6. Fishery Activity

6-1 Fishery Production

The fishery production of the nation in 1982 totaled about 1,502 thousand tons, a slight decrease from 1981.

In the last five years, national fishery production has increased favorably from about 819 thousand tons in 1978 to about 1,502 thousand tons in 1982, as shown in Table III-31.

The fishery production in the Manzanillo region was officially recorded as 3,500 tons in 1983, but the volume in the last six years has fluctuated from year to year.

As shown in Table III-31, it increased remarkably from 1,329 tons in 1978 to 6,353 tons in 1980, but went down by half in 1981, and increased again to 3,500 tons in 1983.

We hear that the 6,353 tons in 1980 was due to a change of landing ports for tuna. Namely, some tuna which has been landed at American ports were for a variety of reasons landed at Mexican ports. In this sense we see that this volume in 1980 is an unusual figure.

Overall, fishery production in the Manzanillo region has been favorably increasing from 1,329 tons in 1978 to 3,500 tons in 1983.

Table III-31 Fishery Production by Region

(Unit: t)

Area	1978	1979	1980	1981	1982	1983
Mexico	818,511	1,002,925	1,257,146	1,565,465	1,502,300	–
Pacific	626,916	769,255	1,006,724	1,232,587	–	–
Gulf and Carib	179,143	189,707	222,329	290,377	–	–
Colima State	4,131	4,644	9,248	10,340	5,461	–
Officially Registered	1,927	2,440	7,044	4,410	4,214	–
Manzanillo	1,329	1,744	6,353	3,454	2,550	3,500

Note: 1) – indicates no available data.
2) This table is based on the fishermen's association statistics.
Source: PESCA

There are 3 fishery offices in Colima State: Manzanillo, Colima and Tecoman, of which the Manzanillo region supplies the greater part of the officially registered fishery production as shown in Table III-32.

The main species landed in the Manzanillo region are sharks, shrimps, and scale-fishes such as "Mojarra" and "Guachinango".

Table III-32 Fishery Production by Office in Colima State (1981)

(Unit: t)

Office	Fishery Production
Total	10,340
Colima	98
Manzanillo	3,454
Tecoman	858
Not Officially Registered	5,930

Note: This table is based on the fishermen's association statistics.
Source: PESCA, "Anuario Estadístico de PESCA 1981"

The Pacific coast is primary for Mexican fishing. In 1981, about 80% of fishery production in Mexico was supplied by this zone, as shown in Table III-33.

According to the Ministry of Fishery, fishery sea areas in Mexico are classified into below four zones, and the Manzanillo region belongs to Zone II, as shown in Fig. III-43.

Zone I .... consists of Baja California, Baja California Sur, Sonora and Sinaloa State.

Zone II .... is the sea area from Nayarit State to Chiapas State.

Zone III and Zone IV .... are the sea area in the Gulf of Mexico.

Zone I supplies 87% of fishery production along the Pacific coast, and the Manzanillo region accounts for only 0.3%. On the other hand, almost all of the products are used for direct human consumption in Zone II, but more than 50% are used for processing purposes in Zone I, as shown in Table III-33.

Table III-33   Fishery Production and Use by Zone (1981)

(Unit: t)

Use / Zone	Total	Direct Human Consumption	Indirect Human Consumption	Industrial Use
Pacific	(78.8%) 1,232,587 [100.0%]	(64.5%) 589,097 [100.0%]	(98.8%) 613,511 [100.0%]	(96.0%) 29,979 [100.0%]
Zone I	1,072,714 [87.0%]	433,008 [73.5%]	610,332 [99.5%]	29,374 [98.0%]
Zone II	159,873 [13.0%]	156,089 [26.5%]	3,179 [0.5%]	605 [2.0%]
Manzanillo	3,454 [0.3%]	3,454 [0.6%]	—	—
Gulf and Carib	(18.5%) 290,377	(31.0%) 282,930	(1.2%) 7,445	(0.1%) 2
Others	(2.7%) 42,501	(4.5%) 41,271		(3.9%) 1,230
Total	(100.0%) 1,565,465	(100.0%) 913,298	(100.0%) 620,956	(100.0%) 31,211

Note: 1) — indicates no available data.
2) This table is based on the fishermen's association statistics.
3) (   ) is a share of the total, and [   ] is a share of the Pacific side.
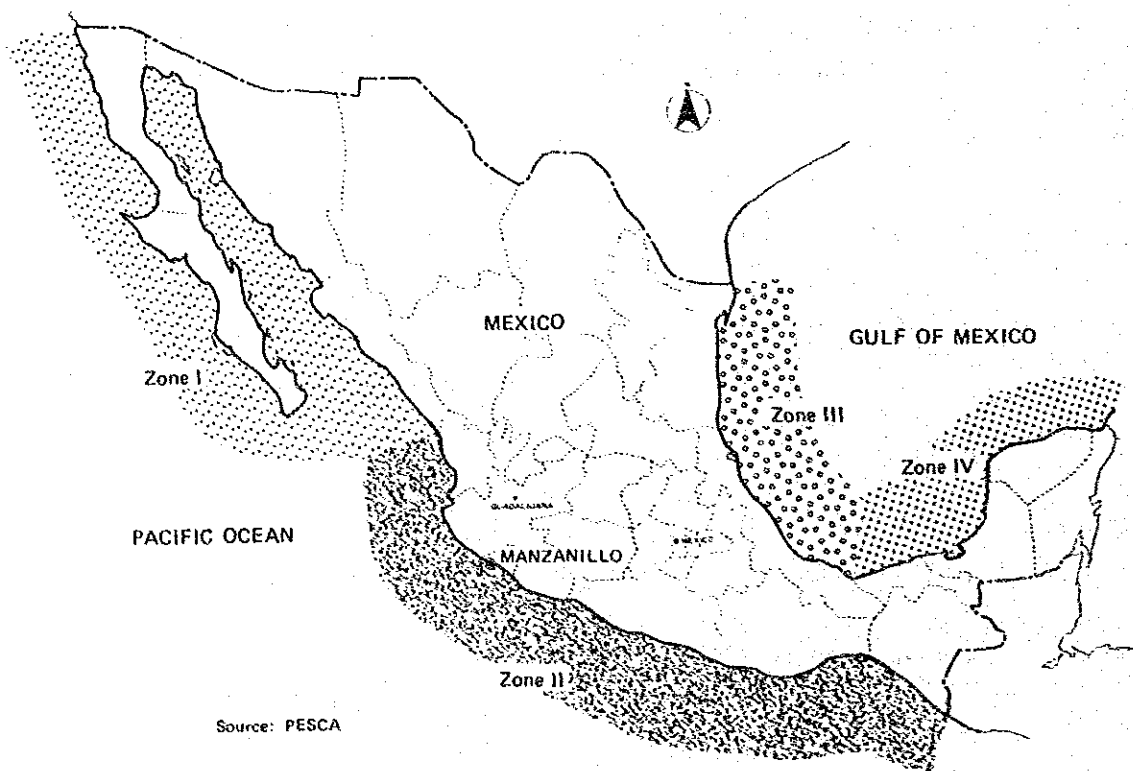Source: PESCA, "Anuario Estadistico de PESCA 1981"

Fig. III-43   Fishery Sea Areas in Mexico

Main species captured in Zone I are sardines, tunas, anchovies and sargassos, of which anchovies for indirect human consumption and sargassos for industrial use supply 100% of Mexican demand, as shown in Table III-34.

Table III-34   Fishery Production of Main Species in Zone I and Zone II (1981)

(Unit: t)

Zone	Direct Human Consumption		Share of the National Total	Indirect Human Consumption		Share of the National Total	Industrial Use		Share of the National Total
Zone I	Sardine	116,075	99.3	Anchovy	365,587	100.0	Sargasso	20,401	100.0
	Tuna	31,225	93.7	Sardine	227,681	98.5	Alga	8,870	96.5
	Shrimp	30,713	42.7						
Zone II	Mojarra	31,568	53.2	Sardine	202	0.09	—		
	Shrimp	8,791	12.2						
	Shark	6,523	31.6						

Note: 1) – indicates no available data.
　　　2) This table is based on the fishermen's association statistics.
Source: PESCA, "Anuario Estadistico de PESCA 1981"

6-2   Fishing Boats

In 1980, the nation's fishing boats numbered about 36 thousand boats. Most of which were small boats below 1 ton. Colima State had only 350 boats, as shown in Table III-35.

Table III-36 shows the number of fishing boats by sea area, main species and method of propulsion in 1980.

Table III-35   Fishing Boats by Region (1980)

(Unit: boats)

Area	Total	Below 1 t	1 ~ 3 t	3 ~ 5 t	5 ~ 10 t	10 ~ 20 t	20 ~ 40 t	40 ~ 60 t	60 ~ 80 t	80~100 t	Over 100 t
Mexico	36,041	20,040	11,162	916	392	271	752	1,650	616	147	95
Pacific	18,266	9,910	5,965	330	133	102	387	875	394	80	90
Gulf	16,823	9,183	5,192	586	259	169	365	775	222	67	5
Colima	350	201	60	6	4	4	8	45	16	6	—

Source: PESCA, "Anuario Estadistico de PESCA 1981"

Table III-36　Number of Fishing Boats by Region, Main Species and Method of Propulsion

Zone		Total	Main Species					Method of Propulsion			
			Shrimp	Tuna	Sardine	Scale-fish		Motor	Oar	Sail	No Classification
						Greater	Smaller				
Pacific		18,266	1,540	51	123	214	16,338	11,907	6,268	--	91
	Zone I	9,605	1,237	51	123	172	8,022	8,615	938	--	52
	Zone II	8,661	303	--	--	42	8,316	3,292	5,330	--	39
	Colima	350	74	--	--	5	271	245	100	--	5
Gulf and Carib		16,823	1,173	--	--	430	15,220	9,681	6,977	135	30
Others		952	--	--	--	--	952	196	756	--	--
Total		36,041	2,713	51	123	644	32,510	21,784	14,001	135	121

Source: PESCA, "Anuario Estadístico de PESCA 1981"

Table III-37 shows the number of fishing boats registered to the Manzanillo fishery office in 1981.

Table III-37　Fishing Boats Registered in the Manzanillo Region

(Unit: boats)

Ship Size	Number of Boats
Below　1 t	82
1 ~　3 t	69
3 ~　5 t	9
5 ~　10 t	8
10 ~　20 t	15
20 ~　40 t	4
40 ~　60 t	3
60 ~　80 t	16
80 ~ 100 t	42
Over 100 t	14
No classification	7
Total	269

Most of these boats are based at other fishery ports because of the insufficiency of landing and processing facilities at Manzanillo.

Furthermore, we hear that 280 more boats were registered in 1982.

6-3 Distribution of Fishery Products

Fig. III-44 shows the destinations and transportation share of the fishery products in the Manzanillo region. Main destinations are as follows:

Federal District	(35% of total)
Jalisco State	(20% of total)
Aguascalientes State	(12% of total)
Colima State	(9% of total)

6-4 Processing Facilities

As for the facilities for fishery processing in the Manzanillo region, most of them are located at some distance from the port. Table III-38 shows the details of these facilities.

Table III-38   Facilities for Fishery Processing

Kind of Facility	Number of Companies	Capacity
Ice Making	5	150 t/24 hours
Cold Storage	4	325 t
Frozen Storage	3	30 t
Freezing	2	34 t/24 hours

Source: PESCA

All of these facilities are related to the capture and the distribution of fishery products. In this sense, there are no full-scale facilities for fishery processing in the Manzanillo region.

