year by year, and eventually to increase the capacity of cold storages and other related facilities. At present imported cold foods have exceeded 300,000 tons per year.

The Ministry of Supply and Home Trade is responsible for the procurement, storage, distribution, and price control of all commodities supplied in ARE. The General Authority for Supply Commodities, executing body of the Ministry of Supply and Home Trade, controls all activities related to the supply of commodities.

GERCO Co. for Refrigeration & Engineering and Alexandria Co, the major public companies under the Ministry, are directly in charge of the management of cold storages and the handling of cold foods.

IV-1-2. Components

The main components of the Project consist of the following;

(1) Construction of cold storages for imported meat, chicken, fish, and dairy products in the three port areas of Alexandria, Port Said, and Suez as well as in Greater Cairo.

(2) Construction of meat processing plants in Alexandria and Greater Cairo for efficient distribution to consumers. The meat processing plant will be attached to the proposed cold storages in the major areas of consumption.

(3) Improvement and strengthening of the transportation means to connect the port areas and Cairo, which is the largest area of consumption of imported cold foods in ARE.

(4) Construction of an ice plant at Alexandria for cooling fresh fish.

IV-2. Development Plan

IV-2-1. Demand and Supply Analysis

(1) Population Forecast

The population of ARE increased from 25.8 million to 42 million during the twenty-one years from 1960 to 1980. The average growth rate during 1960 to 1969 was 2.52 percent per year, and slightly increased to 3.05 percent during 1978 to 1980. From this trend, the population of ARE is forecast to increase to 52.5 million by 1990 and to 65 million by the year 2000.

"A Statement on the Population of the Arab Republic of Egypt" issued by the Central Agency for Public Mobilization & Statistics in November 1981 forecasts that the population of 44 million in 1981 (22.34 million male and 21.66 million female) will increase to 66 million by the year 2000. This forecast is slightly higher than that mentioned above, but the difference is less than 1.5 percent. The demand and supply forecast in the Project is made based on the forecast population of 65 million in 2000.

In forecasting the future consumption of foods, the resident population of Egyptians in overseas countries shall be deducted from the total population. Statistical data of the above-mentioned agency show that about 1.6 million Egyptians live overseas. This population is estimated to increase to 1.8 million in 1990 and to 2.1 million in 2000. Therefore, the demand and supply forecast is made based on the resident population in ARE of about 63 million in 2000 (see Table 7).

Table 7. Population Forecast

(Unit: 1,000)

Year	Total Population	Population Abroad	Population in ARE
1960	25,832	-	-
1961	26,579	-	-
1962	27,257	-	-
1963	27,947	-	-
1964	28,659	-	-
1965	29,389	-	-
1966	30,203	-	-
1967	30,892	-	-
1968	31,596	-	-
1969	32,316	-	-
1970	33,053	-	-
1971	33,807	-	-
1972	34,578	-	-
1973	35,366	-	-
1974	36,172	-	-
1975	36,997	-	-
1976	37,841	(1,425)	36,416

1977	38,794	(1,444)	37,350
1978	39,819	-	-
1979	40,983	(1,434)	39,549
1980	42,289	(1,578)	40,711
Estimate 1/			
1985	46,971	(1,677)	45,294
1986	48,004	(1,705)	46,299
1990	52,564	(1,825)	50,739
1995	58,625	(1,973)	56,652
2000	65,156	(2,121)	63,035

Source: Statistical Yearbook
Note: 1/ Population was estimated by the regression equation using the above data.
- No data available.

(2) Forecast of Food Demand

The FAO statistical data indicate that the daily calory intake per capita in ARE was 2,540 Kcal during 1969 to 1971 and increased to 2,949 Kcal during 1978 to 1980. The said data also suggest that so far as the calory intake is concerned the nutritive condition of Egyptians is on a relatively high level in comparison with that in other countries specially in Africa and Middle East. According to the data, the calory intake of Japanese of 2,916 Kcal was nearly equal to that of Egyptians (refer to Table B-1 of Appendix)

The "Statistical Indicators" issued by the Central Agency for Public Mobilization & Statistics describes the food composition of middle-class Egyptians as below; (See for details Table B-3 of Appendix)

Cereals

The major source of nutriments for Egyptians is cereals. About 70 percent of their total caloric intake depends on cereals. The yearly cereal consumption per capita was 216.9 kg in 1969, and increased to 281.1 kg in 1978. This increase is mainly attributable to an increase in cereal consumption as a staple food. However, the recent tendency is that the rate of calory intake from cereals is gradually decreasing.

Vegetables and Fruits

The yearly consumption per capita of vegetables and fruits was 151.4 kg in 1969 and 152.6 kg in 1978. There was no remarkable increase in their consumption.

Sugar, Beans, Vegetable Oils and Fats, and Other Vegetable Food

The consumption of sugar, vegetable oils, and vegetable fats is increasing of late. As a result, the rate of caloric intake from these items increased from 10.7 percent in 1969 to 15.0 percent in 1978.

Meat and Chicken, Fish, Dairy Products, and Egg

The annual consumption per capita of these animal foodstuffs totaled 60.6 kilograms in 1969, and increased to 67.5 kilograms in 1978. The consumption of dairy products hardly increased from 1969 to 1978, and remained at about 48 kilograms. On the other hand, the consumption of meat and chicken, and fish increased from 8.8 kilograms to 12 kilograms and from 2.4 kilograms to 4.7 kilograms, respectively, during the same period. Their rates of increase were 36.4 percent and 95.8 percent, respectively.

In addition to an increase in per capita consumption, the present population of 42 million itself is forecast to grow to 65 million by the end of the year 2000, to be about 1.5 times as large the population at present. It is therefore an urgent necessity to institute proper measures for the stable supply of sufficient food for the increasing population. A great effort will be necessary to secure a sufficient quantity of vegetables, and animal foodstuffs.

The per capita demand for foodstuffs related to the Project as of 2000 is herein forecast by categorizing them into meat and chicken, fish, cheese, and butter.

The forecast is made only by time series analyses due to the limited data available. With respect to the annual consumption per capita, the data prepared by the Central Agency for Public Mobilization & Statistics are available as mentioned above (see Table 8). However, since the data deal with cheese and butter as one item under the "dairy products", reference is made to the FAO statistical data on milk presented in "Production Yearbook".

Meat and Chicken

The FAO data show the total yearly per capita consumption of both meat and chicken. Therefore, these two items are not separated in forecasting the future demand. A regression analysis is made to obtain a trend from 1969 to 1978 for the yearly per capita consumption of meat and chicken as follows;

$$Y = 0.2788\ x - 10.2109 \quad \ldots\ldots\ldots\ldots\ldots \quad (1)$$

By substituting the year 79 for x, the per capita consumption in 1979 is computed at 11.8 kilograms. On the other hand, the data from the "Meat Problem in ARE" published by the Ministry of Agriculture indicate that the per capita consumption in the same year was 12.8 kilograms. This figure is higher, to a considerable extent, than the forecast consumption per capita by the above regression equation. Therefore, the following regression equation is developed by adding the consumption per capita of 12.8 kilograms.

$$Y = 0.3236x - 13.4400 \quad \ldots\ldots\ldots\ldots\ldots \quad (2)$$

Table 8. Trend in Annual Consumption per Capita of Meat & Chicken, Fish and Dairy Products

(Unit: kg)

Year	Chicken	Fish	Dairy Products	Egg
1969	8.8	2.4	48.1	1.3
1970	8.8	2.2	48.1	1.4
1971	9.1	2.2	48.1	1.4
1972	10.9	2.2	49.3	1.5
1973	10.9	2.2	48.5	1.5
1974	10.9	2.6	48.2	1.5
1975	10.6	2.9	48.2	1.8
1976	10.2	3.7	50.4	1.5
1977	10.6	3.3	48.2	1.8
1978	12.0	4.7	47.5	3.3
1979	12.8	4.4		
1980	13.8	5.0		

Source: 1) 1969 - 1978 data from Statistical Indicators, published in 1979 and 1981, Central Agency for Public Mobilization & Statistics
2) 1979 data from Meat Problem in ARE, MOA
3) 1980 data from MOP publications

It is considered that the figures in Table-9 are still smaller than actual ones in 2000 since the above computation was made on 1970 data only. The demand of meat is sharply increasing in recent years due to the improvement of the living standard, and the increase in the urban population as compared with the rural population, and increased expatriate residents and tourists from overseas countries. To meet the increasing demand, meat imports increased sharply from 55,000 tons in 1978 to 62,000 tons in 1979, 128,000 tons in 1980, and 225,000 tons in 1981(See Table 4). From the records from January to August, 1982, it is judged that meat imports this year would be probably less than that in 1981. It suggests that the large meat imports in 1981 were attributable to both an increased demand and a drop in domestic production. Apart from it, the per capita consumption of meat in the 1980s is larger than that in the 1970s. The annual per capita consumption in 2000 is forecast by the following equation based on the consumption in 1980;

$$Y = 0.3755x - 17.1932 \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (3)$$

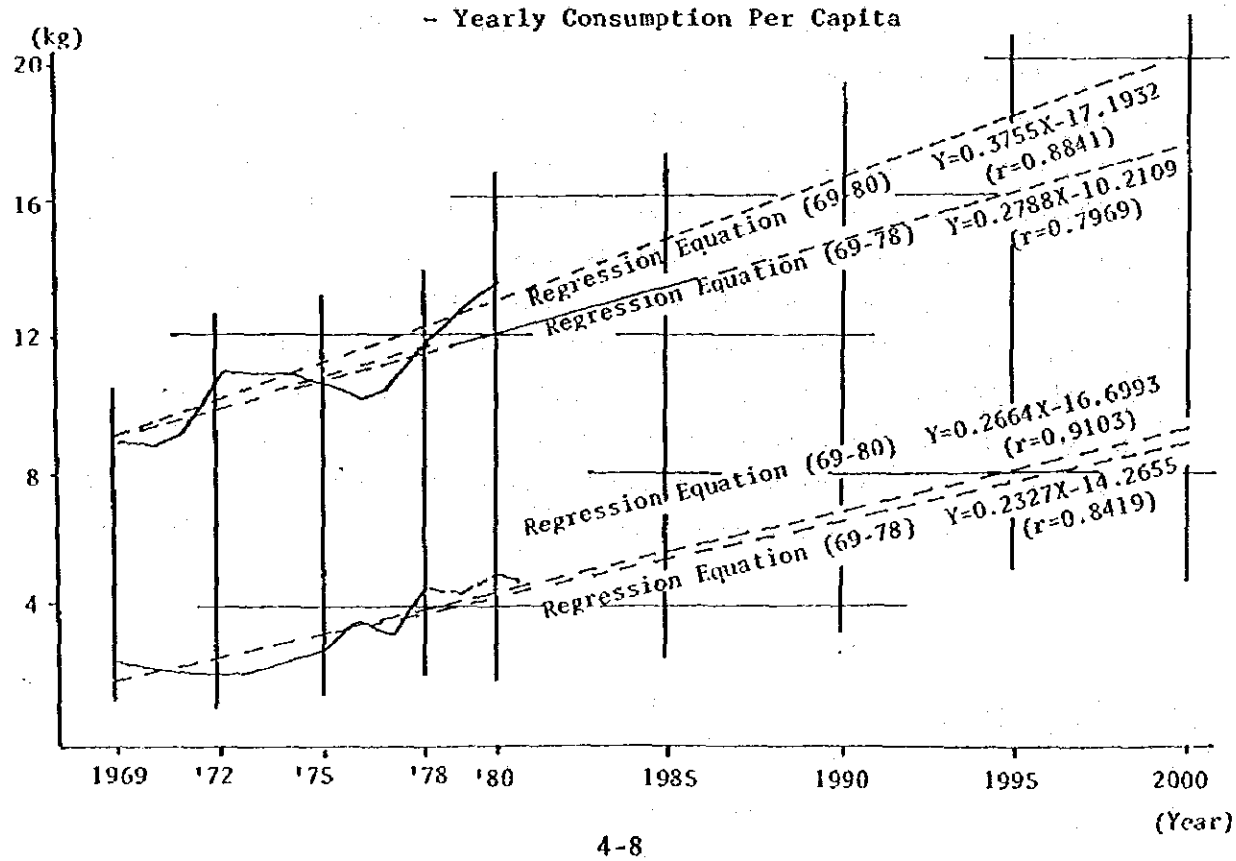
The future demand for meat and chicken will be somewhere in between the estimates obtained through regression equations (1) and (3). The yearly per capita consumption of meat and chicken is forecast as shown in the column B of Table-9.

Table-9 Forecast Demand and Supply in Target Year 2000
-Yearly Consumption Per Capita

(Unit: kg)

	Meat and Chicken			Fish		Cheese & Butter
Year	Based on 1969-78 rate	Based on 1969-79 rate (A)	Based on trend since 1980 (B)	Based on 1969-78 rate	Based on 1969-79 rate	Based on 1970-79 rate
1985	13.5	14.0	15.4	5.5	5.7	2.6
1990	14.9	15.7	17.1	6.7	6.9	2.9
1995	16.3	17.3	18.7	7.8	8.1	3.1
2000	17.7	18.9	20.3	9.0	9.4	3.4

Figure-6. Past Ten-Year Trend and Forecast till 2000
- Yearly Consumption Per Capita



Note; 1) 1969 - 1978 data from Statistical Indicators, published in 1979 and 1981, Central Agency for Public Mobilization & Statistics
2) 1979 data from Meat Problem in ARE, MOA
3) 1980-81 data from MOP publications

Fish

The following equation is obtained as a result of the regression analysis based on data shown in Table-8;

$$Y = 0.2327x - 14.2654 \text{ (1969-78 data)}$$
$$= 0.2644x - 16.6993 \text{ (1969-80 data)}$$

By this equation, the consumption per capita of fish is forecast at 5.7 to 6.2 kilograms in 1986 and 9.0 to 9.9 kilograms in 2000. The fish consumption in 2000 is estimated at 1.9 times as much as that in 1978.

Cheese

As seen in Table-8, the per capita consumption of cheese hardly increased during the ten-year period. The FAO data also indicate that the milk protein intake also did not increase during the same period. It seems that a similar tendency will extend into the future as well.

Butter

The FAO data show that the per capita consumption of butter increased slightly in the ten-year period. From the data it is forecast that the yearly consumption per capita of 2.4 kilograms in 1978 will increase to 3.6 kilograms in 2000.

(3) Forecast of Domestic Meat Production

a) Trend of Animal Breeding

The total head of domestic animals tended to increase during 1952 to 1973, although it had been decreasing since 1973 except water buffaloes and goats (see Table 10). This is attributable to the limited farm lands of ARE which account for only four percent of the territory and to the low priority given to fodder crops after cash crops. Due to the limited animal feed available specially in summer, it is difficult to increase the head of domestic animals. On the other hand, it is also difficult to reduce the head to be slaughtered to meet the domestic demand. Tables B-7 and B-8 of Appendix indicate the total cropping area and the cropping area of clover, the sole fodder crop available in ARE.

Table 10. Number of Livestock

(Unit: 1,000 heads)

	Cows	Buffaloes	Sheep	Goats	Camels	Pigs
1952	1,356	1,212	1,254	703	165	27
1960	1,588	1,524	1,578	833	188	17
1968	2,058	1,943	1,935	1,125	127	13
1970	2,115	2,009	2,006	1,155	127	15
1973	2,127	2,135	1,993	1,264	113	14
1974	2,119	2,170	1,965	1,293	109	15
1975	2,102	2,024	1,926	1,321	105	15
1976	2,079	2,236	1,878	1,349	101	15
1977	2,048	2,266	1,821	1,275	97	15
1978	2,587	2,542	2,554	1,440	93	15
1979	1,954	2,321	1,679	1,427	88	15
1980	1,912	2,347	1,593	1,451	84	15

Source: Statistical Yearbook, Central Agency for Public Mobilization and Statistics, July 1981

Table 11. Number of Poultry

(Unit: 1,000 heads)

	Local Chickens	Turkeys	Ducks	Geese	Pigeons (Pairs)	Rabbits
1973	25,458	678	3,148	2,565	1,762	2,072
1974	25,764	687	3,197	2,589	1,569	2,063
1975	26,069	696	3,246	2,613	1,551	2,053
1976	26,375	705	3,294	2,637	1,440	2,043
1977	26,680	715	3,343	2,661	1,325	2,032
1978	26,986	724	3,392	2,685	1,207	2,020
1979	27,292	733	3,440	2,725	1,084	2,012
1980	27,597	742	3,489	2,734	1,107	1,994

Source: Statistical Yearbook, Central Agency for Public Mobilization and Statistics, July 1981

The major domestic animals are buffaloes and cattle accounting for 60 percent of the total head, and with goats following. Judging from the past record, it seems that domestic animal breeding centering around buffalo will also extend into the future.

b) Slaughter of Domestic Animals

Except 1976, the number of slaughtered domestic animals increased yearly until 1979, and 1,538,000 head were slaughtered in the peak year of 1979. After that, it decreased to 1,353,000 heads in 1980. The number of swine, camels, goats and bulls slaughtered did not widely fluctuate in these eight years. However, that of calves and sheep varied to a considerable extent.

It is notable that many calves have been consumed. The number of calves slaughtered in 1980 was equivalent to 54 percent of the total head of slaughtered domestic animals. This might be attributable to the present demand structure of foodstuffs, or to the fact that adult cattle are used as draft cattle, and only calves are available to meet the demand for beef. The slaughter of many calves has caused a limited production of meat in comparison

with the slaughtered heads. In connection with farm mechanization, some measures should be taken to produce beef from grown cattle.

Table-12. Number of Slaughtered Livestock

(Unit: 1,000 head)

	1973	1974	1975	1976	1977	1978	1979	1980
Oxen	18	7	2	2	1	1	2	1
Cows	28	32	33	26	26	41	56	46
Buffaloes	75	89	83	72	74	98	111	98
Veals	306	329	295	259	285	347	340	282
Calves	323	365	352	327	355	384	472	443
Sheep	379	372	400	371	399	445	432	369
Goats	26	20	22	22	23	21	24	24
Pigs	40	42	45	49	46	45	56	58
Camels	53	64	50	51	57	52	45	32
Total	1,248	1,320	1,282	1,179	1,266	1,434	1,538	1,353

Source: Statistical Yearbook, Central Agency for Public Mobilization and Statistics, July 1981

c) Forecast of Meat and Chicken Production

As mentioned above, the cropping area of clover is small in ARE. Moreover, many calves are slaughtered to meet the demand for meat. Some countermeasures against the shortage of fodder crops shall be taken in future for an expected increase in domestic animals. Without an increase in the head of domestic animals, no increase in meat production can be expected. In this respect, a decrease in the slaughtered calves and the improvement in breeding would be prerequisite. The demand for meat will increase in proportion to an increase in population and in the consumption per capita. The rate of imported meat to the domestic consumption would become higher than at present.

The FAO Production Yearbook indicates that the domestic meat production increased at 3.3 percent per annum during the ten-year period from 1970 to 1979 as shown in Table B-5 of Appendix. The production of chicken increased by 1.8 times during the period and this figure is remarkable in comparison with the low rate of increase in the others.

In forecasting the meat production in future, regression equations showing the relationship between the slaughtered head of domestic animals in Table-12 and the meat production in Table-13 are developed. In computation, chicken is deducted from the meat shown in Table-13, and camels from the head of domestic animals indicated in Table-12. The regression equations obtained are as follows;

Table-13. Meat Production

(Unit: 1,000t)

Year	Beef & Veal	Mutton, Lamb & Goat Meat	Poultry	Pork	Total
1970	210	46	76	1	355
1971	220	48	79	1	364
1972	223	49	82	1	374
1973	226	45	80	2	375
1974	228	46	84	2	385
1975	236	48	86	2	395
1976	243	49	88	2	406
1977	236	44	102	2	421
1978	239	46	135	2	458
1979	249	47	139	2	474

Source: FAO Production Yearbook
Total of each year does not coincide with each kind of meat production

Regression equation of the first degree

$$Y = 0.06989x + 225.36741$$

Quadratic regression equation

$$Y = 0.00051x^2 - 1.26446x + 1096.7979$$

The meat production is forecast by substituting for x the forecast head of slaughtered domestic animals in Table B-9 of Appendix after deducting the head of camels. The comparison between the estimated meat production by the above-mentioned equations and the actual record reveals that the estimates obtained by the quadratic regression equation are more reliable than those estimated by the equation of the first degree as shown in Table B-11 of Appendix. The meat production in 2000 is estimated by the quadratic equation at 326,000 tons as shown in Table B-11 of the Appendix.

The production of chicken increased 1.8 times during the decade from 1970 to 1979. Chicken can be forwarded to market after a short breeding period of about 2.3 months. Poultry farming is the most advantageous to cover the urgent shortage of meat. Presently some poultry producers raise broilers. Assuming broiler raising expands in ARE in the future, the chicken production in 2000 is forecast to be 262,000 tons as shown in Table B-12 of Appendix.

As a result, with 326,000 tons of meat and 262,000 tons of chicken, the total production in 2000 is computed at 588,000 tons.

d) Production of Cheese and Butter

Cheese production increased at 3.3 percent on a yearly average although the rate of increase fell slightly to 1.8 percent per annum in the last five years. Butter increased at 2.1 percent in the past, but its rate of increase has remained at 1.4 percent

during the last five years. (see Tables B-13 of Appendix). Milk, ingredients of cheese and butter, increased at 2.2 percent from 1970 to 1979, and at 2.1 percent in the last five years (see Table B-14 of Appendix) The domestic production of cheese and butter has remained low due to a low increase rate for milk. As a result of the regression analysis, the production of cheese and butter in 2000 is forecast at 400,000 tons and 94,000 tons, respectively, as shown in Tables B-18 of Appendix.

e) Fish

As shown in Table B-15 of Appendix, the fish yield increased at 6.5 percent per annum. Specially, the increase rate in 1978 and 1979 was so high at 29 percent due to the 1.8 increase in the fish yield in the Mediterranean Sea and the Red Sea and due to the start of deep-sea fishery. However, since more than a half of the yield consists of lake fish of mostly the Tilapia family, a further remarkable increase in fish yield cannot be expected since the lake area is limited. Furthermore, from the view point of natural resources, a high yield of fish in the Mediterranean Sea and the Red Sea cannot be expected for a long period. Thus, the fish yield in the year 2000 is forecast at approximately 226,000 tons.

(4) Food Import Forecast

The total demand for foods is computed by multiplying the forecast consumption per capita by the forecast population. The total demand for the four items of foods in 1986 and 2000 is forecast as follows;

(Unit: 1,000 tons)

Year	Meat and Chicken	Fish	Cheese and Butter
1986	639 to 699	264 to 287	426
2000	1,116 to 1,286	567 to 624	630

Although the domestic production of animal products and fish is expected to increase in future as detailed in the previous chapter, the growth rate of domestic production will be lower than that of demand to result in a larger gap between future demand and supply. In this report, this gap is regarded as a necessary quantity of foods to be imported.

Table 14 indicates the import requirement of meat and chicken, fish, and cheese and butter, totaling the huge amount of 300,000 to 377,000 tons in 1986, 454,000 to 562,000 tons in 1990, 679,000 to 838,000 tons in 1995, and 957,000 to 1,169,000 tons in the year 2000.

The domestic economic situation, international demand and supply balance of meat and the other various international affairs will affect the import of food although no remarks are made on the difficulty of importing food in this report. It is an urgent necessity of ARE to take measures to improve the cold storage and port facilities, etc., as soon as possible in order to meet a rapid increase in imported cold foods.

Table-14. Food Import Forecast

Item/Year	1986	1990	1995	2000
Population	46,299,000	50,739,000	56,652,000	63,035,000
Per Capita Consumption (kg)				
Meat & Chicken	13.8-15.1	14.9-16.6	16.3-18.5	17.7-20.4
Fish	5.7- 6.2	6.7- 7.3	7.8- 8.6	9.0- 9.9
Cheese & Butter	9.2	9.4	9.7	10.0
Total Demand (1,000 tons)				
Meat & Chicken	639-699	756-842	923-1,048	1,116-1,286
Fish	264-287	340-370	442- 487	567- 624
Cheese & Butter	426	477	550	630
Domestic Production (1,000 tons)				
Meat & Chicken	483	512	549	588
Fish	158	177	202	226
Cheese & Butter	374	408	451	494
Import Requirement (1,000 tons)				
Meat & Chicken (Conversion to boneless meat)	142-196	222-300	340-454	480-635
Fish	106-129	163-193	240-285	341-398
Cheese & Butter	52	69	99	136
Total	300-377	454-562	679-838	957-1,169

Forecast the import requirements of meat and chicken were made after consideration of the following;

i) Time series data on per capita consumption of meat and chicken(Statistical Indicators, Central Agency for Public Mobilization & Statistics) used to estimate their future demand refer to the sum of meat and chicken. The forecast on necessary imports was made on the same basis.

ii) The demand for and domestic production of meat and chicken was estimated on the bone meat basis. The necessary import amount covers the difference between demand and domestic production. The meat actually imported is mostly in the form of boneless meat, which deservedly required the

conversion of the figures based on the bone meat into those of boneless meat in the estimation of the amount for imports.

iii) On the other hand, chicken is imported in the form of bone meat, and this is expected to continue in the future and does therefore not necessitate the conversion of above figures.

iv) For the reason stated in i) above, the forecast of demand for, and the import of meat and chicken were not made separately, but based on the proportion of meat and chicken imported in 1980. The following are the 1980 import figures.

	Meat	Chicken	Total
1980 Import	73,814 tons	54,354 tons	128,168 tons
	(57.6)	(42.4)	(100.0)

Based on these figures, the ratio of meat to chicken is considered to be 6:4, and the conversion into boneless meat figures was made for 10:6 of the necessary imports. Conversion was attempted for all the meat imported although part of imported meat is bone meat.

v) The conversion rate of bone meat into boneless meat(deboning only) is 85 percent following the data in "Report to the Egyptian Company for Meat and Milk Production, 1981 by Buch-Larsen(FAO Meat Officer).

IV-2-2. Priority in Project Planning and Target Storages

To accommodate the above-mentioned imported cold foods, a necessary capacity of cold storages in the public sector, that is, the Ministry of Supply and Home Trade, will range from 48,000 to 88,000 tons in 1985, from 81,000 to 141,000 tons in 1990, from 120,000 to 204,000 tons in 1995, and from 169,000 to 282,000 tons in 2000 on the assumption of four to six times rotation of cold storages per year. A rapid increase in imported cold foods will necessitate a huge capacity of cold storages since the present storage capacity is less than 30,000 tons, although the necessary capacity varies considerably depending upon the number of rotations of cold storages actually made.

In 1979 for which statistics are available, cold foods of 121,875 tons were imported while the capacity of cold storages under the Ministry of Supply and Home Trade (GERCO Co. and Alexandria Co.) was 25,800 tons. It seems that the cold storages could accommodate 125,000 tons of imported cold foods throughout the year on the assumption of five-time rotation of cold storages in a year.

In 1980 the import of cold foods sharply increased to 213,664 tons. The capacity of public cold storages in this year is not clear. However, it is estimated at 26,350 tons assuming a linear increase in storage capacity to 27,450 tons till August 1982, which was obtained in the study. The total cold foods stored in 1980 are estimated at 131,750 tons on the assumption of a five-time per year rotation of the meat in cold storage. The rest of the total, about 80,000 tons, is considered to have been stored in private cold storages and so a shortage of cold storages must have occurred in that year.

Table-15 Capacity of Cold Storages

(Unit: 1,000 tons)

	Public Storages			Private Storages			Total		
	F	C	Total	F	C	Total	F	C	Total
August, 1882									
Alexandria	5.5	-	5.5	16.0	1.0	17.0	21.5	1.0	22.5
Port Said	1.95	-	1.95	22.0	-	22.0	23.95	-	23.95
Suez	5.4	-	5.4	-	-	-	5.4	-	5.4
Cairo*	11.8	2.8	14.6	29.5	-	29.5	41.3	2.8	44.1
Total	24.65	2.8	27.45	67.5	1.0	68.5	92.15	3.8	95.95
Without the Project in 1985									
Alexandria	7.5	5.0	12.5	16.0	1.0	17.0	23.5	6.0	29.5
Port Said	3.95	-	3.95	22.0	-	22.0	25.95	-	25.95
Suez	7.9	-	7.9	-	-	-	7.9	-	7.9
Cairo*	15.8	2.8	18.6	29.5	-	29.5	45.3	2.8	48.1
Total	35.15	7.8	42.95	67.5	1.0	68.5	102.65	7.8	111.45
With the Project in 1985									
Alexandria	13.5	5.0	18.5	16.0	1.0	17.0	29.5	6.0	35.5
Port Said	8.95	-	8.95	22.0	-	22.0	30.95	-	30.95
Suez	10.9	-	10.9	-	-	-	10.9	-	10.9
Cairo*	21.8	2.8	24.6	29.5	-	29.5	51.3	2.8	54.1
Total	55.15	7.8	62.95	67.5	1.0	68.5	122.65	8.8	131.45

Note: * includes the capacity of two private cold storages in Tanta
F: F Category Cold Storage
C: C Category Cold Storage

GERCO estimates the imported cold foods in 1981 at 312,000 tons as shown in Table-16 based on its own survey although this figure has not yet been officially published. Apart from this, a survey conducted in parallel with the said GERCO survey has revealed that imported cold foods during January to August, 1982, was 152,000 tons. Even if the import of these increases at the same rate toward the year end, the total imported amount would not exceed 300,000 tons.