N

COAHUILA

NUEVO LEON

DURANGO

AGUASCALIENTES

QUERÉTARO

TLAXCALA

DISTRITO FEDERAL

NAYARIT

JALISCO
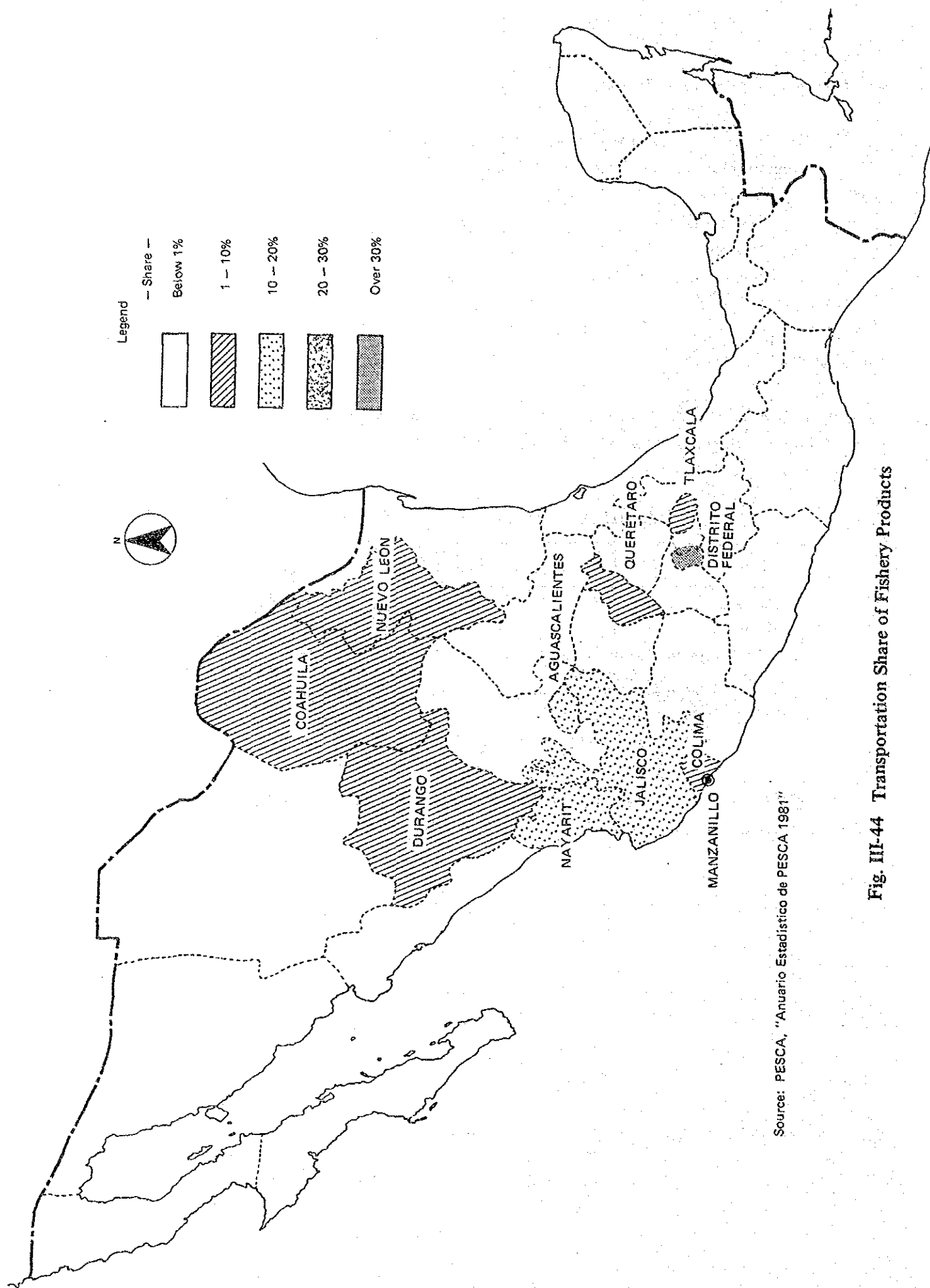
COLIMA

MANZANILLO

Fig. III-44 Transportation Share of Fishery Products

7. Tourism

7-1 Tourists Visiting Manzanillo

The number of tourists visiting Colima State is shown in Table III-39. This number has increased gradually with some fluctuations from year to year. In 1983, about 480 thousand tourists which includes about 140 thousand foreign tourists visited Colima State.

Although Mexicans comprise the majority of the tourists, the percentage of alien tourists shows a significant increase from 20% in 1979 to 29% in 1983.

More than 50% of these tourists visited the Manzanillo region. The Manzanillo region is the most important touristic zone in Colima State.

Table III-39 Tourists Visiting Colima State

(Unit: persons)

Year	Total	Mexicans	Foreigners
1979	460,734	368,588	92,146
1980	482,692	386,154	96,538
1981	481,572	375,627	105,945
1982	487,232	360,552	126,680
1983	478,326	339,612	138,714
1984*	387,368	271,158	116,210

Note: * from January 1 to August 31.
Source: TURISMO

To comply with increased demand, new lodging facilities have been constructed as shown in Table III-40.

Table III-40 Number of Lodging Facilities

Type of Facility \ Year Item	1982		1983	
	Buildings	Rooms	Buildings	Rooms
Condominiums	18	1,743	24	1,912
Hotels	20	1,001	16	1,013
Motels	4	106	4	131
Apartment Houses	4	205	22	326
Bungalows	20	287	10	216
Guest Houses	11	156	11	185
Trailer Parks	3	84	3	118
Total	80	3,582	90	3,901

Source: TURISMO

7-2 Crusing Vessels

As for cruising vessels moving along the Pacific coast of Mexico, 36 vessels anchored at Manzanillo Port and the passengers numbered about 14 thousand persons in 1983, as shown in Table III-41.

The number of vessels in the last five years has been increasing. However, the number of vessels and passengers is very few as compared with Acapulco, Puerto Vallarta and the like which are typical tourist cities.

Table III-41   Cruising Vessels and Passengers Calling at Pacific Coast Ports

(Unit: Ships, Persons)

Port \ Year Item	1979 No. of Vessels	1979 No. of Passengers	1980 No. of Vessels	1980 No. of Passengers	1981 No. of Vessels	1981 No. of Passengers	1982 No. of Vessels	1982 No. of Passenger	1983 No. of Vessels	1983 No. of Passengers
Ensenada	–	–	– –	–	98	50,804	93	67,361	110	70,289
Cabo San Lucas	35	30,027	53	38,249	65	41,693	55	43,814	76	64,570
Mazatlan	57	41,071	63	42,707	60	39,378	62	54,924	109	91,169
Pto. Vallarta	60	41,128	65	42,269	78	48,430	75	58,909	117	96,533
Manzanillo	17	10,696	9	6,042	9	5,774	24	10,971	36	13,622
Zihuatanejo	–	–	–	–	–	–	–	–	41	31,592
Acapulco	90	44,825	76	40,218	81	40,040	97	56,657	96	70,853

Source: DGODP, "Estadísticas del Movimiento Portuario Nacional de Carga y Buques 1983"

Table III-42 shows the characteristics of the vessels which move along the Pacific coast.

Six vessels periodically anchored at Manzanillo Port in 1983. Fig. III-45 shows an operation diagram of four typical vessels from October 1st to December 31st, 1983. The "Pacific Princess" and "Cunard Princess" come every fourteen days on route to Acapulco. The G/T of these two vessels is about 20 thousand G/T.

There are about 30 lunches in the outer port. Most of the boats anchor in the sea area because of the lack of proper mooring facilities.

Table III-42   Characteristics of Vessels Moving along the Pacific Coast

Name of Vessel	Company	G/T	Size of Vessel (m)	
			Length	Draft
Queen Elizabeth 2	Cunard Line	65,863	293.52	17.06
Camberra	Princess Cruises	43,974	249.48	8.84
Roterdam	Holland American Quices	37,783	228.17	—
New Amsterdam	Holland American Quices	33,930	193.74	8.90
Europa	Apag Lloyd	33,819	199.92	8.53
Eugenio "C"	Costa Lime Sitmar	30,567	217.38	9.80
Sea Princess	Princess Cruises	27,670	201.17	8.84
Atlantic	Homelines Cruises	27,029	203.79	7.92
Maximo Gorky	Necherman and Reison	24,980	195.00	9.00
Agafjord	Morwegian American	24,002	188.08	8.23
Tropicale	Carnival Cruises	22,919	204.69	23.00
Royal Viking Sea	K/S Royal Viking Sea A/S	21,897	178.00	18.10
Royal Viking Sky	Royal Viking Line A/S	21,891	177.74	18.10
Royal Viking Star	Royal Viking Line A/S	21,847	178.00	18.10
Ivan Franco	Black Sea Shipping C.D.	20,203	176.00	8.10
Island Princess	Princess Cruises	19,906	163.00	6.40
Pacific Princess	Princess Cruises	19,903	163.00	6.40
Cunard Princess	Cunard Line	17,495	163.50	8.84
Sun Princess	Princess Cruises	17,370	163.03	6.70
Fairwina	Sitmar Cruises	16,666	153.00	10.27
T.S.S. Fairsea	Fairsea Shiving Corp.	16,627	176.00	8.83
Statendam	Holland American Cruises	15,377	187.66	10.36
Universe	Scawise Fundation Inc.	13,950	171.92	10.97
Odessa	Black Sea Shipping C.D.	13,757	125.58	8.00
Alphue	Delian Cruises	10,545	162.26	7.92
Golden Odyssey	Royal Cruises Line	6,751	118.49	6.20
Rhapsody	Paquet Cruises	24,414	195.00	8.23

Note: — indicates no available data.
Source: DGODP, "Estadísticas del Movimiento Portuario Nacional de Carga y Buques 1983"