Table-16 Cold Foods Imported through Ports in 1981

(Unit: ton)

	Alexandria	Port Said	Suez	Total
Meat	49,756	46,055	19,308	115,119
	(43.2)	(40.0)	(16.8)	(100.0)(36.9)
Chicken	57,344	47,542	5,400	110,286
	(52.0)	(43.1)	(4.9)	(100.0)(35.4)
Fish	49,351	32,198	4,950	86,499
	(57.1)	(37.2)	(5.7)	(100.0)(27.7)
Total	156,451	125,795	29,658	311,904
	(50.2)	(40.3)	(9.5)	(100.0)(100.0)

Cold Foods Imported through Ports
During January to August, 1982

	Alexandria	Port Said	Suez	Total
Meat	34,700	40,239	3,000	77,939
	(44.5)	(51.6)	(3.8)	(100.0)(51.3)
Chicken	5,438	13,657	2,308	21,403
	(25.4)	(63.8)	(10.8)	(100.0)(14.1)
Fish	29,511	20,403	2,800	52,714
	(56.0)	(38.7)	(5.3)	(100.0)(34.7)
Total	69,649	74,299	8,108	152,056
	(45.8)	(48.9)	(5.3)	(100.0)(100.0)

Source: GERCO Co survey in Sept, 1982

The amount of cold foods imported by ARE has been widely fluctuating year by year. Taking into consideration that the Project would require a huge investment for its materialization, the Project plan should, therefore, be formulated not to meet the maximum forecast demand for cold foods in distant future, but to cover a reliable forecast demand in near future which is almost equal to the lowest among the forecast figures in Section IV-2-1. Paying due attention to the above descriptions and to the fact that the acceleration of the construction of cold storages is the only way to cope with the increasing imported cold foods, the highest priority in formulating the Project plan is given to the establishment of a cold storage chain in the public sector by the year 1986 so that the Ministry of Supply and Home Trade will be able to deal with the target amount of 300,000 tons by that year.

IV-2-3. Comprehensive Planning of Cold Storage Chain

The Project aims to establish a cold storage chain that covers the process from the unloading of imported cold foods at ports to their distribution to consumers. The quantity of imported cold foods to be unloaded at each port and the channel of distribution from the port to consumption areas shall be decided for this purpose, and then the capacity of cold storages and meat processing plants, etc., to be installed as well as the transportation means shall be decided.

(1) Basic Concept in Planning the Cold Storage Chain

In planning the cold storage chain, it is ideal that new facilities and transportation means to be proposed in the Project are planned on the basis of detailed information and data on the existing handling conditions at the ports and storages inclusive of those used by that organization on a rental basis. Such information and data is insufficient. In principle, the Study was carried out to determine the main features of various facilities as well as the transportation means to smoothly distribute the target amount of imported cold foods determined in the Study. The marketing system planned for the Project will be developed as "a closed system".

Due attention should be paid to the following in planning the chain of cold storages;

° Cold Storages at Ports

Cold storages at ports should have the largest storage capacity possible within the extent allowable by the sites. It is desirable that such storages be located beside a wharf. If it is difficult to secure a site beside a wharf, then they should be located closest possible to a wharf to shorten the handling

and transportation time of imported cold foods from ships. The merits of such cold storages at ports are as follows;

- Quick and smooth unloading of imported cold foods which will lead ARE to an advantageous position in the international tendering of cold foods;
- Saving of the penalty which is imposed on delays in unloading; and,
- Daytime unloading which is more efficient than nighttime unloading.
- In particular, large cold storages at ports with a short distance to a wharf will be inevitably necessary to meet the increasing quantity of imported cold foods.

° Cold Storages in the Consumer Area

Cold storages in consumer areas will be provided with a meat processing plant and do not aim at accommodating a large quantity of imported cold foods like port-type storages, but to meet the daily demand for foods in the consumer area through stable supply to consumers. However they should have sufficient storage capacity to meet the daily fluctuation of demand and the delay in supply from ports because of traffic troubles, etc.

As mentioned above, the cold storages and meat processing plants in the Project have been planned as a closed system. However, some of them will have a larger capacity than required for the closed system since there is a huge and increasing demand for imported cold foods inclusive of those not selected in the Project. In practical operations, these facilities will be able to handle cold foods other than the selected ones. There is no need to adhere to the closed system in their practical operations. For instance, some cold foods should be forwarded directly from a port to a meat processing plant in Cairo which is the greatest consumer area in ARE, or to other

consumption areas without storage at a port cold storage if it is more economical to do so and so the quality of foods to be distributed to consumers would not decline.

d) The necessary capacity for cold storage differs with the rotation time. Since data on the rotation time of cold storage is hardly available, interviews with personnel in charge were made in the field survey. As a result, the rotation time is evaluated to range from four times to six times per year. On the other hand, the rotation time computed from the handling quantity of cold foods by GERCO and the total capacity for cold storage in 1979 and 1980 also give a similar ratio ranging from four to five times per year. In Japan the rotation time was more than six times a year in the early 1970s, but showed a tendency to decrease towards five times per year in 1980. Taking into due consideration the above-mentioned and the special role of port cold storages in ARE to accommodate huge quantities of cold foods to be purchased when the prices are low, the rotation time of cold storages in formulating the Project plan is determined at five times. It is considered that a higher rate than this cannot practically be expected.

(2) Elements in the Chain of Cold Storages

a) Cold Storages at Ports

It is estimated that cold foods of 300,000 tons in total will be imported in 1986. All the imported amounts will be brought into ARE through ports. The first step in formulating the Project plan was, therefore, to determine the capacity for cold storage at ports based on the basic concepts mentioned above.

The cold storage capacity under the Ministry of Supply and Home Trade will amount to 27,450 tons in August, 1982. This capacity is expected to grow to 42,950 tons in 1986 when the operation starts at Kabbary No. 1 and No. 2 storages in Alexandria, at the New Abbas storage in Port Said and at some storages in Cairo to be improved soon. With a five times rotation of all these cold storages of 214,750 tons of cold food will be distributed through the public marketing system, and a difference of about 85,000 tons between 300,000 tons to be imported and 214,750 to be dealt with in the public sector shall be distributed through the marketing system in the private sector, if no measures are taken in future. On the assumption of a five times rotation of cold storage per year, the necessary capacity of cold storage to accommodate this quantity is computed to be 17,000 tons.

The Project aims to erect cold storages at ports and Cairo to accommodate 17,000 tons of imported cold foods. Taking into consideration the characteristics of the three ports of ARE as mentioned below, the cold storage capacity totaling 17,000 tons is allotted to each port as follows;

Alexandria	6,000 tons
Port Said	5,000
Suez	3,000
Cairo	3,000
Total	17,000 tons

Alexandria

It is recommended to allot the largest storage capacity to Alexandria upon consideration of the following;

i) Alexandria itself is one of the biggest consumers of imported cold foods;

ii) The city is located nearest the western countries which are the major suppliers of cold foods to ARE. In fact, 80 percent of meat, 100 percent of chicken, and 65 percent of fish are brought into ARE from European and North and South American countries across the Mediterranean sea;

iii) Alexandria port has the largest handling capacity of the three ports of ARE (see Table 20).

Port Said

Port Said has the following characteristics;

i) In principle, ships move to Port Said from Alexandria when the latter port is too crowded;

ii) The present allocation of imported cold foods to each port is;

Alexandria	50 %
Port-Said	40 %
Suez	10 %

Suez

Suez port deals with cold foods much less than the other two. However, this port has the following advantages.

i) Because of the shorter distance to Cairo as compared with the other two ports, the inland transportation cost of imported food to Cairo is the lowest; and,

ii) While the unloaded volume of cold foods at Suez is presently small, meat from Australia and New Zealand and fish from Japan will be possibly imported at lower prices than from the other countries in future.

Cairo

Cairo is one of the biggest consumer areas of processed meat. A part of imported cold meat shall be transported directly to Cairo immediately after being unloaded at port and stored in the storage in Cairo.

Table 17. Imported Meat and Value by Suppliers
(Year 1980)

Country	Unit of Quantity	Quantity	Value in 000's L.E.	Notes
Lebanon	Tons	25	29	F
Romania	Tons	246	369	P
Denmark	Tons	1,149	1,518	F
	Tons	940	1,222	P
Norway	Tons	56	66	P
Austria	Numb	415	465	Live Animal of Bovine
	Tons	31	55	P
United Kingdom	Tons	36	51	F
Irish Free State	Numb	4,975	1,312	Live Animal of Bovine
Italy	Tons	7,824	5,946	F
Belgium	Tons	587	853	F
Switzerland	Tons	212	391	P
France	Tons	14,468	12,603	F
U.S.A.	Tons	10,384	8,829	F
Canada	Tons	33	49	P
Argentina	Tons	16,671	15,843	F
Uruguay	Tons	4,123	2,167	F
Brazil	Tons	374	727	P
Australia	Tons	12,055	14,264	F
	Tons	242	420	P
New Zealand	Tons	1,615	1,438	F

F: Meat and edible offal, fresh or cold.
P: Prepared or preserved meat or meat offal.

Source: Monthly Bulletin of Foreign Trade Dec., Jan./Dec. 1980 Central Agency for Public Mobilization & Statistics, Aug., 1981.

Table 18. Imported Chicken and Value by Suppliers
(Year 1980)

Country	Quantity Tons	Value 000's L.E.	Notes
Greece	1,649	1,740	
Sweden	832	721	
United Kingdom	3,168	2,779	
Belgium	212	307	
Switzerland	2,774	3,387	
France	622	483	
U.S.A.	45,049	39,399	
	1,962	1,525	Poultry Liver

Source: Monthly Bulletin of Foreign Trade Dec., Jan./Dec. 1980 Central Agency for Public Mobilization & Statistics, Aug., 1981.

Table 19. Volume and Value of Fish Import by Country (Year 1980)

Country	Quantity Tons	Value 000's L.E.	Notes
Tunisia	40	50	P
Lebanon	76	47	P
Morocco	37	45	P
U.S.S.R.	23,854	6,610	F
Bulgaria	1,055	848	P
Yugoslavia	851	1,105	P
Spain	2,005	311	F
Sweden	8,763	1,327	F
	43	68	P
Norway	68	155	S
United Kingdom	318	409	S
Germany	505	309	F
Switzerland	137	137	P
Netherlands	194	281	S
Taiwan	13	30	P
Japan	8,142	6,270	P
South Korea	41	63	P
Singapore	448	205	F
U.S.A.	554	116	F
Peru	149	81	P

F: Fresh, chilled or cold fish.
P: Prepared or preserved fish and caviar.
S: Salted, dried or smoked fish.

Source: Monthly Bulletin of Foreign Trade Dec., Jan./Dec. 1980. Central Agency for Public Mobilization & Statistics, Aug. 1981.

Table 20. Imports by Port

	-1979-		-1980-	
	Value (1'000 LE)	Quantity (Ton)	Value (1'000 LE)	Quantity (Ton)
Alexandria & West Frontier	2,078,803 (77.4%)	8,126,021 (78.9%)	2,299,748 (67.6%)	8,237,018 (71.6%)
Port Said	329,256 (12.3%)	1,641,344 (15.9%)	347,703 (22.0%)	2,868,640 (24.9%)
Suez & Related Ports	160,112 (6.0%)	446,735 (4.3%)	191,454 (5.6%)	380,093 (3.8%)
South Frontier	13,787 (0.5%)	74,826 (0.7%)	-	-
Airports	104,154 (3.9%)	11,558 (0.1%)	163,094 (4.8%)	31,003 (0.1%)
Total	2,686,212 (100%)	10,300,484 (100%)	3,401,999 (100%)	11,498,754 (100%)

Note: This table does not include Crude Petroleum Oil

Source: Monthly Bulletin of Foreign Trade December, Jan./Dec., 1980. Central Agency for Public Mobilization & Statistics, Aug. 1981.

b) Cold Storages and Meat Processing Plants in Consumption Areas

Cold foods purchased economically in large quantities are stored in a port cold storages, and quantities necessary to meet daily demand are hauled to consumer areas, and distributed to consumers after processing and packing if necessary. Processing and packing could be completed at port cold storages prior to transportation to a consumer area. However in ARE frozen meat is mainly supplied to consumers mainly in three-kilogram packages, and some in one or two kilogram packages. The long distance transportation of cold meat after processing is less advantageous than that before processing due to the shape of the processed meat and the capacity of trucks.

For this reason, it is more economical to install meat processing plants in consumer areas than at ports.

Alexandria itself is a big consumer of cold foods. A GERCO survey reveals that half of the imported foods stocked at cold storages in this city are consumed locally and in the area along the agricultural road leading to Cairo. Therefore, a meat processing plant will be attached to the proposed cold storage in this city.

It is very difficult to obtain a site in Cairo large enough to construct two cold storages which have meat processing plants attached. Only the site adjacent to the existing cold storage in Ramada is available for constructing a cold storage with a meat processing plant.

The daily processing and storage capacities of these meat processing plants and cold storages will be discussed hereafter.

The proposed cold storage at Alexandria will have a storage capacity of 6,000 tons. With a five times rotation, this cold storage will be able to accommodate 30,000 tons of cold food of which half will be supplied to Cairo and the remaining half consumed locally in Alexandria and along the agricultural road. The quantity to be consumed locally is equivalent to a daily consumption of 41 tons. Since meat processing is necessary for 35 percent of frozen meat, a meat processing plant having a capacity of 14.4 ton per day is required in this city.

An annual total of 70,000 tons of cold foods will be supplied to Cairo from the three ports. (i.e, 15,000 tons from Alexandria, 25,000 tons from Port Said, 15,000 tons from Suez, and 15,000 tons from Cairo itself.) This is converted to a daily supply of 192 tons of which 67 tons per day or 35 percent per day will be cold meat to be processed. The demand for meat processing is already huge and still increasing. Taking into consideration, some allowance in the

capacity, the meat processing plants will designed to have a capacity of 25 tons per shift. With two-shift operation per day, one meat processing plant will be able to process 50 tons of cold meat per day. A cold storage of 3,000 tons capacity will be constructed in Ramada to store the amount of imported cold meat sufficient to operate the meat processing plant smoothly.

c) Sites of Cold Storages and Meat Processing Plants

At ports it is the most preferable to select a site close to a wharf for cold storages and meat processing plants. However, waterfront areas at ports are usually occupied by existing equipment and facilities. In addition, cold storages need water, electricity, labor, and a good foundation. Furthermore, the site should of course be convenient for transportation, etc.

The following sites are selected in consideration of the above conditions as well as information of GERCO on the availability of lands.

- Alexandria — El Dekihla
- Port Said — Adjoining site of New Abbas cold storage
- Suez — Site between Attaqa No. 2 and No. 3 cold storages

In Alexandria the meat processing plant will be attached to the proposed cold storage. Processed meat is usually distributed from meat processing plants to retail stores by truck. In consideration of traffic jam in Cairo specially around the main railway station as well as of shortening the distribution time by truck, a meat processing plant with a cold storage will be installed at two sites in the suburbs of Cairo so that cold foods will be supplied from three cold storages inclusive of the existing one at Ramada without passing through places which are congested with traffic.

However, no sufficient site could be obtained, and so the following site was selected for cold storage for Cairo.

- Ramada: Adjacent to the existing cold storages at Ramada.

d) Handling from Ships to Cold Storages at Ports

To shorten the unloading and hauling time of cold foods from ships to cold storages at ports, it is desirable that cold storages be close to wharves but it seems difficult to secure the sites for the proposed cold storages at port just behind a wharf. Efforts should be made to secure the sites as close as possible to a wharf.

Cold foods will be unloaded from ships to barges or to a wharf by ship crane or derrick crane, and hauled commonly by trucks to the cold storage. For this purpose, it should be tried to unload cold foods onto a pallet at a wharf so as to load them, together with the pallet, onto trucks to shorten the handling time from wharves to cold storages. Even at the existing cold storages, carts should be used to carry cold foods in the storages to cope with increasing imports of cold foods.

e) Hauling of Cold Foods to Meat Processing Plants in Consumption Area

Cairo is located 221 km distant from Alexandria, 220 km from Port Said, and 134 km from Suez. To transport cold foods to

Cairo takes about 4.5 hours from Alexandria, 4.5 hours from Port Said and about 2.5 hours from Suez. 10-ton refrigeration trucks will be used for transporting cold foods. Assuming that loading and unloading can be made in two hours and mechanical fixing of a truck takes 0.5 hour, the necessary time for one cycle hauling(round trip) is computed as follows;

Alexandria - Cairo	11.5 hours
Port Said - Cairo	11.5 hours
Suez - Cairo	7.5 hours

Two-cycle hauling per day is possible between Alexandria and Cairo, and Port Said and Cairo, and three-cycle hauling between Suez and Cairo.

As mentioned in b), cold foods sent to Cairo from Alexandria, Port Said, and Suez before and after processing are 15,000 tons, 25,000 tons, and 15,000 tons per year, respectively. The consumption of cold foods at Alexandria includes those consumed by people along the agricultural road. It seems that some inhabitants along the road are supplied with cold foods from cold storages in Alexandria. At present no detailed data are available on the quantity and destination of cold foods being distributed. Under the situations, the necessary number of refrigerated trucks is estimated on the assumption that all the above-mentioned cold foods are sent to Cairo. In this case, cold foods sent from Alexandria to Cairo is 30,000 tons per year. On the assumption of 300 working days per year, the hauling volume to Cairo is 100 tons per day from Alexandria, 85 tons per day from Port Said, and 50 tons per day from Suez. In consideration of mechanical trouble and fixing time, the following number of trucks will be necessary:

Alexandria - Cairo	7 units
Port Said - Cairo	6
Suez - Cairo	3
Total	16 units

In view of the present road condition in ARE, the transportation will be equally efficient if 8 units of 10-ton truck were replaced by 4 units of 20-ton truck.

f) Forklift

Electric forklifts and pallets will be used to unload cold food from truck and carry them into the cold rooms of a cold storage. A GERCO survey shows that presently 4,000-ton ships arrive at Alexandria and Port Said, and 3,000-ton ships at Suez. On the assumption of an unloading period of around five days, cold foods of 800 tons per day both at Alexandria and Port Said and 600 tons per day at Suez are unloaded and carried into cold storages.

Assuming that it takes 10 minutes per cycle for a 1.5-ton forklift to handle 1.0 ton cold foods, one unit can carry six tons of cold foods per hour into cold rooms. On the assumption of 16 working hours in busy time, one unit can handle 96 tons per day. In consideration of the recharging time, etc., 10 forklift will be necessary both at Alexandria and Port Said, and seven at Suez. Only 91.5 tons of cold foods will be carried into each of the proposed cold storages in Cairo. However, for full operation of the cold storage, unloading from three units of truck shall be simultaneously made. Five forklift will be necessary to unload 30 tons of cold foods per hour.

g) Ice Plant

Table 21 shows the demand and supply of ice at Alexandria in 1982. As the population of Alexandria increases by 1.5 million in summer, the total capacity of ice plants presently available is considered insufficient for this season. Presently 400 tons of ice is consumed per day for home use while 250 tons per day are used for fisheries. By 1983 the construction of two more ice plants with a capacity of 50 tons per day each will be completed. However, in

view of the increasing demand for ice for both fishery and home use in this city in future, the construction of an ice plant with a capacity of 100 tons per day should be planned at a site near the port.

Table 21. Ice Produced and Consumed in Alexandria in Summer

(unit: tons/day)

	1982	1983	1986
Production	565	665	765
Consumption			
Home use	400	400	450
Fishery	250	250	300
Total	650	650	750
Balance	-85	+15	+15

IV-3. Physical Planning

IV-3-1. Basic Concepts on Physical Planning

(1) Schematic Plan of Cold Storages

a) Region-wise roles of cold storages

In general cold storages aim to store cold foods like meat, fish, etc. at the appropriate temperature for each food. The facilities of a cold storage should have an adequate scale and function to meet regional requirements for the local marketing conditions of cold foods in particular.

In this respect, the proposed facilities can be divided into the following two types:

Type	Area covered by the cold storage
Port-area type	Alexandria, Port Said, Suez
Consumption-area type	Cairo, Alexandria*/

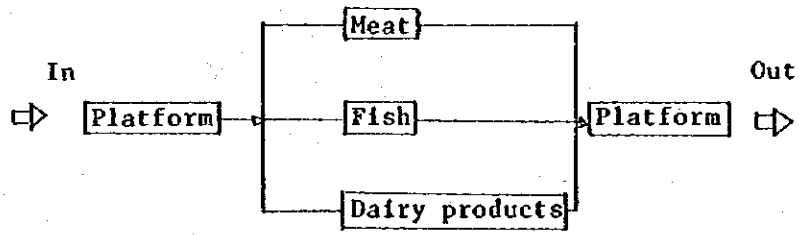
A port-area cold storage functions to store imported cold foods until they are forwarded to Cairo where as a consumption-area type functions to store temporarily and distribute them to retail shops to meet the daily consumer demand. The cold storage proposed for Alexandria will have the function of both types.

The capacity of the each cold storages is referred to in the previous paragraph of IV-2-3, "Comprehensive Planning of the Cold Storage Chain".

b) Types and functions of cold storage facilities

° Port-area type cold storages

This type of cold storages is characterized by its functions of handling massive cargoes in a short time and to forward them to consumption areas as a relaying base of cold foods.



° Consumption-area type (Cairo, Alexandria)

This type of cold storages is characteristically provided with meat processing facilities and small cold rooms to store cold foods after assortment since a small quantity is distributed to meet the daily demand.

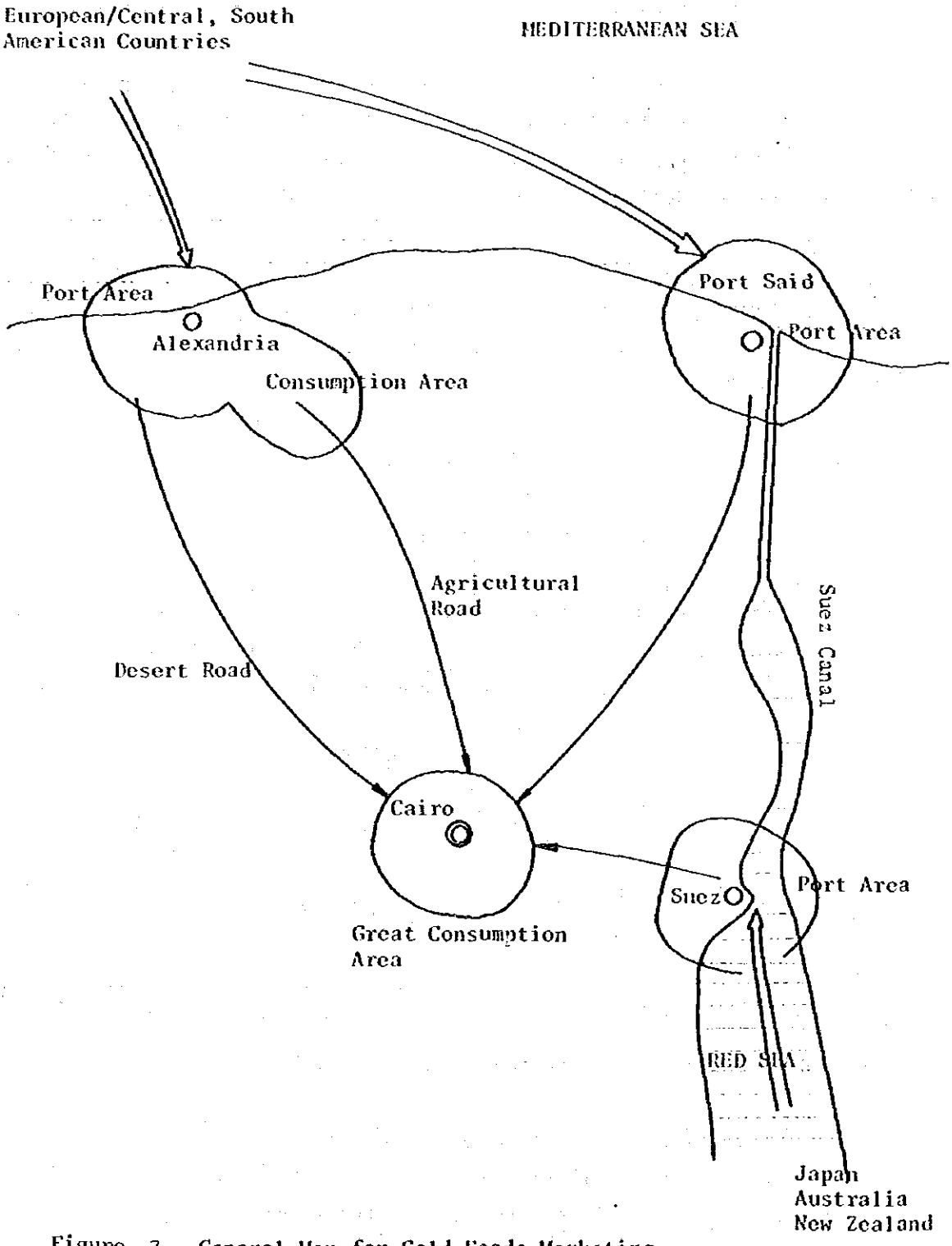
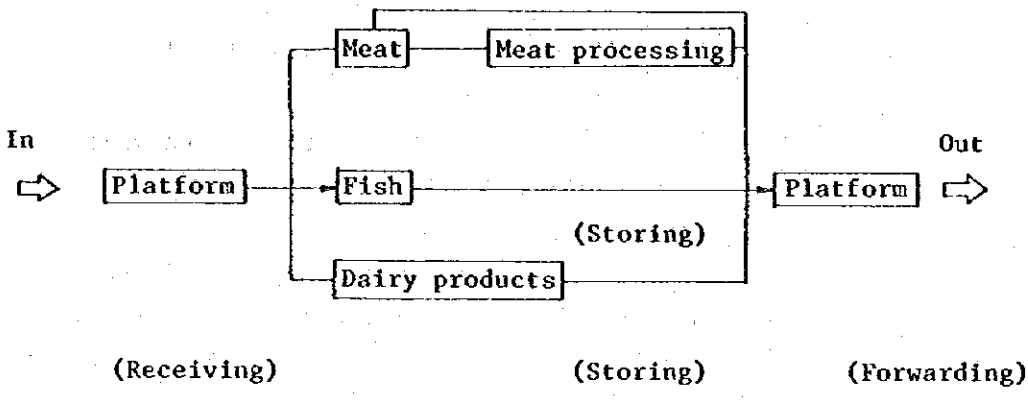


Figure -7. General Map for Cold Foods Marketing



c) Storage temperature and stored products

i. The cold storages in this Project aim to store meat, chicken, fish, and dairy products at the appropriate temperatures which are classified into the F Class for meat, chicken and fish, and the C Class for the dairy products of butter and cheese.

The F Class temperature is -25°C, while the C Class is 0°C.

For reference, the Japan Cold Storage Association has established the following rule of cold storage temperatures by classes:

Class	Temperature	Remarks
F	-20°C or below	The standard temperature in class F is set at -23°C, and the temperature is practically maintained at -23°C to -25°C in operations.
C_1	-10°C to -20°C	
C_2	-2°C to -10°C	
C_3	+10°C to -2°C	

In the Project, the cold storage facilities convertible to either Class F or Class C have been proposed for efficient operations in response to the strong request of GERCO (refer to Appendix B-22).

ii. Cold foods and storage temperature by facility

The cold foods, etc., and their storage temperatures by facility are tabulated below:

Facilities	Cold foods	Storage Temperature
Handling Area, Anteroom	All products	10°C
Cold Storage "F"	Meat, chicken, fish	-25°C
Cold Storage "C"	Dairy products	-5°C to 0°C
Freezing room	Meat	-30°C
Meat Processing Room	Meat for processing	18°C
Ice Storage Room	Ice	-7°C to -5°C

d) Estimation Criterion of Storage Capacity

In the Study a storage capacity and a floor area of cold storages in each city in total were computed based on the Egyptian criterion as follows;

$$\text{Storage Capacity} = \frac{\text{Effective Capacities(cu.m.)}}{3.5 \text{ (cu.m./ton)}}$$

Site	Capacity (ton)	Equation Applied (ton)	Floor Area (sq.m.)
Alexandria	6,000	$\frac{A \times H \times 0.9}{3.5} = 6,000$	Approx. 3,000
Port Said	5,000	$\frac{A \times H \times 0.9}{3.5} = 5,000$	Approx. 2,500
Suez	3,000	$\frac{A \times H \times 0.9}{3.5} = 3,000$	Approx. 1,500
Cairo	6,000	$\frac{A \times H \times 0.9}{3.5} = 6,000$	Approx. 3,000

A = Floor Area, H = Inner Height
0.9 = Effective volume ratio

(2) Architectural Planning

a) Room Layout

The layout of cold rooms, handling rooms (platform), and processing rooms is as follows.