Fig. III-45 Operation Diagram of Four Cruising Vessels
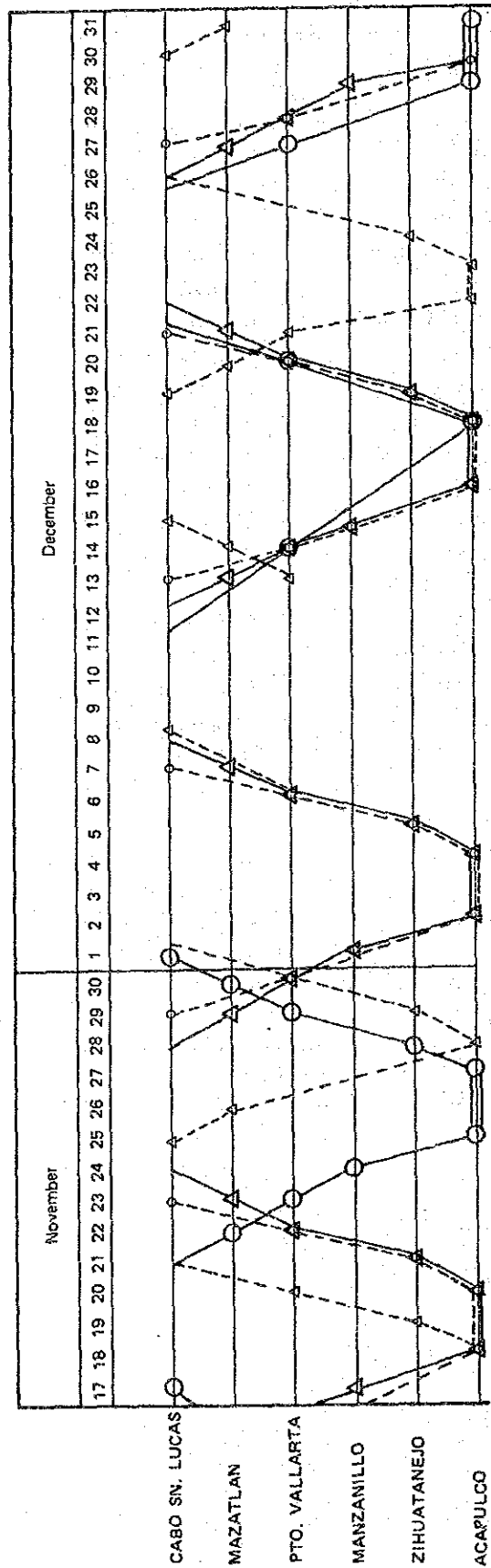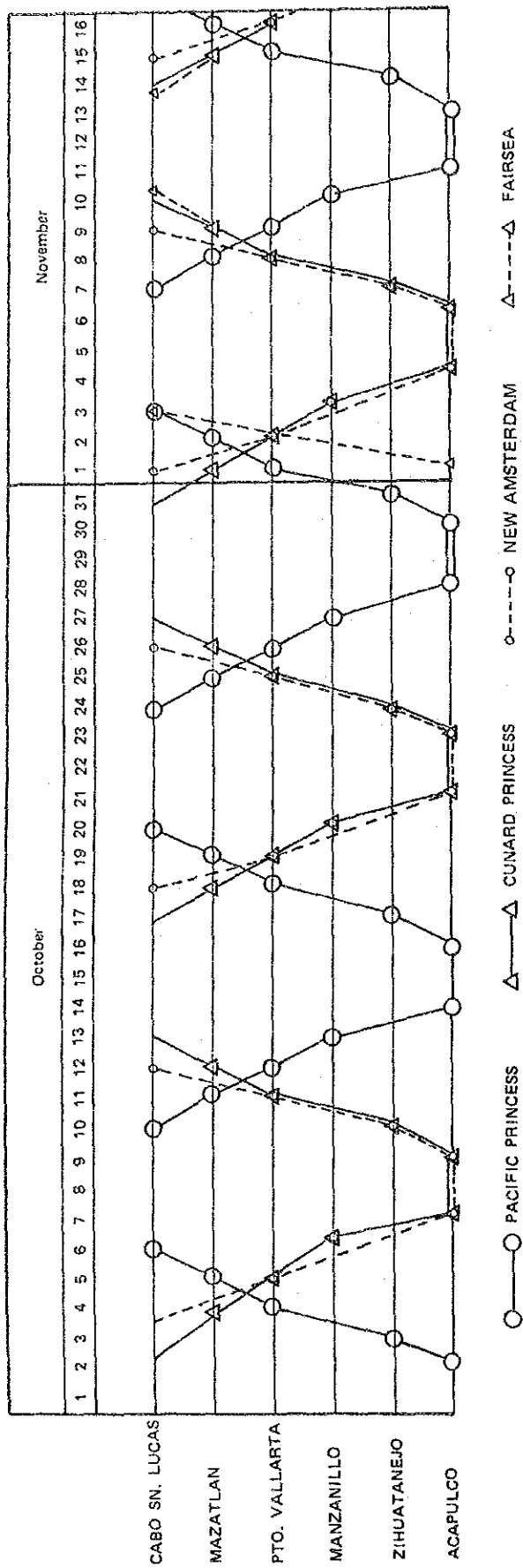
Source: Servicios Portuarios de Acapulco, S.A. de C.V.

PACIFIC PRINCESS   CUNARD PRINCESS   NEW AMSTERDAM   FAIRSEA

CHAPTER IV.
BASIC CONCEPT FOR THE DEVELOPMENT

CHAPTER IV BASIC CONCEPT FOR THE DEVELOPMENT

1. National and Regional Development Plan

The Port of Manzanillo Development Plan should be written after reviewing the National Development Plan as well as functional and regional development plans so as to take the spirit of these plans into consideration.

The main plans concerned are described below.

1-1 National Plan

1-1-1 "Plan Nacional de Desarrollo 1983 ~ 1988"

This plan published on May 30, 1983 includes national economic targets, two main policies for economic reconstruction and structural reformation, and suggested means for implementing policies, assuming that a high level of growth cannot be expected because of the present economic conditions in Mexico and throughout the world.

The plan includes the "economic reconstruction policy" consisting of ①reducing inflation and unstable exchange rates and ②recovering strong growth rates in each industrial sector; and the "structural reformation policy" consisting of ① creating employment associated with expanding production and improving income distribution and ②controlling the growth of Mexico City and promoting decentralization of production activities and population centers.

Based on this program, concrete execution programs have gradually been published such as the "Programa Nacional de Fomento Industrial y Comercio Exterior Trade 1984 ~ 1988" and "Programa Nacional de Comunicationes y Transportes 1984 ~ 1988", and regional development plans such as "Plan Colima".

With respect to the Pacific coast including Manzanillo Port, there is the stipulation that the "Central portion of the Pacific coast from Manzanillo to Guadalajara is considered as one of the suitable regions to be further developed for decentralization", as part of the decentralization policy, one of the main factors of the "Plan Nacional de Desarrollo 1983 ~ 1988".

Also, government policy for the transportation industry states: "Manzanillo will have to consolidate its commercial and service functions".

1-1-2 "Programa Nacional de Comunicaciones y Transportes 1984 ~ 1988"

Based on the "Plan Nacional de Desarrollo 1983 ~ 1988", this plan states targets such as the modernization and increased efficiency of transport, and the readjustment of local traffic flow to correct excessive centralization. The Program presents various policies for each sector.

For roads, the policy is to modernize the main trunk lines and construct local roads. As one of the projects in the plan, construction of a four-lane 240 km road between Manzanillo and Guadalajara is taking place, and further construction of a four-lane road from Guadalajara to Aguascalientes is being considered. When these roads are completed, the time required for

road transportation from Manzanillo to Guadalajara, Aguascalientes, Monterrey, and Mexico City will be greatly reduced.

As for railways, expansion of the trunk network with the construction of a transnational railway is being considered. A new line short-cutting the distance between Guadalajara and Monterrey by about 200 km from the existing trunk line is now being planned (see Fig. II-11). On this new line, the 118 km from Salinas to Laguna Seca will be completed in 1985. In addition, on the trunk line from Guadalajara through Mexico City to Veracruz, an electrified double-line from Mexico City to Queretaro, and expansion to a double-line between Queretaro and Irapuato are planned, and construction has begun. Each of these plans will help to greatly reduce the transportation time from Manzanillo to Monterrey and to Mexico City.

On the other hand, as for marine transport, improvement and development of harbor facilities are the main factor of the policy. Furthermore, policies to improve the loading ratio of Mexican ships as well as improving the management and operation of ports are promoted. With respect to the port of Manzanillo in this plan, construction of an access railway line and yard, dredging and construction of a new wharf for general cargo, and reclamation of the Tapeixtles Lagoon are planned to moderize this commercial port.

1-2 Regional Plans

The latest regional development plans which directly concern the development of the port of Manzanillo are as follows:

① "Pan de Desarrollo Urbano de Manzanillo" 1982
② "Plan Colima" 1983
③ "Plan Parcial de Zonas de Crecimiento" 1984

1-2-1 "Plan de Desarrollo Urbano de Manzanillo"

The relevant organizations:
① SEDUE
② Colima State Government
③ Manzanillo Municipal Government

In this plan, with a view to promoting urban growth in appropriate areas in the valley and at the foot of hills, the outline for basic land use is set forth. Areas to be preserved and to be developed are determined.

1-2-2 "Plan Colima"

The relevant organizations:
① Mexican Federal Government
② Colima State Government

This plan is made up based on the "Plan Director del Centro de Poblacion de Manzanillo", and includes the "Programa de Desarrollo Urbano Integral de Manzanillo".

Here, the development policy for the Manzanillo Metropolitan Zone directly relating to the development of the port of Manzanillo is shown as follows:

① Expand and modernize communication and transportation systems
② Increase the capacity of the catch of fish
③ Consolidate touristic development
④ Strengthen mineral and energy industries
⑤ Develop selected industries
⑥ Promote residential construction
⑦ Modernize commercial system
⑧ Enlarge and strengthen health, medical and social services

1-2-3 "Plan Parcial de Zonas de Crecimiento"

The relevant organizations:
① Colima State Government
② Manzanillo Municipal Government
③ COCOMABA
④ SEDUE

This plan gives an account of the areas where development is planned in the Manzanillo Metropolitan Zone. It considers criteria for choosing areas for development, and emphasizes a balanced and gradual growth in accordance with the varied functions of the port and metropolitan area.

Especially, population, population density and the number of tourists are minutely considered, and the land use plan in shown.

The area of development and the land use plan are shown in Table IV-1 and Fig. IV-1.

Table IV-1 Area of Development and Type of Land Use in the Manzanillo Metropolitan Zone

(Unit: ha)

Item	Short Term 1984 ~ 1988	Middle Term 1989 ~ 1994	Long Term 1995 ~ 2000	Total
Residential	232	285	352	869
Tourism	151	130	150	431
Light Industry	32	50	67	149
Heavy Industry	9	—	60	69
Commercial Port	80	—	—	80
Fishery Port	45	—	37	82
Naval Zone	40	—	—	40
Other	55	25	29	109
Total	644	490	695	1,829