1. Cold room

Cold rooms shall have a sufficient space to store a certain volume of cold foods evenly at the appropriate temperatures. The layout of cold rooms was made in consideration of the following:

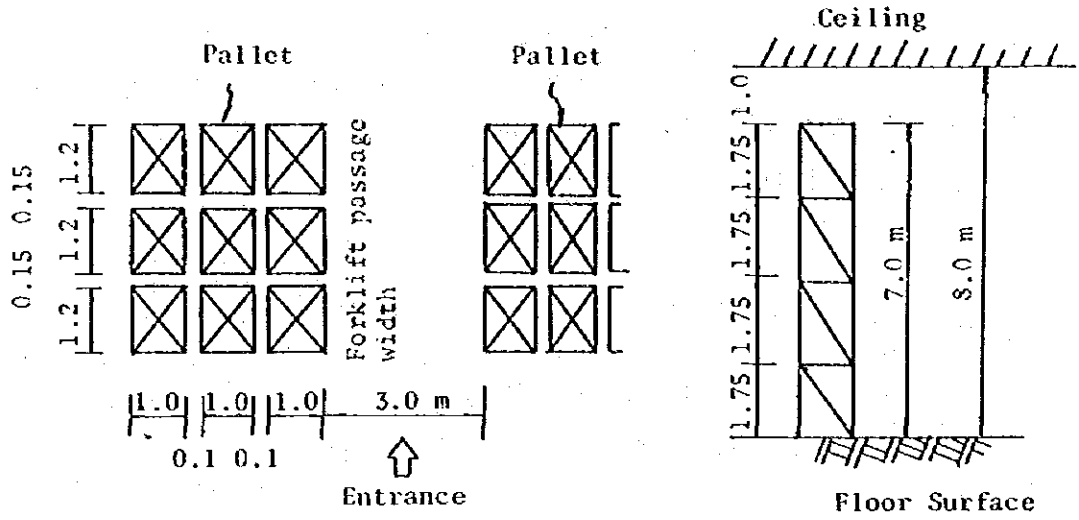
° Loading/unloading and Piling

In consideration of the present methods and efficiency, it is proposed to use forklifts for loading and unloading, and to pile up pallets in four layers for storing cold foods in cold rooms in order to meet increasing import of cold foods.

The pallets currently used in Egypt are 1.0 meter wide, 1.2 meters long, and 1.75 meters deep.

° Plans and Sections

The plans and sections of a cold room are designed assuming the following pallet piling and passage width of forklifts.



- Interval between pallets — short-side; 100 mm
  long-side ; 150 mm
- Passage width of forklifts ; 3.0 m
- Clearance ; 8.0 m
  ((1.75x4)+1.0)

° Cold room capacity

The cold rooms will have different storage capacities by the types of cold storages

Types	Unit capacity/Room	Remarks
Port-area Type	750 - 1,500 tons	The capacity of a room will be larger than that of the consumption-area type because of the mass handling of products.
Consumption-area	200 - 1,000 tons	Forwarding of small quantities will necessitate frequent door opening of the rooms, and the provision of many small-scaled rooms will facilitate operation and management of storage.

ii. Platforms

Port-area Type (Suez and Port Said)	The handling rooms should be of a closed type to prevent products from degradation in freshness caused by outdoor heat intrusion and to keep constantly the room temperature at +10°C.
Consumption-area Type (Cairo and Alexandria)	The handling rooms should be of open type in due consideration of the facts that the closed type will hamper vehicles from smooth traffic requiring frequent opening of doors for handling many small lots of products. Freshness of products can be maintained because small lots will be little exposed to the outdoor hot air.

iii. Meat processing rooms

- Needless to say, sufficient space should be secured at each stage of works to process a necessary quantity of meat. To process, pack, and store meat under good hygienic conditions, particular attention was paid to the following in the layout of meat processing rooms.

- The meat processing rooms will be provided with their own air conditioners separately from the other part of cold storage so that the temperature in the rooms will be maintained at +18°C. Air filters and air washers will be installed at fresh air intakes for preventing dust and dirty materials from intruding into the processing rooms;

- An anteroom will be provided at the entrance of the processing room so as to separate the room from other facilities; and

- Locker rooms and lavatories for laborers in charge of meat processing will be provided separatly from those for the other laborers.

b) Heat insulation and structure of buildings

i. Structure of the existing cold storages

Many of the existing cold storage buildings in Egypt are of one-storied reinforced concrete structure, excepting a few three-storied buildings. These multi-storied cold storages were built because of difficulties in land acquisition. One-storied buildings are much more advantageous than multi-storied one in loading and unloading as well as in their construction cost.

The Ramada cold storage in the suburbs of Cairo and the new cold storage in Suez have been constructed since 1970 under foreign aid while the New Abbas cold storage in Port Said is presently under construction and has one-storied prefabricated buildings with steel truss structure.

The proposed cold storage will have the following structures;

- Infrastructure: Foundation and floor slab with reinforced concrete
- Superstructure: Steel truss structure
  Heat insulation is made by assembling insulation panels

ii. Determination of structures

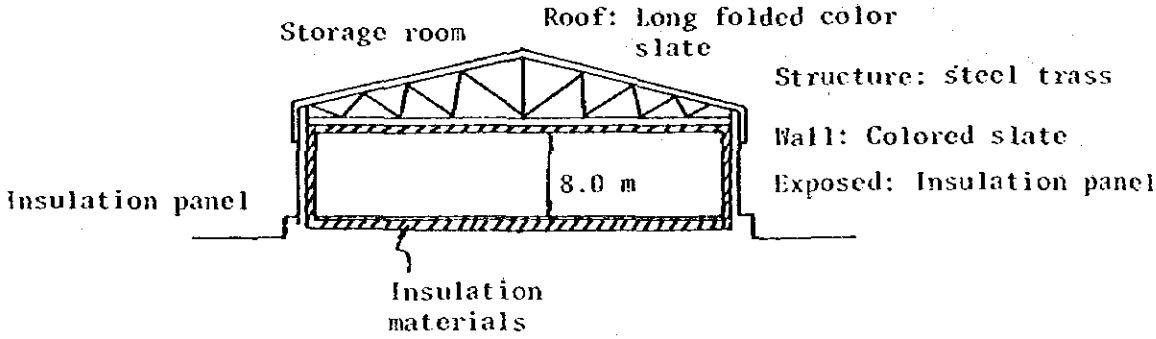
The following factors are taken into consideration in determining the cold storage structure.

- Shape and size of proposed sites,
- Heat insulation method,1/
- Construction materials and construction method,1/
- Construction period, and1/
- Capacity of facilities and equipment2/

NB: 1/ Different methods, materials, and construction period will be necessary for each of the panelling method and conventional method

2/ A capacity of facilities and equipment will be different by the building type, that is, one-storied or multi-storied buildings

In Egypt, the one-storied steel truss structure prefabrication method will be much more advantageous conventional construction method in shortening the construction period, securing high quality and accuracy in construction, keeping a considerably long durable life of costruction materials against heat and dewing, and securing good hygienic conditions.



The construction cost by the prefabrication method with a steel truss structure is a little higher than that by the conventional method. However, a substantially long life of the buildings by the former method can easily compensate for a higher cost. The two methods are compared as follows (see Table - 22).

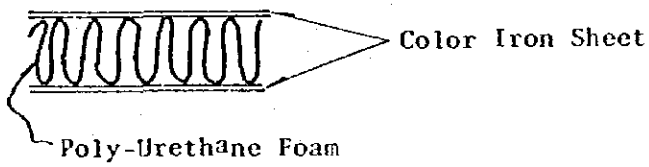
Table 22. Comparison of Prefabrication Method with Conventional Method

Items	Prefabrication	Conventional Method
Construction period	Considerably short because of the prefabrication method (**)	Long because of complicated construction works. (x)
Construction Works	Designed function can be obtained through assembling on a prescribed mainly only. (**)	Skilled labor is necessary, and problems still remain. (x)
Quality	Panels prefabricated though an integrated work in factory show a high efficiency in heat insulation. Their high insulation does not deteriorate. (**)	A small mistake in construction affects the efficiency in heat insulation The efficiency in heat insulation easily goes down. (x)
Durability	No maintenance is necessary for the wall surface with metal sheets. (**)	A small mistake in construction may cause freezing and dewing on the wall surface, resulting in a short durable life. (x)
Resistivity against dewing	A designed resistivity against dewing is obtained because of stabilized manufacturing with homogeneous materials. (**)	Mistakes in construction are anticipated. (x)
Sanitation	Cleaning of metal surface is easy. Metal surface does not absorb malodor. (**)	Due to on-site placing, the surface tends to be insanitary. It is difficult to clean it. (x)
Cost	The cost is high as compared with the conventional method. However, the above-mentioned merits of a short construction period, longer durable life maintenance-free wall surface, etc., can compensate the cost.	The cost is low at present. However, the above-mentioned constraints remain. (*)
Removal and increase facilities, etc.	Both are easy because of assembling method. (**)	Almost impossible. (x)

Note : excellent: (**) good: (*)
fair having merits and demerits
poor: (x)

c) Determination of insulation panel and thickness

The proposed insulation panels shall be composed of the core materials of insulative poly-urethane foam covered with colored iron sheet.



The thickness of insulation panels was computed by the following equation. The designed panel thickness is determined so as to maintain the intruding heat (91) at 7.5 to 9 Kcal/m^2hr.

$q_l = KF (t_1 - t_2$ --- Intruding Heat (Kcal/h)

where K --- Penetrating Heat (Kcal/sq.m h°C)
F --- Area in m^2 (sq.m)
t_1--- Outdoor temperature (designed temperature: +40°C)
t_2--- Indoor temperature (°C)

Table - 23 Thickness of Insulation Panels

(Unit: mm)

Temperature	Floor	Wall	Ceiling
+18°C	Insulator 25	25 / 44	44
+10°C	Insulator 50	25 / 62	62
-25°C	Insulator 200	25 / 152	152
-30°C	Insulator 250	25 / 152	152

(3) Proposed Refrigeration Facilities

a) Refrigeration Method

i) Refrigeration method and refrigerant

The proposed refrigeration facilities will be of a temperature convertible type either to Class F or Class C, and ammonia will be used as refrigerant for the direct expansion method. Alternative studies were made on the use of freon (R-22) as refrigerant and indirect refrigeration method by employing brines. Freon family refrigerants, however, have not been produced in Egypt, and are very expensive as they are all imported. Ammonia has long been commonly used as a refrigerant and so ammonia is selected as a refrigerant for the Project, taking into account its superior properties to the freon family refrigerants.

On the other hand, a comparative study on the direct and the indirect refrigeration methods showed advantages in adopting the direct method because of the following reasons.

° The indirect method has been lately employed for only a few cold storages because the operation efficiency is 20 to 30 percent lower than that the direct method although superior in safety of operation, ease of operation and so on.

° The direct method has been improved and the materials used have been upgraded, automatized systems have been widely introduced, construction works have been improved in technical terms, and safety and ease in operation are almost on the same level as the indirect method.

ii) Refrigerator compressor

A two-stage compressor with the highest performance at -25°C will be used, and the screw type compressor is recommended for easy maintenance with small numbers of spare parts and longer maintenance-free time.

Furthermore, the central control method will be employed for easy conversion either to Class F or Class C, low running costs, smooth centralized machine control, etc.

b) Appurtenant facilities

The functional operation and management of cold storage will necessitate the following appurtenant facilities.

i) Doorway

A wide doorway is essential for the smooth operation of forklifts for handling works, and the electric sliding door leaf system would be employed and the air curtain would be linked to the operation of doors.

Furthermore, a door-heater shall be provided around the doorway to prevent the door leaves from being cold, and a floor heater shall be installed around the doorway so that forklifts do not slip.

ii) Monitoring and warning system

A centralized control system will enable close watching or monitoring of the equipment and machines so as to prevent troubles and accidents. A cold storage warning system shall be provided for detecting and warning of ammonia gas leaks.

iii) Ammonia fighting facilities

Water sprinklers should be installed in the machine rooms as a countermeasure against ammonia leaks. Gas masks and fighting suites shall be provided ready for use in case of emergency. On the other hand, hydrants and water pumps should be provided for fire fighting and other emergencies. Furthermore, a diesel generator should be installed for power cutoff to secure consecutive 10-hour operation of the machines.

(4) Management of Cold Storages

Cold storages are facilities to store foods like meat, chicken, fish, and dairy products at low temperatures, and consequently, the successful operation and management of cold storages requires not only stringent checking of the flow of products in terms of quantity but also the quality control and sanitation maintenance. And the basic requirements for successful operation and management of cold storages are presented hereunder, while the details of the operation and maintenance of the facilities are described in Section V-2, "Operation and Maintenance Plan".

a) Complete quality and sanitation control in cold storages

An appropriate temperature control in cold storages is quite essential to keep stored products in high quality and sanitation, and for this purpose, great care should be taken of the following points.

i. To store cold foods at appropriate temperatures in terms of their kinds and quantity,
ii. To conduct thorough training of laborers for their full understanding on the concept of TTT (Time, Temperature, Tolerance),

iii. To realize the sanitary handling of meat and other foods in their processing.

b) Quantitative control of the stored products to meet the demand-supply conditions.

The quantitative control of cold storages is necessary for a balanced demand and supply of well cooled cold foods. The thorough quantity check of products coming in and out as well as the establishment of an efficient operation plan of a group for cold storages based on a variety of information on demand meat, suppliable quantity, quantity control among cold storages, transportation capacity of meat, etc., are essential.

c) Efficient operation, stringent maintenance, and effective management of cold storages

The proposed cold storages should be provided with built-in thermostat for the automatic control of storage temperature corresponding to the kinds of stored products, and also ammonia sensors should be installed to give early warning of ammonia leakage to protect the staff from poisoning. Mechanized works should be introduced with forklifts as major equipment so as to have higher labor productivity and safety.

d) Establishment of functional managerial organization

The establishment of a functional managerial organization is essential for smooth and efficient operation of a cold storage. The said organization will be able to function fully to facilitate the entire works of the cold storage through the exchange of information, secure an effective flow of instructions and reports and also to clearly divide the responsibility for works.

(5) Outline of Meat Processing Plants

The physical plan of meat processing plant was formulated aiming at efficient processing works and quality control of products, and hence, the meat processing plants should have a rationalized processing system. Specially, their equipment and working environment should meet hygienic requirements.

The basic concepts for the proposed processing plants are discussed hereunder.

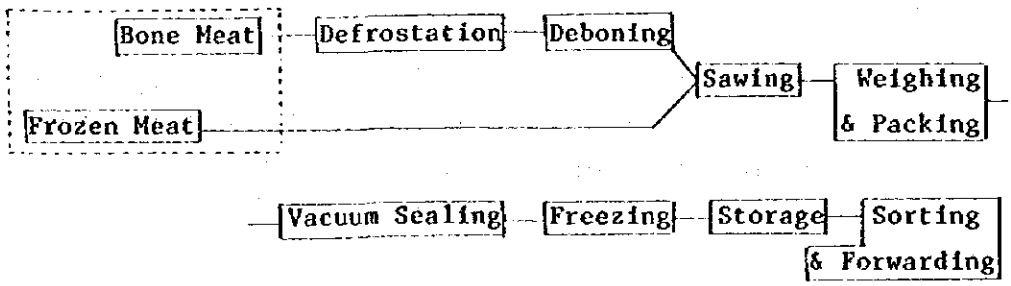
a) The meat processing plants will be attached to the consumption-area type cold storages. Temperature in processing rooms should be kept within a range from 15°C to 18°C, while temperature in the cold rooms should be in a range from 0°C to -30°C. A processing room should not be flanked by cold rooms, but provided separately from cold rooms.

b) The following points should be taken into consideration for maintaining clean and hygienic environment in and around a processing room.

i. To check laborers going in and out of the processing room;
ii. To install shoe-cleaners at doorways; and,
iii. To provide air-cleaning devices in the processing rooms.

c) The flow of processing works is illustrated as follows:

(Cold Storage)



d) One deboning staff member can deal with bone meat of 450 kg (1.5 head equivalent) per eight hours, two sawing staffs (for one machine) can cut meat into 3,840 blocks per eight hours, and one weighing and packing staff member can make 1,440 bags of meat per eight hours on an average.

e) The conveyor system or tray system is proposed for hauling products in the meat processing plants so as to minimize the labor required for hauling and to simplify the flow of work for a high working efficiency and a clean working environment.

f) The germ-free defrosting method is proposed to secure a high quality of products(see Appendix B-23) instead of watering and natural defrosting methods.

g) Vinyl bag packing commonly employed at present shall remain unchanged on the assumption that modern equipment and devices such as automatic weighing machines with digital price indicators, automatic cartoning machines, and so on will not be introduced.

h) Trays or containers will be used for handling small blocked loaves of meat in packs. And hence, washing machines will be introduced for cleaning these trays and containers.

i) The blocked meat packed in vinyl bags shall be sealed by vacuum sackers to keep a high quality of products.

j) In terms of hygienic control of the processing rooms, high pressure washing machines should be employed for making it a rule to clean the processing rooms every day after the day's work is over.

k) The products, immediately after packing, should be refrozen in the freezing room, and stored in cold rooms until forwarding in order to keep a high quality of production.

(6) Ice-making Plant

The proposed ice plant shall have a daily ice making capacity of 100 tons. Crystal block ice with a weight of 25 kilograms will be produced.

The plant shall be equipped with an ammonia refrigerator, ice making tank, ice making can, evaporation coils, automatic water supply tank and filler for ice cans, dipping tank, can dump, electrically operated overhead crane, air blow system for making crystal ice, and so forth.

The water quality analysis was made on the water samples taken during the field investigation, and the water is found suitable as raw water for ice making. The results of the analysis are shown in Table 24.

Table - 24 Water Quality Analysis

(Unit : ppm)

Items	Port-said	Port-daid Abbas	Alexandria Kabbary	Alexandria Labban	Alexandria Maryut	Suez Office	Suez Ice making	Suez Ataqa#2	Cairo Ramada
1. Total mineral soluble salts (different salts)	830	736	894	970	868	988	1,120	1,060	1,230
2. Iron (Fe)	1	1	2	2	2	3	3	3	4
3. Calcium (Ca)	54	48	56	57	59	47	45	49	122
4. Total hardness ($CaCO_3$)	157	136	150	157	164	143	139	143	336
5. Sulphate (SO_4)	390	398	410	430	440	425	438	400	488
6. Chloride (Cl)	60	43	156	171	85	206	249	234	142
7. PH	7.72	7.64	7.59	7.60	7.70	7.59	7.62	7.38	7.61
8. Mg	22	19	21	21	24	17	16	19	64

Notes : 1. The PH value was determined using electro-chemical analysis.
2. The colour and odour of the water samples are normal.
3. The taste is not known.

(7) Site Conditions and Geological Surveys

a) Site Conditions

Taking into consideration the existing traffic condition and difficulty in land acquisition in ARE, the proposed cold storages and ice plant will be erected at the sites selected by GERCO. As for the cities like Alexandria where the sites have been selected recently, a detailed study should be carried out in future.

It is most desirable that the Government of Egypt should carry out the following matters so as not to hamper the realization of the Project.

i. Surveying and bore hole drilling at the sites;
ii. Site arrangement and levelling;
iii. Withdrawal or removal of existing buildings and buried obstructions from the proposed sites; and,
iv. Provision of electricity, water supply, and telecommunication facilities.

b) Foundation

The location of borehole in the data provided should be confirmed as to whether it covers the location of the proposed buildings or not.

After taking the bearing capacity of the ground at each site into consideration, reinforced concrete slabs are planned for the foundation, except for the GHAMRA site in Cairo which shall be supported by pile.

(8) Industrial Standards

The British Standards prevail among the indigenous products and some imported materials, and the import goods except the above should employ International Standards.

IV-3-2. Schematic Plan of Facilities by Sites

(1) Cold Storage in Alexandria

a) Site

Half of the cold foods stored in the cold storage in Alexandira are for consumption. The selection of the site has been conducted in consideration of the conveniences of the transportation to consumers in Cairo. GERCO has proposed a site in Amria along the desert road.

b) Schematic Design of Facilities

Many heavy trucks for long distant transportation to Cairo and light trucks for local distribution will arrive and depart at the cold storage. In schematic design, due attention was paid to to the flow of trucks in the compound for smooth loading and unloading.

The compound will be provided with a building for cold storage and meat processing plant, truck bay, parking areas, pallet yards, a shed for outdoor equipment, and service roads as follows:

° Building:

A cold storage with a capacity of 6,000 tons and meat processing plant with a capacity of 25 tons per day will be integrated in one building. The building will be located in the center of the proposed site.

° Truck Bay and Parking Areas:

A truck bay with a parking area for heavy trucks will be separated from these for light trucks so as to operate these trucks on different truck zones in the compound.

° Pallet Yard:

For smooth unloading and loading, two pallet yards, one for heavy trucks and the other for light trucks, will be attached to the platform for each type of trucks.

° Shed for Outdoor Equipment:

The shed for outdoor equipment will be located near the machine room to be provided in the building.

° Service Roadway:

For smooth operation in the compound, a service road will be laid out to connect the heavy truck zone with the light truck zone.

c) Architectural Plan of Facilities

The building is roughly divided into the cold storage zone and the meat processing zone. Therefore, the flow of general cold foods will be separated from that of processed meat. For smooth operation and maintenance, the office space for management will be provided beside the heavy truck platform while the equipment space is provided beside the light truck platform. The major dimensions of facilities at Alexandria will be as follows(see Appendix B-24);

Compound area:	24,000 sq.m	
Floor area in total:	7,656 sq.m	
Cold room capacity:	6,000 tons	(1,500 tons/room x 3 rooms + 750tons/room x 2 rooms)

Meat processing capacity:	25 tons/day
Bone meat:	5 tons/day
Boneless meat:	20 tons/day
Freezing capacity:	4.25 tons/18 hrs
ice-making capacity:	15 tons/day

d) Physical Plan of Cold Storage

Facilities	Capacity	Storage Temperature	Remarks
Cold Room	1,500 tons x 3 Rooms 750 tons x 2 Rooms	-25°C, 0°C	Convertible System of Room Temperature
Product Stock Room	15 tons x 1 Room	-25°C	
Freezing Room	4.25 tons x 1 Room	-30°C	4.25 tons/ 18 hrs
Meat Processing Room		+18°C	

Major Equipment

- Ammonia Compressor 4 units

Type : Two-staged Screw Compound Compressor
Capacity: Approx. 100,000 Kcal/h x 100 kw
Evaporation Temperature -40°C
Condensing Temperature +40°C

- Ammonia Compressor 1 unit

Type : High Speed Multi Piping Two-staged Compressor
Capacity: Approx. 25,000 Kcal/h x 45 kw
Evaporation Temperature -45°C
Condensing Temperature +40°C

- Ammonia Condenser 3 units

Type : Evaporation Type
Capacity: Approx. 40 RT

- Forklift 10 units

Type : Reaching Type (Battery-Driven)
Capacity: 1.5 tons x 6 m

- Stand-by Diesel Generator 3 units

Capacity: Approx. 250 KVA 2 units
Approx. 100 KVA 1 unit

(2) Abbas and Sherif Cold Storages at Port Said

a) Site Conditions

The function of proposed cold storage facilities at Port Said will be to temporarily stock and forward imported cold foods to Greater Cairo. In other words, the facilities will be of the port-area type. It would be most desirable to obtain a single site sufficient for 5,000 tons of cold storage in the port area. GERCO, however, has proposed two sites at Abbas and Sherif instead, mentioning the difficulty in land acquisition in the port area. GERCO has cold storages at the both sites which have been deteriorating considerably, and intends to dismantle these existing cold storages for the proposed ones.

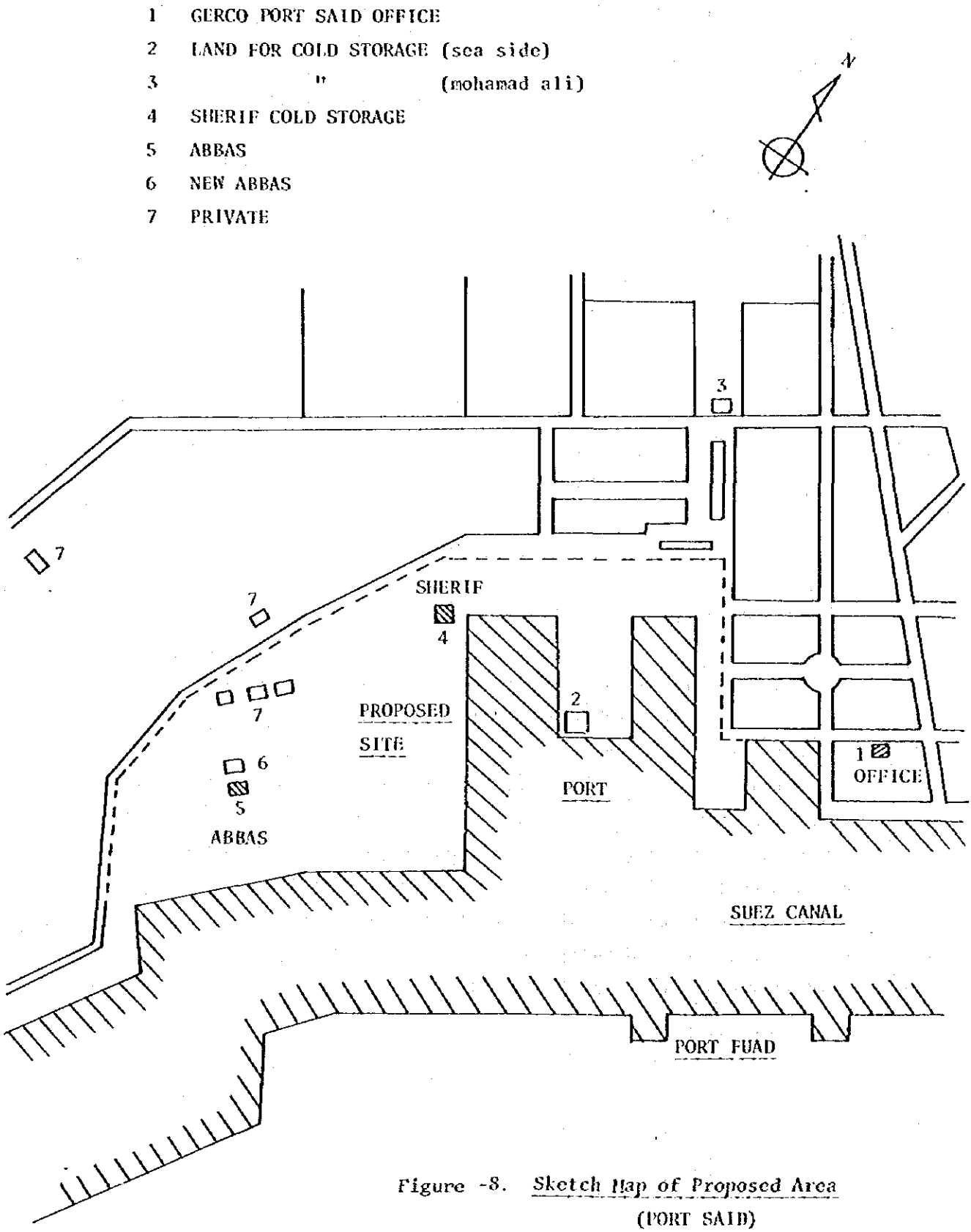
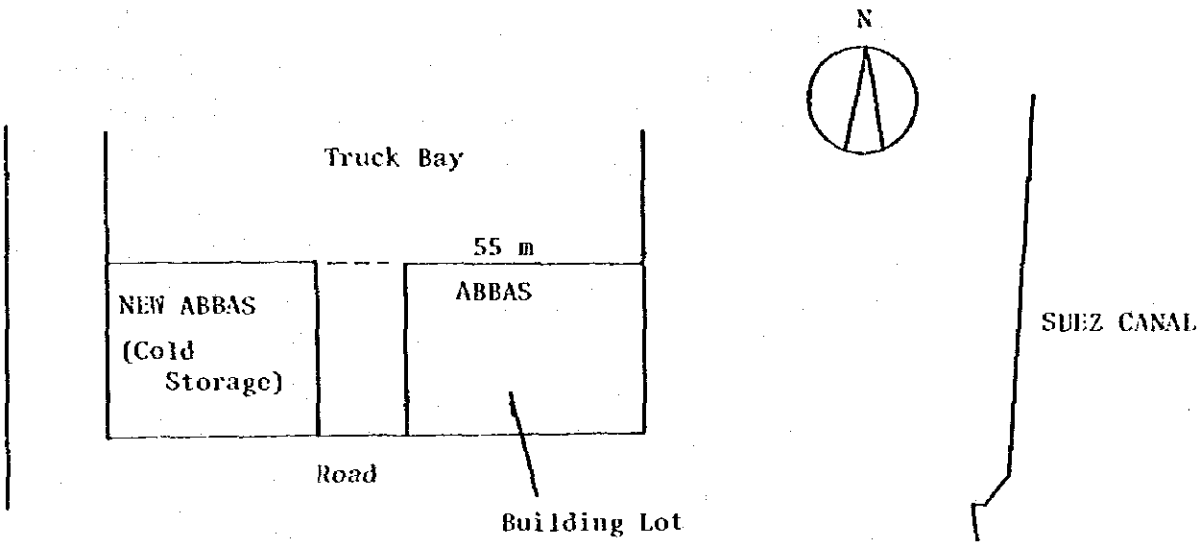