Source: "Plan Parcial de Zonas de Crecimiento"
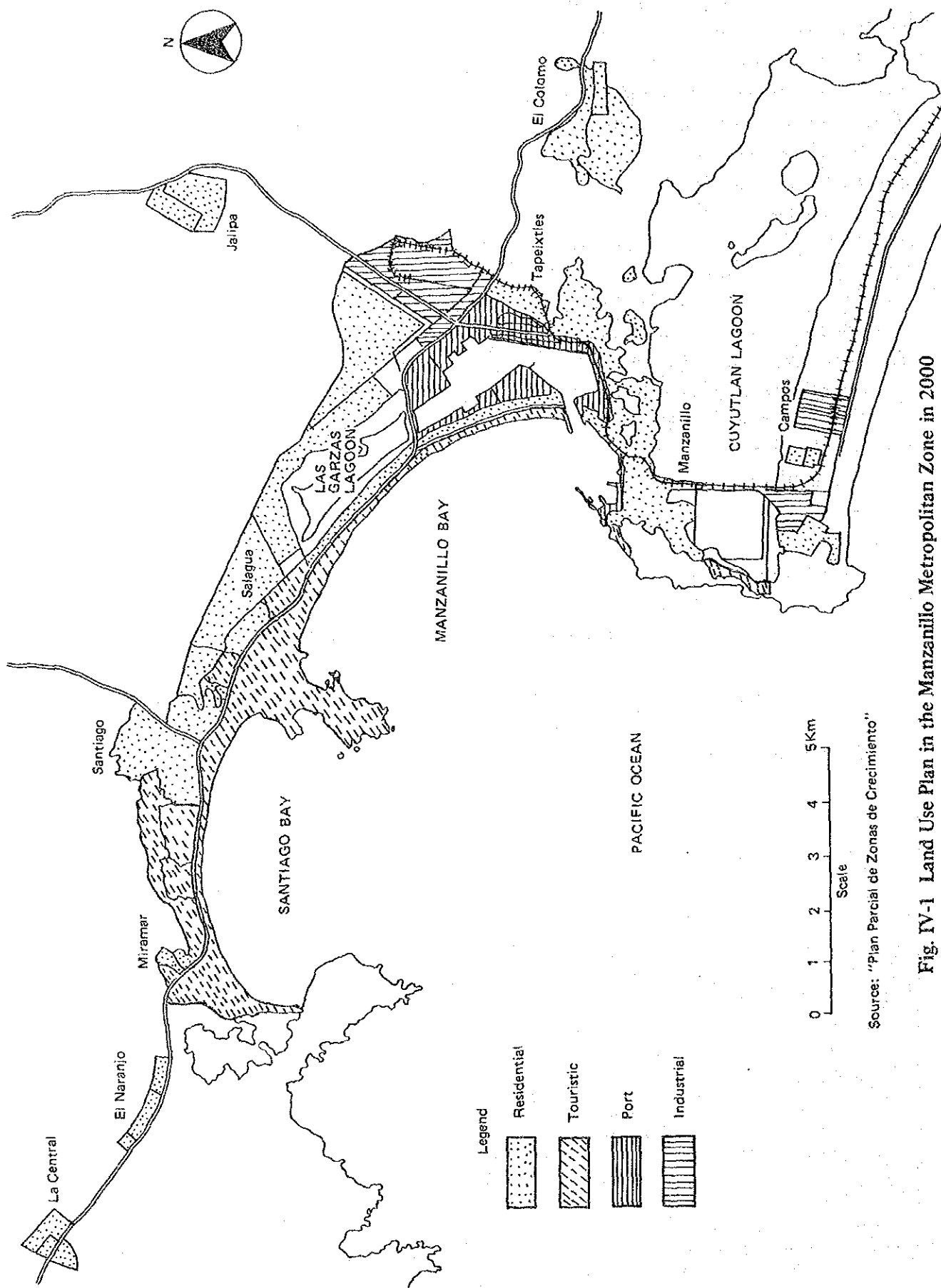
Fig. IV-1 Land Use Plan in the Manzanillo Metropolitan Zone in 2000

Source: "Plan Parcial de Zonas de Crecimiento"

Legend

Residential

Touristic

Port

Industrial

Scale

0 1 2 3 4 5Km

N

La Central

El Naranjo

Miramar

Santiago

SANTIAGO BAY

Jalipa

Salagua

LAS GARZAS LAGOON

MANZANILLO BAY

PACIFIC OCEAN

Tapeixtles

El Colomo

Manzanillo

CUYUTLAN LAGOON

Campos

2. Development Policy

2-1 Purpose of the Development

Ports fulfill two major roles: they function as the link between land and marine transportation, and they function as the nucleus of regional development. As for the first major role, "soft functions" such as port administrative systems, customs clearance procedures, and pilotage services are just as important as hardware such as berths and navigational aids. As for the second major role, through proper planning, port development can greatly contribute to regional economic growth and the elevation of standards of living. This is of particular importance along the Pacific coast of Mexico as the economy of the region is relatively depressed.

Specifically, the main goals of the development of Manzanillo Port are:

① To promote decentralization of population and economic activities; to help control the expansion of Mexico City

② To serve as a key port to facilitate cargo flow throughout the nation

2-2 Role of Manzanillo Port

In this section, the role of Manzanillo Port, especially the commercial role in relation with the port of Lázaro Cárdenas, is considered.

① From a historical viewpoint, the port of Manzanillo has been one of the most important ports on the Pacific coast. The port is connected by roads and railways with Guadalajara City, the second largest city in Mexico, and with other principal cities throughout the country.

② The port of Lázaro Cárdenas, located 260 km south-east of Manzanillo Port, has two berths for general cargo, one berth for container cargo, and some specialized berths like those for iron ore and fertilizer. A grain storage silo and a grain loading pier are under construction and will be completed in 1985. The general cargo volume handled at the port of Lázaro Cárdenas reached 547 thousand tons in 1983.

③ A big industrial zone will be formed in the future around the port of Lázaro Cárdenas. An iron and steel plant has already begun operating, and other industries such as manufacturing of pipe and tube products, oil refining, petrochemical production and food processing are expected to locate around the port. This means that the port will be characterized as an industrial port for shipping raw materials and products to and from the plants located near the port. Additionally, because of the new grain handling and storage facilities, the port will also play a prominent role in handling agricultural bulk cargo for the region.

④ The improvement of the inland transportation road and railway network connecting Lázaro Cárdenas Port with its hinterland, especially with the metropolitan area, will also make the handling volume at the port increase. However, in general, cargo shift from one port to another is difficult and takes a long time due to established trade routes and commercial patterns.

⑤ Considering that Acapulco Port will gradually lose its commercial port function and become an entirely touristic port, the current commercial trade at Acapulco Port will be divided

between the ports of Manzanillo and Lázaro Cárdenas.

⑥ Future Mexican foreign trade with East and Southeast Asia including Japan and South Korea is expected to expand in volume. This implies that the share of cargo volume handled at the Pacific coast ports will grow.

⑦ As mentioned above, the volume of cargo handled at the port of Lázaro Cárdenas will increase. Especially cargoes to and from the metropolitan area are expected to grow because Lázaro Cárdenas Port is located closer to Mexico City than Manzanillo Port is. Therefore, general cargo to and from the metropolitan area currently handled at the port of Manzanillo may very gradually shift to Lázaro Cárdenas Port in the future.

⑧ Although the port of Lázaro Cárdenas has consolidated its position as the primary industrial port and as the key port for grain imports on the Pacific coast, the port of Manzanillo will retain its position as one of the major Pacific ports. The volume of general cargo handled at Lázaro Cárdenas Port will gradually grow. Cargoes to and from the metropolitan area should grow in accordance with the improvement of inland transportation. Nevertheless, Manzanillo Port will continue to be of prime importance to its hinterland including Colima, Jalisco and Aguascalientes State, and to its influence area including D.F., Guanajuato, Michoacán, Nayarit, Querétaro and México State as will be described in Chapter V, Section 1. Especially, the hinterland has very favorable potential for development.

⑨ In addition, Manzanillo Port is a port of call for various liners which ply among Mexican ports and for liners which call at ports on both sides of the Pacific including those located on the west coast of U.S.A. and in the Far East and Southeast Asia. As there is no container wharf at the port of Manzanillo, full- and semi-container vessels currently do not call at the port. Containers are presently carried by conventional vessels, and thus the system for container cargoes is inefficient.

However, the overall volume of container cargoes to and from Mexico is expected to continue to increase. After consulting with shipping agents, it seems that the construction of a container wharf at the port of Manzanillo is justified.

The port of Lázaro Cárdenas will function as the primary port for container cargo on the Pacific coast of Mexico. Nonetheless, it seems that the construction of a container wharf at Manzanillo Port is economically sound. The increased cost which would be incurred by container vessels calling at Manzanillo Port is estimated to be small enough to be acceptable. It seems that the incremental cost would be more than offset by additional revenues. Thus, such a service would be profitable. If proper facilities for servicing container vessels were to be constructed at the port of Manzanillo, shipping agents would include the port in the container liner network between Mexico and the Far East and Southeast Asia.

2-3 Development Strategy

2-3-1 Functions

The functions of Manzanillo Port are as follows:
① The port of Manzanillo will serve commercial, fishery, tourist and military functions.

② Manzanillo Port's commercial roles described in the previous section are
　　o　one of the important gateways on the Pacific coast, and
　　o　the maritime transport center for the factories located around the port which will be the nucleus of the regional development.

③ Manzanillo Port should function as a key port for fish landing in Zone II fishery sea area, as mentioned in Chapter III, Section 6. The fish processing industry will be encouraged in Manzanillo City, and a number of fish processing companies are expected to locate just behind the fishery port.

④ As for the touristic function, Manzanillo Port is at present a port of call for cruising vessels along with Ensenada, Cabo San Lucas, Mazatlan, Puerto Vallarta, Zihuatanejo and Acapulco.

But the number of vessels and passengers landing at Manzanillo Port is very small compared with Mazatlan and Puerto Vallarta as explained in Chapter III, Section 7. Manzanillo Port should be consolidated as one of the major tourist ports on the Pacific coast. Recreational facilities should be built in Manzanillo City to promote increased tourism.

⑤ Manzanillo Port is the biggest navy base along the Pacific coast of Mexico. The navy plans to concentrate its facilities in the inner port. However, the present study will exclude the planning of the naval zone in accordance with the Minutes of the Discussion agreed upon by both the Mexican and Japanese sides in June 1984.

2-3-2　Overall Planning

The planning must be in harmony with land use planning around the object area, and with Manzanillo City development plans. The plan should minimize environmental damage.

2-3-3　Outer Port

The concepts of the outer port are as follows:

① Existing commercial activities in the outer port will cease. The outer port will become exclusively a tourist port. The fiscal wharf will only be used for cruising vessels.

② Because commercial cargo will no longer be handled in the outer port, the railways running to this area and some of the warehouses located behind the wharf will be removed and the space changed to a public use area.

③ The existing PEMEX oil facilities on land and in the sea will not be changed.

2-3-4　Inner Port

The concepts of the inner port are as follows:

① Fishery and commercial port functions other than petroleum handling will take place within the inner port.

② The Tapeixtles Lagoon will be reclaimed for industrial use.

③ The largest possible area should be reserved for future expansion.

2-3-5 Port Planning

The general planning concepts are:

① To cope with the modernization of sea transportation
② To improve traffic flow
③ To ensure port safety

CHAPTER V.
SOCIO-ECONOMIC FRAME FOR DEMAND FORECAST

CHAPTER V SOCIO-ECONOMIC FRAME FOR DEMAND FORECAST

1. Hinterland of the Port

The hinterland of the port of Manzanillo is determined from the data on the origin and destination of cargoes passing through the port and from the inland transportation situation described in Chapter III, Section 4.

Table V-1 shows the origin and destination of the foreign trade cargo passing through Manzanillo Port by each State, by transportation mode. From the Table, we can calculate the total transport share for each area, for export and import cargo as shown in Fig. V-1 and V-2.

From the figures, the following is apparent:

① As for export cargoes, about 39% of the total cargo originates from Aguascalientes State, followed by D.F. with 16%, and Jalisco with 12%. It must be noted that some of the export cargoes come from distant states such as Sonora, Coahuila and Quintana Roo.

② Jalisco State accepts more than 77% of the imported cargoes, followed by D.F. with about 6% and Colima, Guanajuato and Michoacán with 2 to 5%.

③ As for the total foreign trade cargo volume, summing up export and import cargo, the share for each state as shown in Fig. V-3 is very similar to that for import cargo because the import volume is far greater than the export volume.

④ Colima State in which the port of Manzanillo is located has such a small area and population when compared to the national totals that the flow of cargo is relatively small. However, when calculated on a per capita basis, the cargo volume for Colima State is the second highest, exceeded only by Jalisco State.

In conclusion, when considering the inland transport network, we may consider the following two categories of hinterlands for the port of Manzanillo as shown in Fig. V-4.

Hinterland: Colima, Jalisco, Aguascalientes State

Influence Area: D.F., Guanajuato, Michoacán, Nayarit, Querétaro, México State

Table V-1   Origin and Destination of the Foreign Trade Cargo
Passing through Manzanillo Port

(Unit: t)

State	Cargo Volume					
	Export			Import		
	Railway	Road	Total	Railway	Road	Total
Aguascalientes	29,553		29,553	500	4,403	4,903
Baja California		22	22	244	17	261
Baja California Sur		98	98			
Campeche						
Coahuila		1,683	1,683	3,506	52	3,558
Colima		653	653	11,515	11,868	23,383
Chiapas		51	51	954	1	955
Chiuahua		120	120	459	2	461
Distrito Federal	658	11,617	12,275		42,695	42,695
Durango				344	1,625	1,969
Guanajuato				22,632	8,184	30,816
Guerrero				315		315
Hidalgo		133	133	538	1,195	1,733
Jalisco	81	8,938	9,019	77,560	527,150	604,710
México	2,231	3,371	5,602	9,855	2,260	12,115
Michoacán		354	354	8,725	14,389	23,114
Morelos		421	421	174	849	1,023
Nayarit		51	51	3,324	1,692	5,016
Nuevo León	4,482	2,252	6,734		1,341	1,341
Oaxaca						
Puebla	602	4	606	2,096	386	2,482
Querétaro	4,036	406	4,442	13,120	63	13,183
Quintana Roo		1,649	1,649			
San Luis Potosi					734	734
Sinaloa		180	180	597	27	624
Sonora	220	1,918	2,138		3	3
Tabasco						
Tamaulipas		96	96	178		178
Tlaxcala				407		407
Veracruz		18	18	1,892	78	1,970
Yucatán				57		57
Zacatecas		715	715	70		70
Total	41,863	34,750	76,613	159,062	619,014	778,076

Source: 1983 data received from "Servicios Portuarios de Manzanillo, S.A. de C.V.".
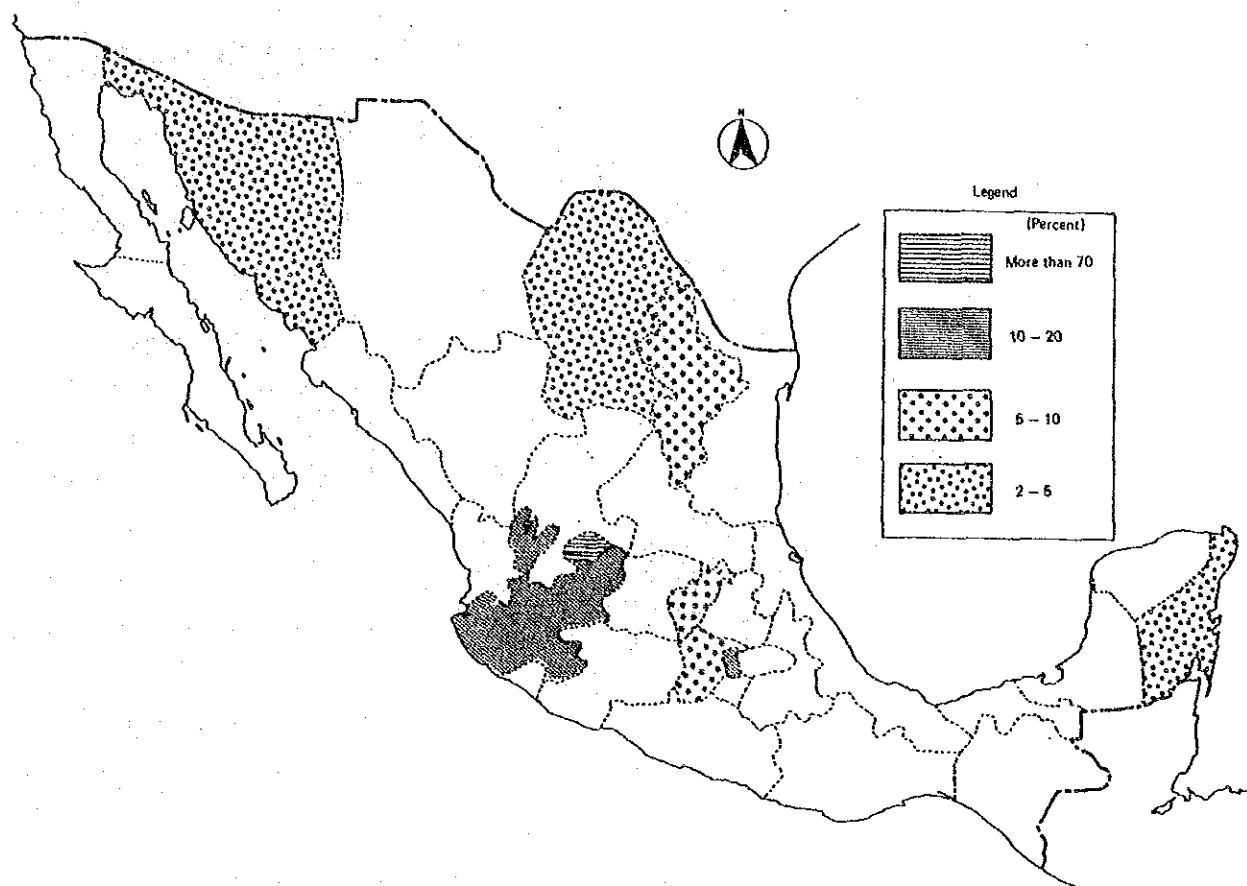
Fig. V-1 Share of Export Cargo Volume Handled at the Port of Manzanillo by Origin
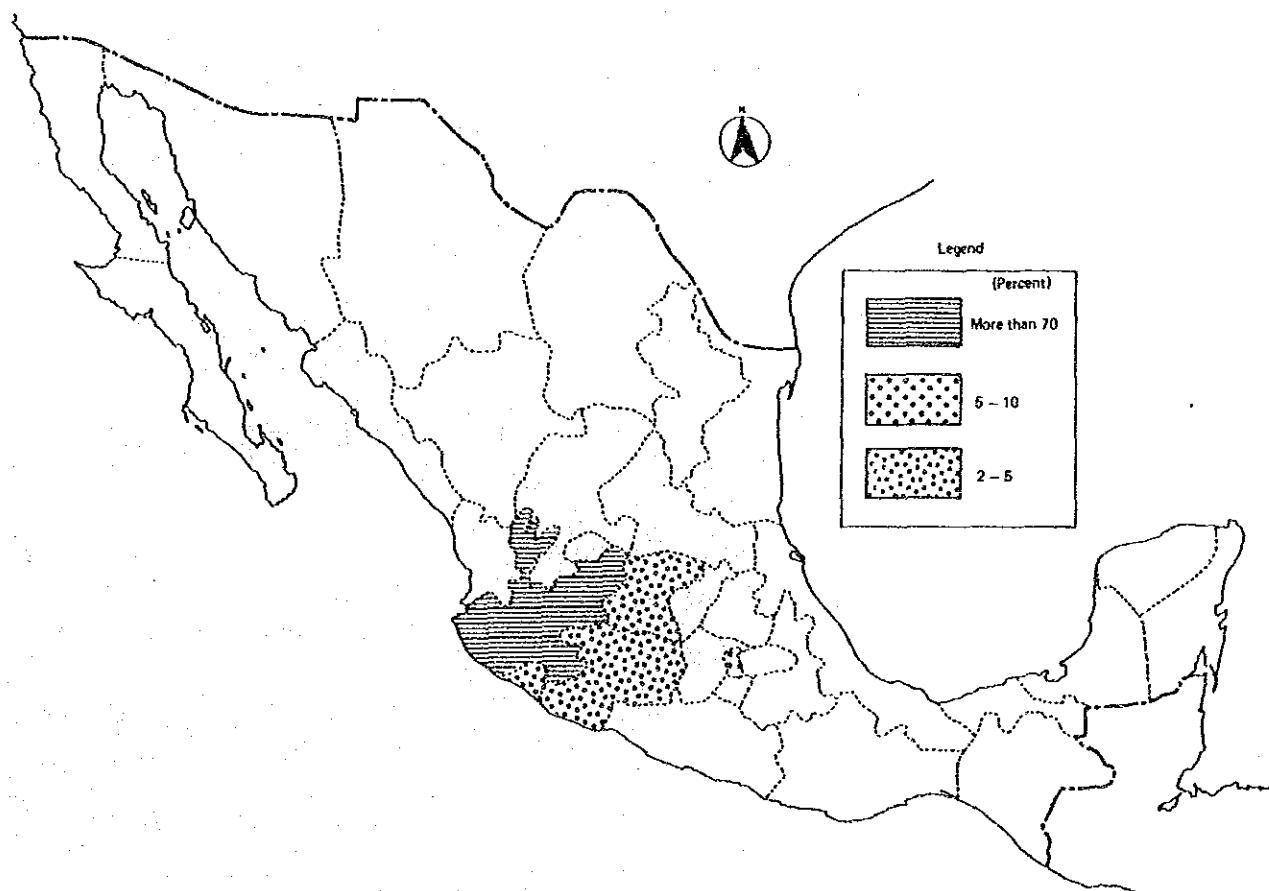