Figure -8. Sketch Map of Proposed Area (PORT SAID)

i. Abbas site

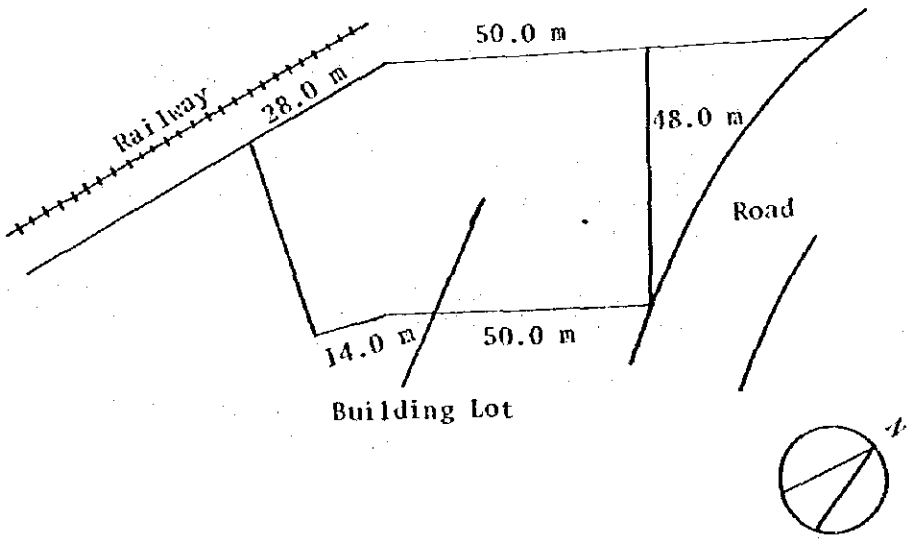
The size and shape of the Abbas site is as illustrated below;



Site area: 2,475 sq.m

ii. Sherif site

The size and shape of the Sherif site is as illustrated below:



Site area: 3,270 sq.m

b) Schematic Design of Facilities

i. Abbas Site

As illustrated above, the Abbas site of 2,475 square meters in size (45m x 55 m) adjoins the New Abbas cold storage which is under construction. The proposed cold storage facilities are designed to face the existing facilities of New Abbas cold storage for common use of the truck zone as well as for the smooth operation and maintenance of both cold storages. The site has no space for a parking area and a pallet yard. It is prerequisite for operation of the proposed cold storage facilities to secure the land for a parking area and a pallet yard in the neighboring areas. Judging from the size and shape of this site, the maximum capacity of cold storage facilities to be installed will be 2,000 tons or less.

ii. Sherif site

The Sherif site is slightly larger than the Abbas site. However, only its northern side faces a road. Judging from the size and shape of this site, no larger cold storage than the capacity of
3,000 tons could be expected. For smooth operation and maintenance, the following requirements should be satisfied;

- The land between the site and the existing road shall be made available for constructing a truck bay for this cold storage;
- For operation and maintenance of the machine room to be placed behind cold rooms, a service road shall be extended across the railway line; and,
- The parking area and pallet yard shall be secured in the neighboring areas of this site.

c) Architectural Plan of Facilities

i. Abbas Site

The cold storage is of a port-area type that handles a large quantity of cold foods in a limited time. The site of 45 meters wide is, however, insufficient for the parallel arrangement of cold rooms which is the most suitable to the above-mentioned type of cold storages. The central corridor type building will be built at this site. An open-type platform will be constructed for the easy handling of cargo. The office space for management will be provided at the frontage of this building having a wide vision of the compound. The shed for outdoor equipment will be placed behind the cold rooms. The access to the shed for operation and maintenance will be made from the road at the wharf side. The major dimensions of the Abbas cold storage are as follows;

Compound area:	2,475 sq.m
Floor area in total:	1,864 sq.m
Cold room capacity:	2,000 tons (500 tons/room x 4 rooms)

ii. Sherif Site

The central corridor type building is designed for cold storage since the site is as small as the Abbas site. The major dimensions of the facility is as follows;(see Appendix B-26)

Compound area:	3,270 sq.m
Floor area in total:	2,444 sq.m
Cold room capacity:	3,000 tons (750 tons/room x 4 rooms)

d) Plan of Cold Storage Facility

1. Abbas Site

Cold Storages : 500 tons x 4 Rooms
Storage Temperature: -25°C to 0°C, Convertible to either Class C or Class F

Major Equipment

- Ammonia Compressor 3 units

  Type: Two-staged Screw Compound Compressor
  Capacity: Approx. 75,000 Kcal/hr x 75 kw
  Evaporation Temperature -40°C
  Condensing Temperature +40°C

- Ammonia Condenser 2 units

  Type : Evaporation Type
  Capacity: Approx. 30 RT

- Forklift 4 units

  Type : Reaching Type (Battery-Driven)
  Capacity: 1.5 tons x 6 m

- Stand-by Diesel Generator 2 units

  Capacity: Approx. 200 KVA x 1 unit
  Approx. 50 KVA x 1 unit

ii. Sherif Site

Cold Storage : 750 tons x 4 Rooms
Storage Temperature: -25°C to 0°C, convertible to either Class C or Class F

Major Equipment

- Ammonia Compressor 3 units

  Type:Two-stage Screw Compound Compressor
  Capacity: Approx. 90,000 Kcal/hr x 100 kw
  Evaporation Temperature -40°C
  Condensing Temperature +40°C

- Ammonia Condenser 2 units

  Type : Evaporation Type
  Capacity: Approx. 40 RT

- Forklift-Truck 6 units

  Type : Reaching Type (Battery-Driven)
  Capacity: 1.5 tons x 6 m

- Stand-by Diesel Generator 2 units

  Capacity: Approx. 250 KVA x 1 unit
  Approx. 50 KVA x 1 unit

(3) Cold Storage at Suez

a) Site Conditions

The proposed site of 1.0 hectare (100 m x 100 m) is located between the existing Attaqa No.2 and No.3 cold storages, and is large enough to erect a 3,000-ton class cold storage.

b) Schematic Design of Facilities

Heavy trucks for long distance transportation will depart and arrive at the cold storage in the future. The site will be provided with a building, a truck bay, a parking area, a pallet yard, and a shed for outdoor equipment. For smooth unloading and loading, the parking area will be located in front of the truck berth across the service road. The open space at the both sides of the building will be utilized as a pallet yard and for placing the shed for outdoor equipment.

c) Architectural Plan of Facilities

A large quantity of cold foods shall be handled in a short time at this cold storage. To meet the requirement, cold rooms will be arranged in parallel. The major dimensions of the facilities are as follows;(see Appendix B-27)

Compound area	:	10,000 sq.m
Floor area in total:		2,350 sq.m
Cold room capacity :		3,000 tons
		(750 tons/room x 4 rooms)

d) Plan of Cold Storage Facilities

Cold room : 750 tons x 4 Rooms
Storage Temperature: -25°C to 0°C, Convertible type either to Class C or Class F

Major Equipment

- Ammonia Compressor 3 units

Type: Two-staged Screw Compound Compressor
Capacity: Approx. 100,000 Kcal/hr x 100 kw
Evaporation Temperature -40°C
Condensing Temperature +40°C

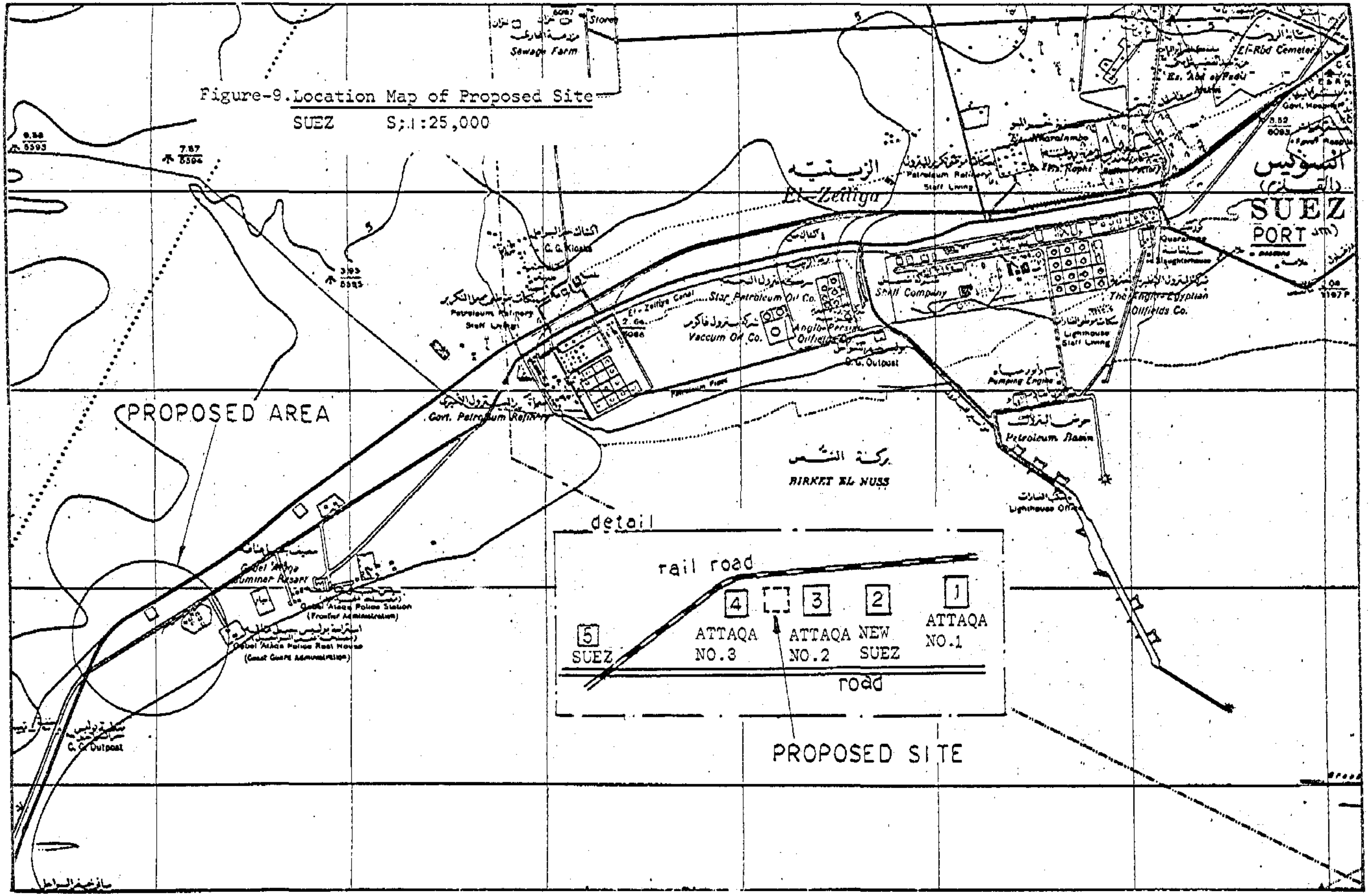


Figure-9. Location Map of Proposed Site
SUEZ S;1:25,000

- Ammonia Condenser 2 units

  Type: Evaporation Type
  Capacity: Approx. 40 RT

- Forklift 7 units

  Type : Reaching Type(Battery-Driven)
  Capacity: 1.5 tons x 6 m

- Stand-by Diesel Generator 2 units

  Capacity: Approx. 275 KVA x 1 unit
  Approx. 50 KVA x 1 unit

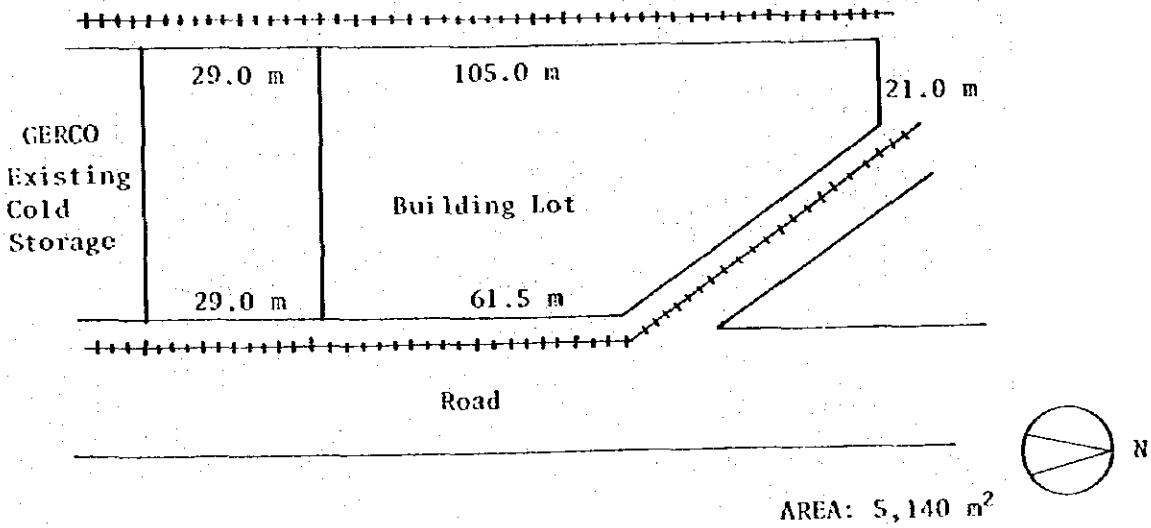
(4) Cold Storages at Cairo

a) Site Conditions

The Study team requested GERCO to secure the sites at Heliopolis and Giza in Greater Cairo. However, GERCO proposed sites at Ghamra and Ramada because of the difficulty in land acquisition at Heliopolis and Giza.

i. Ghamra Site

The proposed site of 5,140 square meters at Ghamra is located at the center of this city, adjoining the existing cold storage of GERCO. The size and shape of this site are illustrated below;



AREA: 5,140 m^2

ii. Ramada

The Ramada site proposed by GERCO is 1.6 hectares in size and adjoins the existing cold storage of GERCO as below.