Fig. V-2 Share of Import Cargo Volume Handled at the Port of Manzanillo by Destination
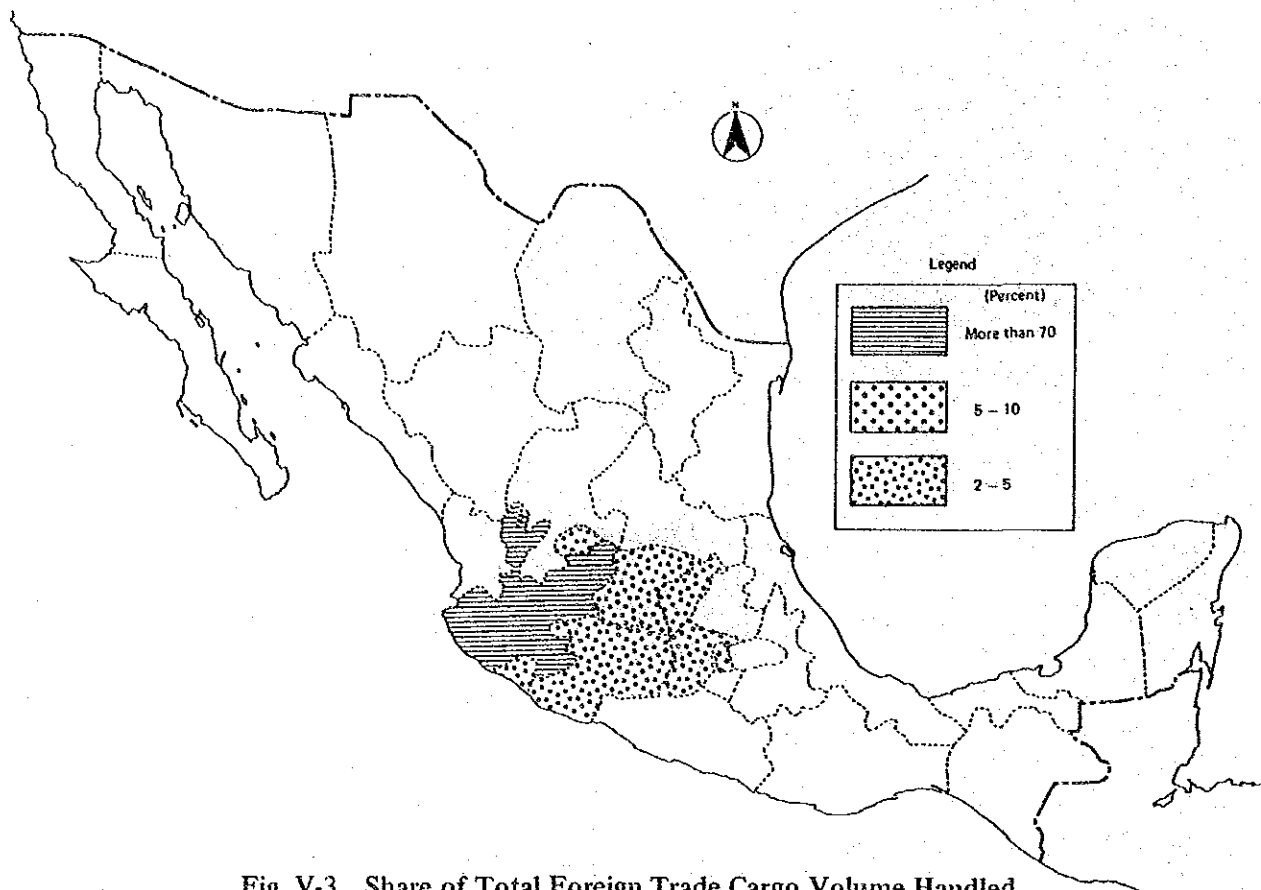
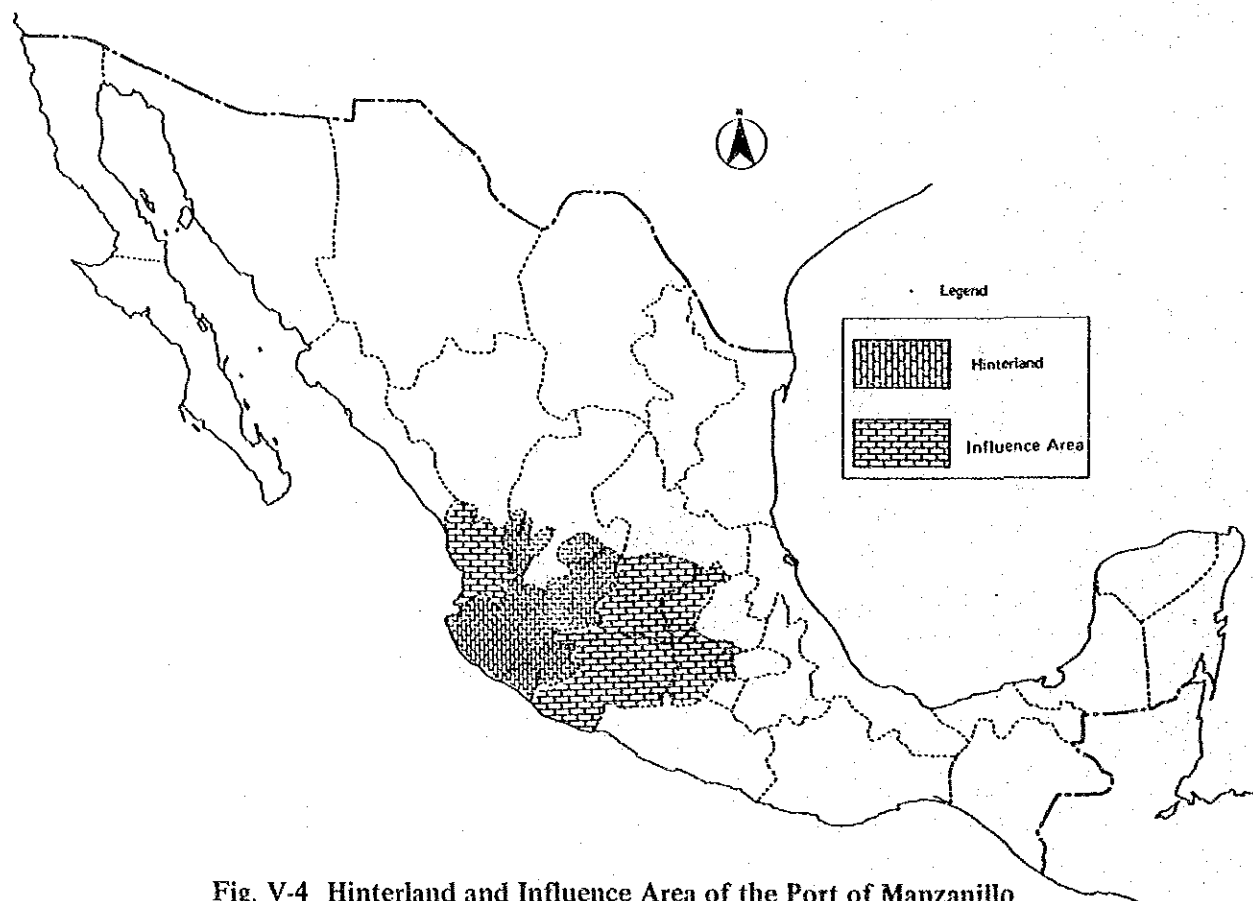Fig. V-3 Share of Total Foreign Trade Cargo Volume Handled
at the Port of Manzanillo

Fig. V-4 Hinterland and Influence Area of the Port of Manzanillo

2. Future Socio-Economic Conditions

2-1 Socio-economic Frame in the National Plan

2-1-1 Population

According to the census taken in 1980, the population of Mexico is about 67 million. The future population was estimated by CONAPO of SPP, as shown in Table V-2. The population growth rate is assumed to be 3.0% per annum (average) for the period from 1980 to 1985, 2.0% from 1985 to 1990, and 1.8% from 1990 to 1995. As a result, the total population in 1995 is estimated to be about 95 million.

Table V-2 Population Forecast

Item	1980	1985	1990	1995
Population ('000,000)	67.3	78.2	86.4	94.7
Rate of Increase (%)	3.0	2.0	1.8	

Source: CONAPO, SPP

2-1-2 Economy

The economic activities of Mexico had been growing satisfactorily. However, the economic crisis in 1982 retarded this growth, causing the growth rate to become negative in 1982 and 1983, as mentioned in Chapter II, Section 2-2.

In order to overcome this crisis, the government published the "Plan Nacional de Desarrollo 1983 ~ 1988" in May 1983, and strongly requested the people's cooperation. In this plan, the target values of the growth rate of GDP are set for 1984 and for the period from 1985 to 1988, as shown in Table V-3.

Table V-3 GDP Growth Rate Forecast

(Unit: %)

Sector	1984	1985 ~ 1988
Total	0.0 ~ 2.5	5.0 ~ 6.0
Agriculture, Forestry, Fishery	0.0 ~ 2.0	3.5 ~ 4.5
Mining	2.8 ~ 3.5	3.7 ~ 4.7
Manufacturing	1.0 ~ 4.0	6.7 ~ 7.9
Construction	-3.0 ~ 2.0	7.0 ~ 9.0
Electricity	2.0 ~ 4.0	6.2 ~ 7.2
Transport, Communication	-0.6 ~ 2.0	6.5 ~ 7.0
Commerce, Hotel, Restaurant	0.0 ~ 1.5	4.3 ~ 5.4

Source: Poder Ejecutivo Federal, "Plan Nacional de Desarrollo 1983 ~ 1988"

Before considering future economic conditions, let us first review the current situation. Table V-4 lists the important economic indicators for 1983, estimates for 1984, and the actual figures for the first quarter of 1984. According to these data, the balance of the current account for the first quarter of 1984 is about 2 billion dollars in the black, contrary to the annual estimate of -1 billion dollars. This positive account has been supported by the sizable black-ink trade balance due to favorable exports and controlled imports in the first quarter of 1984.

Table V-4 Important Economic Indicators

(Unit: '000,000 dollars)

Item	1983 (Actual Results)	1984 (Forecast)	1984 I-Quarter (Actual Results)
Balance of Current Account	5,546	-1,000	1,916
Trade Balance	13,678	10,500	4,004
Export	21,399	22,900	6,118
Import	-7,721	-12,400	-2,114
Travel (net)	1,183	1,300	549
Boder Transactions (net)	170	100	17
Interest Payment	-9,861	-12,000	-2,913
Others	376	-900	259
Price Index (%)			
Consumer Price Index	80.8	40	16.8
Wholesale Price Index	88.0	55	n.d.
Growth Rate of GDP (%)	-4.7	1.0	0.5
Agriculture, Forestry, Fishery	3.4	2.0	n.d.
Manufacturing	-7.3	-0.8	0.5
Construction	-14.3	0.3	-3.6
Electricity	1.3	2.1	6.8

Source: Banco de México

In addition, the growth rate of the GDP is also turning, in general, to a plus, although the construction related industries still indicate a negative rate. When such movement is observed quarterly since 1982 in Table V-5, gradual recovery is observed, in general, from the first quarter of 1983 at the bottom, and the growth became positive in 1984. A powerful recovery is expected in the future.

On the other hand, the rise in the consumer price index that was about 5% per month or about 100% per year is recently decreasing monthly from 6.4% at the peak in January down to 2.8% in August, as shown in Fig. V-5. This is the lowest increase in the last two years. It means an annual increase of 38.5%. If this trend continues, a 60% increase may be estimated for 1984, evan if 40%, the estimated value from Table V-4, is impossible. Compared with 80% in 1983, this factor implies improved social conditions and economic activities in the future.

Table V-5 Change of GDP's Growth Rate by Industrial Sector

(Unit: %)

Period	General	Mining	Manufacturing	Construction	Electricity	Petroleum
1982						
I	6.4	9.5	6.8	2.2	7.9	8.6
II	1.1	3.2	0.5	0.4	11.1	5.9
III	-4.7	10.8	-7.4	-5.2	7.0	10.2
IV	-8.8	13.7	-11.0	-16.0	1.3	11.6
1983						
I	-10.5	0	-11.8	-14.3	1.1	0.8
II	-9.1	-2.8	-8.7	-17.6	0	1.3
III	-8.5	-2.7	-7.4	-19.5	0	0.8
IV	-3.9	-5.5	-3.4	-8.1	6.2	1.7
1984						
I	0.5	4.0	0.5	-3.6	6.8	5.9
II	n.d.	n.d.	n.d.	n.d.	n.d.	1.9

Source: Banco de México
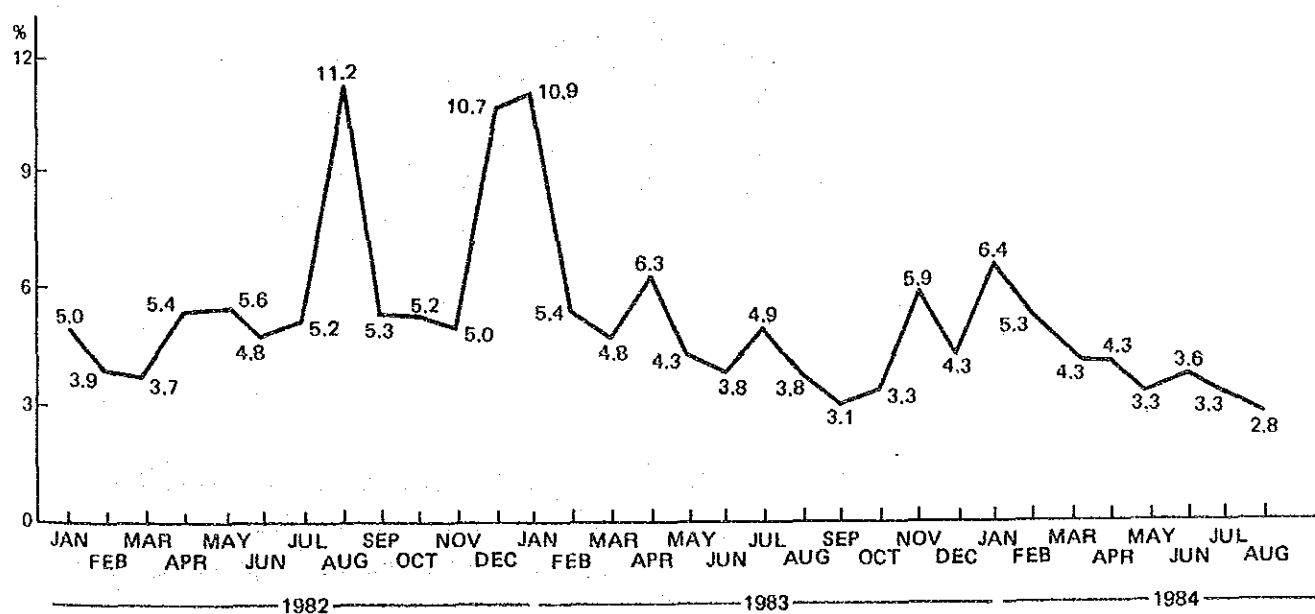
Source: Banco de México

Fig. V-5 Monthly Change of Consumer Price Index

Taking these recent trends into account, the economic prospects, as shown in Table V-6, were announced by representatives of the Mexican government at the 15th meeting of the Mexico-Japan Businessmen's Committee held in Tokyo in October 1984. This gives almost the same estimate of growth as the target value mentioned in the "Plan Nacional de Desarrollo 1983 ~ 1988" for 1988, and an estimate of gradual improvement for the intermediate period from 1984 to 1987. Also, a 7 to 8% estimated growth rate for the manufacturing industries for 1988 was presented at the meeting. This almost agrees with the target value given for the industries in the national plan.

Table V-6   Forecast of Important Economic Indicators

Item	1984	1985	1986	1987	1988
Growth Rate of GDP (%)	1.0 ~ 1.5	3.5 ~ 4.0	4.0 ~ 5.0	5.0 ~ 5.5	5.0 ~ 5.5
Annual Increment Rate of Consumer Price Index (%)	55 ~ 58	35 ~ 40	28 ~ 30	20 ~ 25	20 ~ 25
Exports ('000,000 dollars)	22,500 ~ 23,000	24,500 ~ 25,000	27,000 ~ 27,500	29,700 ~ 30,000	32,000 ~ 32,500
Imports ('000,000 dollars)	13,500 ~ 14,000	17,500 ~ 18,000	21,500 ~ 22,000	24,000 ~ 25,000	25,000 ~ 26,000

Source: Data presented at the 15th meeting of the Mexico-Japan Businessmen's Committee

According to the recent announcement of SPP, the actual growth rate of the GDP in 1984 rised to 3.5%, which was a sharp increase compared with 1 to 1.5% estimated above. In addition, the consumer price index (59.2%) was a little higher than the estimated value (55 ~ 58%) in 1984.

2-2   Socio-economic Frame for the Target Years

2-2-1   Population

With respect to the estimated population for the period up to 1995, the value estimated by CONAPO is judged as appropriate, and adopted as it is, taking into account the recent decrease in the population growth rate from 3.3% in 1980 to 2.7% in 1982, and the further decrease to 2.5% in 1983, as mentioned in Chapter II, Section 2-1.

The forecast population for 2000 is calculated on the assumption that the population growth rate will be 1.7% for the period from 1995 to 2000, considering that the improvement of social and economic conditions should further decrease the growth rate from the 1.8% level for the period from 1990 to 1995.

As a result, the population is estimated as 86.4 million for 1990, and 103.0 million for 2000, as shown in Table V-7.

Table V-7 Population Forecast

(Unit: '000,000 persons)

	1980	1990	2000	Annual Rate of Increase (%)	
				1990/1980	2000/1990
Population	67.3	86.4	103.0	2.5	1.8

2-2-2 Economy

In forecasting the GDP for the target years, considering the recent improvement in the Mexican economy, the highest figures presented at the 15th meeting of the Mexico-Japan Businessmen's Committee (Table V-6) are employed in predictions through 1988. Thereafter, a growth rate of 6% is assumed, presuming that the efforts of the Mexican government to improve the growth rate will be successful. Furthermore, as the growth rates for recent decades (1940 ~ 1950: 6.0%; 1950 ~ 1960: 5.7%; 1960 ~ 1970: 6.7%; 1970 ~ 1980: 6.6) have averaged over 6%, this trend may well continue.

Based on these assumptions, the forecasted growth rates and GDP until the year 2000 are given in Tables V-8 and V-9.

Table V-8 GDP Growth Rate Forecast

(Unit: %)

Sector	1984	1985	1986	1987	1988	1989~ 2000 (Annual)
Total	1.5	4.0	5.0	5.5	5.5	6.0
Agriculture, Forestry, Fishery	1.2	2.9	3.5	4.0	4.0	4.5
Mining	3.2	3.6	3.7	4.2	4.2	4.7
Manufacturing	2.8	5.7	6.7	7.3	7.3	7.9
Construction	0	5.1	7.0	8.0	8.0	9.0
Electricity	3.2	5.4	6.2	6.7	6.7	7.2
Transport, Communication	1.0	4.8	6.5	6.7	6.8	7.0
Commerce, Hotel, Restaurant	0.9	3.3	4.3	4.8	4.9	5.4

Table V-9 GDP Forecast

(Unit: billion pesos)

Sector	1970 Prices			Ratio to 1983 GDP	
	1983	1990	2000	1990	2000
Total	862	1,197	2,145	1.39	2.49
Agriculture, Forestry, Fishery	83	105	163	1.27	1.97
Mining	34	44	70	1.30	2.07
Manufacturing	202	313	669	1.55	3.31
Construction	42	66	156	1.56	3.70
Electricity	15	22	45	1.49	3.06
Transport, Communication	64	95	187	1.47	2.90
Commerce, Hotel, Restaurant	210	279	473	1.32	2.25
Other Service	212	273	382	1.29	1.81

CHAPTER VI. DEMAND FORECAST

CHAPTER VI DEMAND FORECAST

In this chapter, the cargo volume which will be handled and the fish catch which will be landed at the port of Manzanillo, and the number of tourists who will visit Manzanillo City and take part in coastal leisure activities in the target years 1990 and 2000 are estimated.

1. Commercial Port Cargo

1-1 Methodology

Two methods will be used to forecast the commercial cargo volume handled at the port of Manzanillo. One is a macro forecast which is a method to estimate the cargo volume as a group including many commodities, regardless of the volume of each commodity. The other is micro forecast, which is a method to estimate the cargo volume of each commodity individually. modity individually.

In this chapter, petroleum and its derivatives are excluded from the cargo forecast for the following reasons:

① Petroleum and its derivatives are handled mainly at the PEMEX oil pier located in the outer port of Manzanillo. The loaidng and unloading facilities for petroleum seem sufficient to handle the possible future increase of volume.

② If PEMEX is obliged to expand its facility due to a huge increase in handling volume, the construction site will be near the present site in the outer port area.

1-2 Macro Forecast

Two methods are used for the macro forecast. One is to grasp the trend of cargo handling volume from the past data and forecast the volume by a time series analysis. The other is to relate the past cargo handling volume at Manzanillo Port to national social or economic indices such as population or GDP, and to forecast the future cargo volume using future estimates of these national figures.

1-2-1 Handling Volume of Each Commodity

Table VI-1 shows the cargo volume of principal commodities handled at Manzanillo Port from 1975 to 1983 for import, export, and domestic trade. The cargo volumes of these principal commodities are shown graphically for import, export and domestic trade in Fig. VI-1 to VI-3 respectively. Following is a brief explanation of the handling volume variation for each commodity.

Table VI-1   Cargo Handling Volume at Manzanillo Port (Commodity)

(Unit: t)

Trade		Commodity	1975	1976	1977	1978	1979	1980	1981	1982	1983
Foreign Trade	Import	Maize	470,923	142,299	249,127	235,297	138,338	579,517	323,852	–	409,249
		Ammonium sulphate	63,048	96,074	143,687	85,194	95,452	8,557	17,462	--	–
		Ammonium nitrate	16,712	82,980	58,805	53,175	–	–	15,511	35,886	–
		Urea	5,086	75,645	16,153	15,201	–	35,499	–	–	–
		Soybean	--	68,761	87,352	70,427	21,746	--	20,831	36,679	–
		Steel plate	42,881	47,682	65,337	55,034	92,377	124,704	87,327	45,098	25,997
		Cotton oil	–	30,888	–	–	–	–	–	–	–
		Fish meal	49,060	28,398	11,838	23,343	42,229	21,218	3,216	26,755	8,438
		Phosphate rock	--	21,522	--	25,987	85,279	–	–	–	–
		Steel	8,093	15,661	357	2,439	--	1,025	5,494	–	2,566
		Fertilizer	--	9,518	–	–	--	–	--	–	--
		Crude rubber	6,903	7,313	10,390	14,645	27,435	30,960	18,224	8,419	1,643
		Spare parts	2,187	5,204	3,212	5,385	4,270	8,777	21,066	4,759	3,154
		Porcelain isolator	--	3,037	1,153	1,570	1,589	2,455	452	–	--
		Machinery	1,386	2,884	5,093	6,541	8,134	4,387	21,539	19,189	3,456
		Sorghum	67,467	–	–	99,549	135,509	151,920	385,891	125,202	124,062
		Wheat	8,904	--	–	70,578	199,659	--	–	–	19,992
		Sugar	–	–	–	–	–	55,136	39,622	49,977	111,256
		Super phosphate	–	–	–	–	–	--	–	45,896	–
		Ammonium phosphate	–	–	–	–	–	8,557	20,206	39,339	20,675
		Potasium cloride	–	--	--	–	20,422	54,333	25,249	20,397	21,474
	Export	Molasses	42,439	33,693	37,032	63,624	60,824	9,508	13,339	22,392	–
		Lead	6,873	13,265	684	18,228	–	33,362	17,734	6,879	13,049
		Metallic zinc	2,714	6,367	8,797	8,618	–	2,354	2,014	2,778	17,230
		Chemical products	1,727	5,052	1,750	6,645	8,068	13,342	6,087	1,984	2,726
		Concentrated copper	–	4,792	–	–	–	–	--	--	–
		Spare parts	2,268	3,151	1,859	2,187	1,241	5,199	3,162	3,001	3,531
		Active soil	1,180	4,091	3,630	5,921	6,199	2,924	3,178	1,486	1,788
		Carbon electrode	1,565	1,985	1,126	2,105	326	1,840	1,227	–	580
		Garlic	1,010	1,817	2,024	4,246	589	588	–	–	--
		Film	1,181	1,607	1,288	760	352	407	--	–	520
		Acetate fuse	–	1,433	925	921	383	133	--	–	--
		Chick pea	1,608	1,299	1,321	2,307	2,925	2,028	254	–	998
		Copper	1,998	1,199	2,383	2,291	999	757	3,118	2,322	424
		Sodium sulphate	1,249	1,118	3,234	3,138	2,121	1,665	–	–	6,450
		Concentrated Lead	–	–	6,996	11,705	15,949	–	--	–	–
		Cement	–	–	6,452	10,066	–	–	--	–	--
		Sesame	--	–	–	--	22,296	3,845	739	164	586
		Teraphtaline accid	--	--	–	–	–	–	9,985	–	. --
		Polyester	–	–	--	–	–	–	5,396	–	3,189
Domestic Trade	In	Salt	56,863	58,861	69,867	72,001	49,298	113,938	15,856	19,937	–
		Wheat	–	20,560	–	7,608	--	–	--	–	--
		Phosphate rock	–	–	1,488	--	--	–	22,446	81,131	192,268
	Out	Carbon	–	2,082	–	--	--	–	--	--	--
		Coastal goods	246	–	–	336	103	163	25	14	–
		Baryta	–	–	–	--	–	22,354	39,849	22,696	42,061