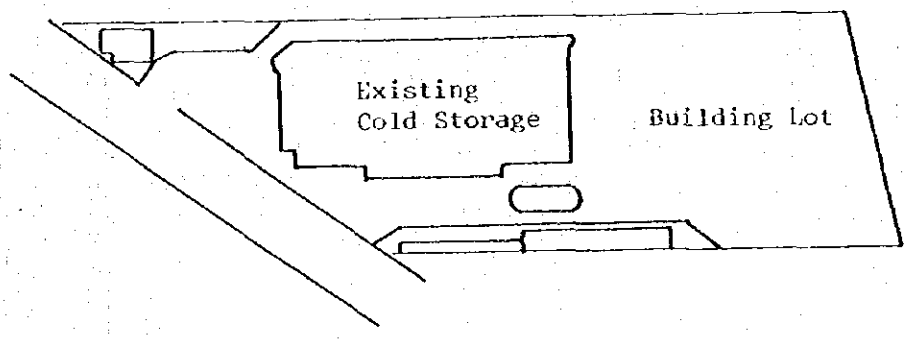
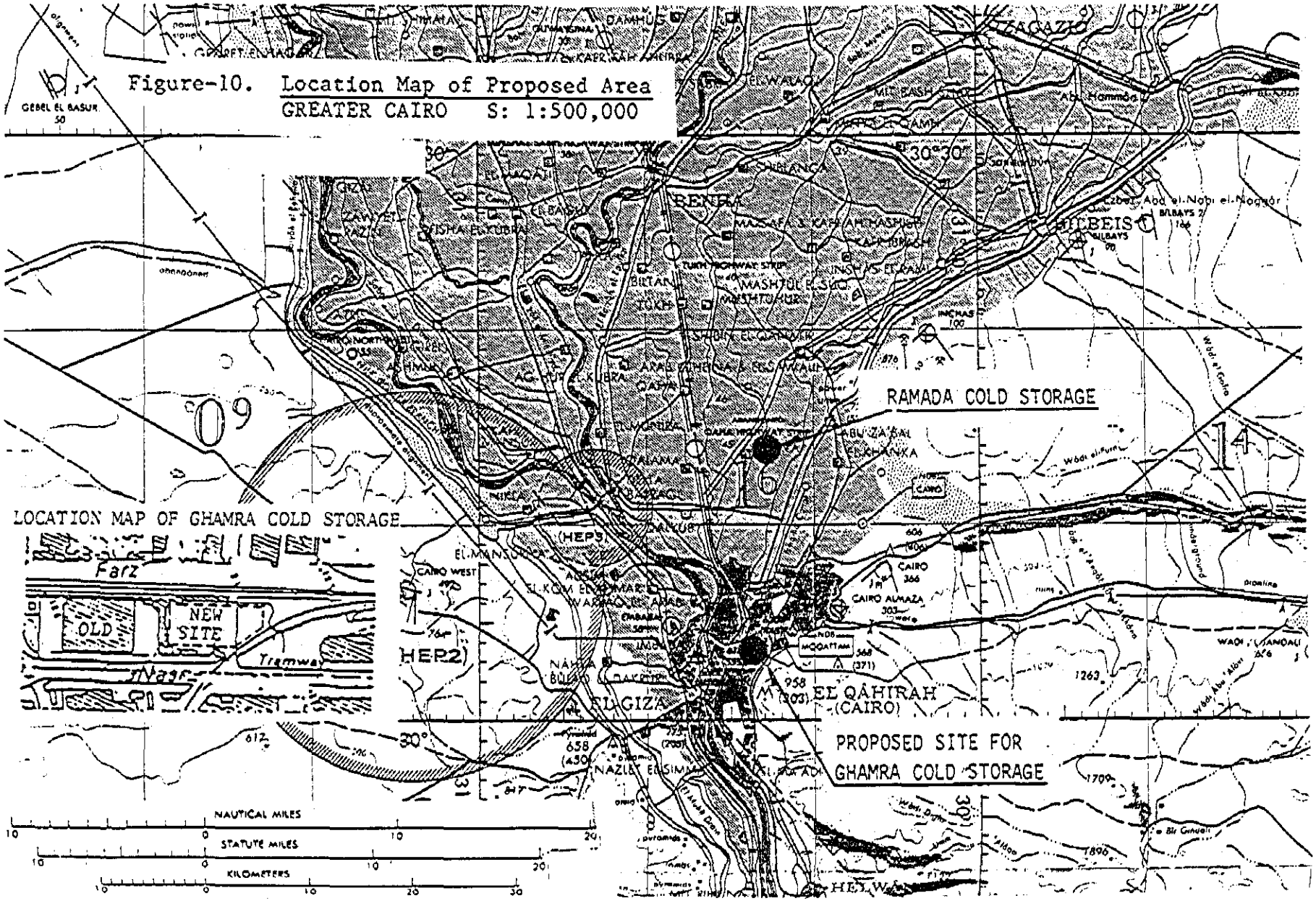


Figure-10. Location Map of Proposed Area
GREATER CAIRO S: 1:500,000



b) Schematic Plan of Facilities

i. Ghamra

As mentioned above, the proposed site adjoins the existing cold storage of GERCO. The new cold storage facilities will be so placed to face the existing ones across a service road for the effective use of land and for the smooth operation and maintenance of these cold storages. The space between both cold storage buildings should be as wide as possible to secure sufficient land for the parking area. The pallet yard will be located behind the new cold storage. It might be difficult to secure land for a meat processing plant at this site, and so only a cold storage with a capacity of 3,000 tons has been planned at Ghamra.

ii. Ramada

Cold storage facilities with a capacity of 3,000 tons and equipped with meat processing plant with a capacity of 25 tons per day are schematically designed as follows;

° Building

A central corridor type building is proposed for the cold storage at Ramada in consideration of its role of distributing a limited quantity of cold foods to consumers in Cairo in order to meet the daily demand. A cold storage and meat processing plant are integrated in one building which will be erected at the heart of this compound.

° Truck Bay and Parking Area

The combination of a truck bay and parking area will be constructed for each type of truck to unload and load general foods and to distribute processed meat. A truck bay and a parking area will be provided for each type of trucks and on each side of the building to separate the two types of truck zones.

° Pallet Yard

A pallet yard will be located beside each platform for easy unloading and loading.

° Shed for Outdoor Equipment

A shed for outdoor equipment will be placed behind the machine room in the building.

° Service Roadway in the Compound

For smooth operation, a service roadway will be extended along the building to connect the truck zone for general foods with that for processed meat.

c) Architectural Plan of Facilities

i. Ghamra

The central corridor type building is planned for the cold storage at Ghamra, after taking into account its role of meeting the small daily demand of consumers. The electricity facilities for the existing cold storage have been installed at the proposed site. They shall be moved to the westernmost

between the two cold storage buildings prior to the erection of new cold storage facilities.

The major dimensions of facilities at Ghamra are as follows;

Compound area	:	5,140 sq.m
Floor area in total:		2,605 sq.m
Cold room capacity :		3,000 tons
		(750 tons/room x 4 rooms)

ii. Ramada

As regards the plan of facilities, the cold room zone will be provided at the side of the platform for general foods while the meat processing zone at the side of the platform for processed meat. For easy operation and maintenance, the office space for management and the room for equipment will be placed adjacent to both the cold rooms and the meat processing plant. The major dimensions of facilities are as follows(see Appendix B-29);

Compound area:	16,000	sq.m
Floor area in total:	4,741	sq.m
Cold room capacity:	3,000	tons
	(750 tons/room x 4 rooms)	
Meat processing capacity:		
Bone meat:	10	tons/day
Boneless meat:	15	tons/day
Total	25	tons/day
Freezing capacity:	8.5	tons/18 hrs
Product Stock Room :	35	tons/day

d) Physical Plan of Cold Storage

i. Ghamra

Cold Storage : 750 tons x 4 Rooms
Storage Temperature: -25°C to 0°C, Convertible to either Class C or Class F

Major Equipment

- Ammonia Compressor 3 units

  Type: Two-staged Screw Compound Compressor
  Capacity: Approx. 100,000 Kcal/hr x 100 kw
  Evaporation Temperature -40°C
  Condensing Temperature +40°C

- Ammonia Condenser 2 units

  Type : Evaporation Type
  Capacity: Approx. 40 RT

- Forklift 5 units

  Type : Reaching Type (Battery-Driven)
  Capacity: 1.5 tons x 6 m

- Stand-by Diesel Generator 2 units

  Capacity: Approx. 250 KVA x 1 unit
  Approx. 50 KVA x 1 unit

ii. Ramada

Facilities	Capacity	Storage Temperature	Remarks
Cold Room	750 tons x 4 Rooms	-25°C, 0°C	Convertible type either to Class F or Class C
Product Stock Room	35 tons x 1 Room	-25°C	
Freezing Room	8.5 tons x 1 Room	-30°C	8.5 tons/18 hrs
Meat Processing Room		+18°C	

Major Equipment

- Ammonia Compressor 4 units

  Type:Two-staged Screw Compound Compressor
  Capacity: Approx. 100,000 Kcal/hr x 100 kw x 3 units
  Evaporation Temperature -40°C
  Condensing Temperature +40°C
  Approx. 55,000 Kcal/hr x 75 kw x 1 unit
  Evaporation Temperature -45°C
  Condensing Temperature +40°C

- Ammonia Condenser 2 units

  Type : Evaporation Type
  Capacity: Approx. 40 RT

- Forklift 5 units

  Type : Reaching Type (Battery-Driven)
  Capacity: 1.5 tons x 6 m

- Stand-by Diesel Generator 3 units

  Capacity: Approx. 250 KVA 2 units
  Approx. 100 KVA 1 unit

(5) Ice-Making Plant at Alexandria

a) Site Conditions

A site necessary for the proposed ice plant is 5,200 sq.m in size at the port area of Alexandria.

b) Schematic and Architectural Plans of Facilities

The ice plant will consist of an ice-production zone and the operation and equipment zone. In the ice-production zone, an ice-making room, a delivery room, an ice storage and a platform will be installed in line according to the production system of ice. The operation and equipment zone will be provided in parallel with the production zone for smooth operation and maintenance. The major dimensions of the facility are as follows(see Appendix B-30);

Compound area	:	5,200 sq.m
Floor area	:	1,066 sq.m
Ice-making capacity	:	100 tons/day
Ice-storage capacity	:	200 tons/day

c) Plan of Ice-making Facilities

Ice-making Capacity	:	Crystal Block Ice of 25 kg, 100 tons/day
Ice Storage Room	:	200 tons x 1 Room
Storage Temperature	:	-5°C to -7°C

Major Equipment

- Ammonia Compressor 3 units

Type : Single-staged Screw Compound Compressor
Capacity: Approx. 320,000 Kcal/hr x 180 kw x 2 units
Approx. 130,000 Kcal/hr x 75 kw x 1 unit
Evaporation Temperature -15°C
Condensing Temperature +40°C

- Ammonia Condenser 2 units

Type : Evaporation Type
Capacity: Approx. 140 RT

- Ice Making Tank 2 units

Capacity: 50 tons x 2 units

- Raw Water Cooling Tank 1 unit

- Stand-by Diesel Generator 2 units

Capacity: Approx. 250 KVA 2 units
Approx. 50 KVA 1 unit

(6) Cold Food Transportation

a) Refrigeration Truck

As mentioned above, 16 10-ton refrigeration trucks will be introduced for the transportation of the Project cold foods such as meat, chicken, fish, and dairy products as follows;

	Unit
Alexandria to Cairo	7
Port Said to Cairo	6
Suez to Cairo	3
Total	16

b) Forklift

For unloading & loading and short distance hauling of cold foods, 37 forklift with a hauling capacity of 1.5 tons will be introduced as follows;

Area	Cold Storage	Unit
Alexandria	Amria	10
Port Said	Abbas	5
	Sherif	5
Suez	Suez	7
Greater Cairo	Ghamra	5
	Ramada	5
	Total	37

IV-4. The Project Cost

The total project cost is estimated at L.E. 54.2 million (16,300 million Japanese yen) inclusive of price escalation during the implementation period, of which about 62 percent (equivalent to L.E. 33.5 million or 10,100 million Japanese yen) comes under the foreign currency portion while the remaining 38 percent (equivalent to L.E. 20.7 million or 6,200 million Japanese yen) under the local currency portion.

The breakdown of the estimated project cost is shown below and the details are presented in Appendix B-31:

Table - 25. Breakdown of the Project Cost
- Initial Investment Cost (Financial) -

(Unit: L.E. 1,000)

Item	Total			1985		1986	
	F/C	L/C	Total	F/C	L/C	F/C	L/C
1. Foundation Works	-	4,428	4,428	-	3,100	-	1,328
2. Building Works	13,489	3,243	16,732	9,442	2,270	4,047	973
3. Cooling Equipment	5,540	689	6,229	3,878	482	1,662	207
4. Meat Processing Facility	2,040	360	2,400	1,428	252	612	108
5. Pallet	-	1,270	1,270	-	-	-	1,270
6. Insulated Truck and Forklift	1,417	-	1,417	-	-	1,417	-
Sub-total	22,486	9,990	32,476	14,748	6,104	7,738	3,886
7. Project Administration	-	3,248	3,248	-	2,085	-	1,163
8. Consulting Service	2,183	594	2,777	1,310	356	873	238
9. Training Program	140	-	140	84	-	56	-
10. Physical Contingency	2,107	1,221	3,328	1,475	855	632	366
Total(1 to 10)	26,916	15,053	41,969	17,617	9,400	9,299	5,653
11. Price Contingency	6,573	5,702	12,275	3,876	3,102	2,697	2,600
Grand Total	33,489 (61.7%)	20,755 (38.3%)	54,244 (100.0%)	21,493	12,502	11,996	8,253

Note: F/C: Foreign Currency L/C: Local Currency

The project cost is estimated under the following conditions:

(1) Cost is estimated by using the unit prices of 1982 for when the field survey was conducted

(2) Exchange rates adopted are US Dollar 1.00 = L.E. 0.80 and L.E. 1.00 = ¥300.00

(3) Estimated cost excludes the cost of land acquisition, removing the existing facilities, and of land leveling, all of which to be covered by other allocation of Egyptian budget

(4) Estimated cost also excludes the cost of exterior ditch works, which would be covered by the Egyptian budget as the necessity arises

(5) Estimated cost includes the cost of piling works at Ghamra and of completely replacing foundation materials at Sherif, and of footing foundation for other areas

(6) Physical contingency is estimated based on the following percentages times the respective base cost

Foundation Works	15%
Buildings	10%
Cooling Equipment	10%
Meat Processing Facility	10%
Pallet	10%
Insulated Truck and Forklift	0%

(7) Project administration cost accounts for ten percent of total base cost and is listed under the local currency portion

(8) Cost will be expended over two years as follows:

	1985	1986
Foundation Works	70%	30%
Buildings	70%	30%
Cooling Equipment	70%	30%
Meat Processing Facility	70%	30%
Pallet	0%	100%
Insulated Truck and Forklift	0%	100%
Project Administration (porportion of actual expenditure)		
Consulting Service and Training Program	60%	40%
Physical Contingency	70%	30%

(9) Contingency for price escalation is estimated using the following figures:

	1983	1984	1985	1986
F/C: Annual Inflation Rate (%)	6.0	7.5	7.0	6.0
Compound Escalation Factor (%)	6.0	14.0	22.0	29.0
L/C: Annual Inflation Rate (%)	10.0	10.0	10.0	10.0
Compound Escalation Factor (%)	10.0	21.0	33.0	46.0