Source: DGODP, "Estadísticas del Movimiento Portuario Nacional de Carga y Buques"

(1) Foreign trade cargo

1) Imports

   a) Maize

   Although the maximum volume handled during the term was 580 thousand tons in 1980, the volume reduced to 0 in 1982. As is shown in the figure, the handling volume of maize fluctuated greatly year by year.

   b) Sorghum

   From 1977 to 1981, the volume of sorghum handled at Manzanillo Port increased rapidly. The maximum handling volume amounted to 386 thousand tons in 1981, but decreased significantly to 125 thousand tons in 1982. There was almost no change in handling volume in 1983.

   c) Soybeans

   The volume of soybeans handled at the port of Manzanillo grew from 1976 to 1977 and reached 87 thousand tons. Then the volume decreased until no soybeans were imported in 1980. In 1982, volume recovered to over 36 thousand tons but fell again to 0 in 1983.

   d) Ammonium sulphate

   From 1975 to 1977, the handling volume increased from 63 to over 143 thousand tons. After 1977 the volume decreased rapidly to almost 0 in 1982, and was 0 in 1983.

   e) Urea

   The peak volume was over 75 thousand tons in 1976. The volume fell once to 0 in 1979, increased to 35 thousand tons in 1980 and fell again to 0 in 1981. No urea was handled from 1981 through 1983.

   f) Ammonium nitrate

   Ammonium nitrate imports peaked in 1976 at a volume of about 83 thousand tons. The volume reduced gradually from 1976 and reached 0 in 1979. Again in 1980 there were no ammonium nitrate imports, but imports rose in 1981 and 1982, reaching about 36 thousand tons in the latter year. In 1983, imports once again fell to 0.

   g) Steel plate

   Handling volume of steel plate increased from 1975 to 1980 to over 124 thousand tons at the maximum. After that, volume decreased sharply to 26 thousand tons in 1983, one fifth of the peak value.

   h) Fish meal

   The handling volume of fish meal fluctuated greatly at 3 to 4 year intervals within a range of 50 thousand tons.

   i) Crude rubber

   From 1975 to 1980, the handling volume increased year by year and totaled 31 thousand tons at the peak. After 1980, volume decreased to less than 2 thousand tons in 1983.

   j) Sugar

   Although there were no sugar imports until 1979, the handling volume increased

rapidly from 1980 and reached 111 thousand tons in 1983. Among imports, sugar has the third largest volume at the port of Manzanillo after maize and sorghum.
maize and sorghum.

2) Exports

a) Lead

During the study period, the volume of lead exports varied considerably. Exports reached a peak of 33 thousand tons in 1980, decreased in 1981 and 1982, and recovered somewhat in 1983.

b) Molasses

This was the biggest export commodity handled at the port of Manzanillo from 1975 to 1979 varying from about 34 to 64 thousand tons. A sharp decrease occurred in 1980 showing only 9 thousand tons, but there was a slight increase in 1981 and 1982. No molasses was exported in 1983.

(2) Domestic trade cargo

1) Domestic imports

a) Salt

During 1975 to 1980, the handling volume of salt at the port of Manzanillo varied from about 57 to 114 thousand tons, playing an important role in domestic trade cargo. Volume dropped sharply in 1981 to about 16 thousand tons, recovered a little in 1982 and again fell to 0 in 1983.

b) Phosphate rock

Handling of phosphate rock at Manzanillo Port began in 1981 and increased remarkably to 192 thousand tons in 1983.

2) Domestic exports

a) Baryta

Shipping of baryta was initiated in 1980 and recorded a value of about 40 thousand tons in 1981. Volume decreased in 1982 but increased in 1983 to 42 thousand tons.

1-2-2 Handling Volume by Package Type

Table VI-2 is the cargo volume by each package type handled at Manzanillo Port from 1975 to 1983 for foreign and domestic trade.
Fig. VI-4 shows the total cargo volume of foreign and domestic trade by each package type: general cargo, agricultural bulk, mineral bulk and fluid.
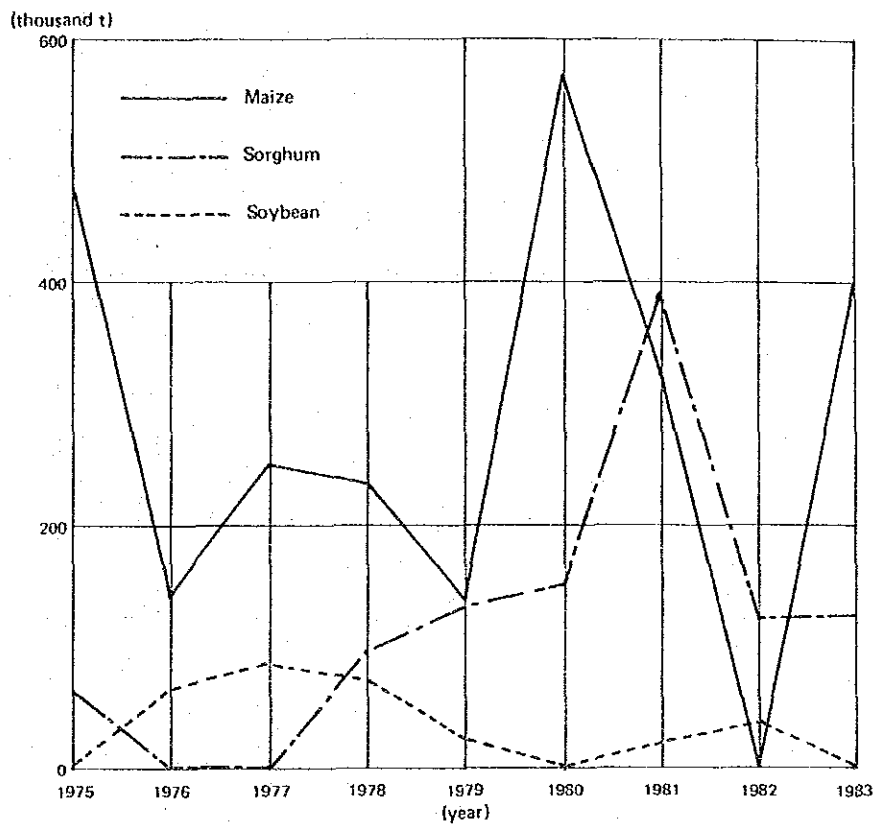
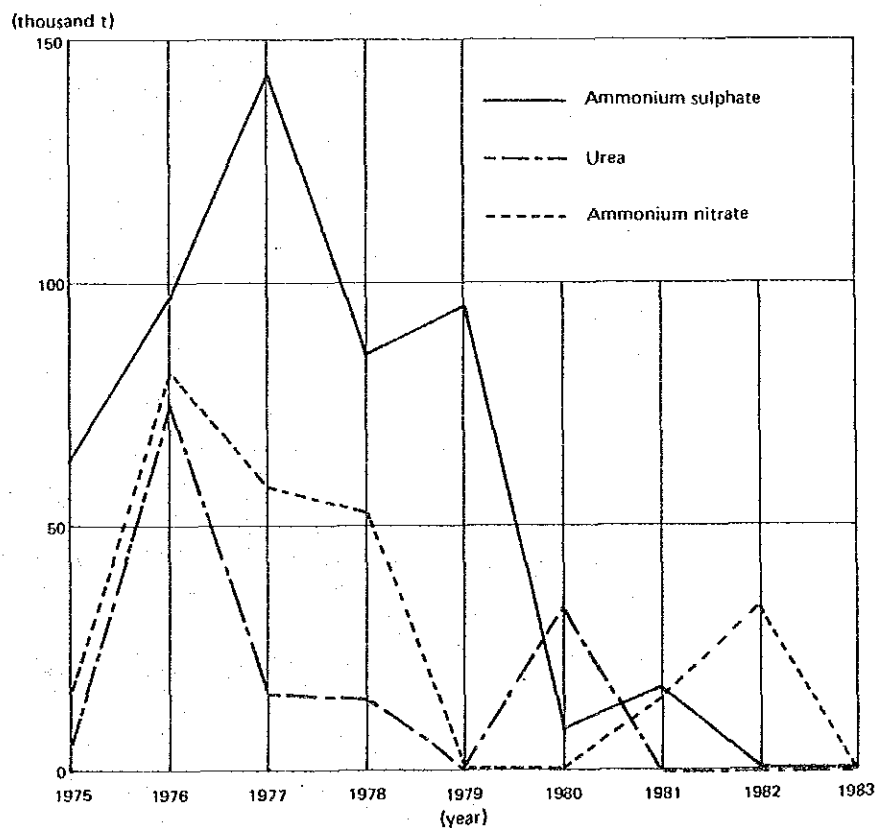Fig. VI-1 (a) Cargo Handling Volume at Manzanillo Port [Import-1]

Fig. VI-1 (b) Cargo Handling Volume at Manzanillo Port [Import-2]

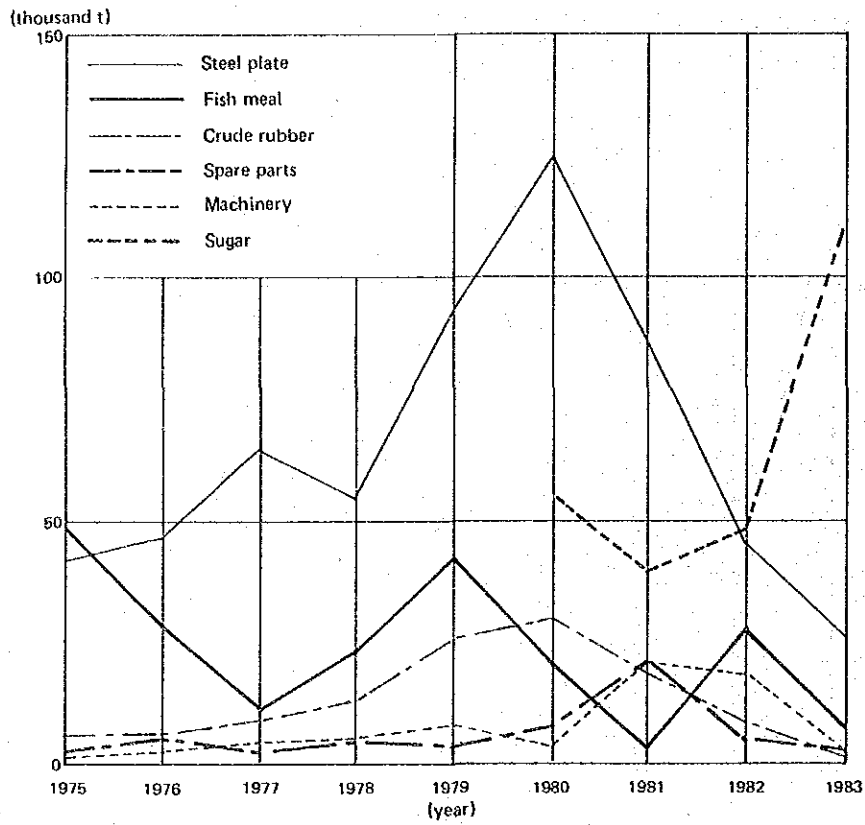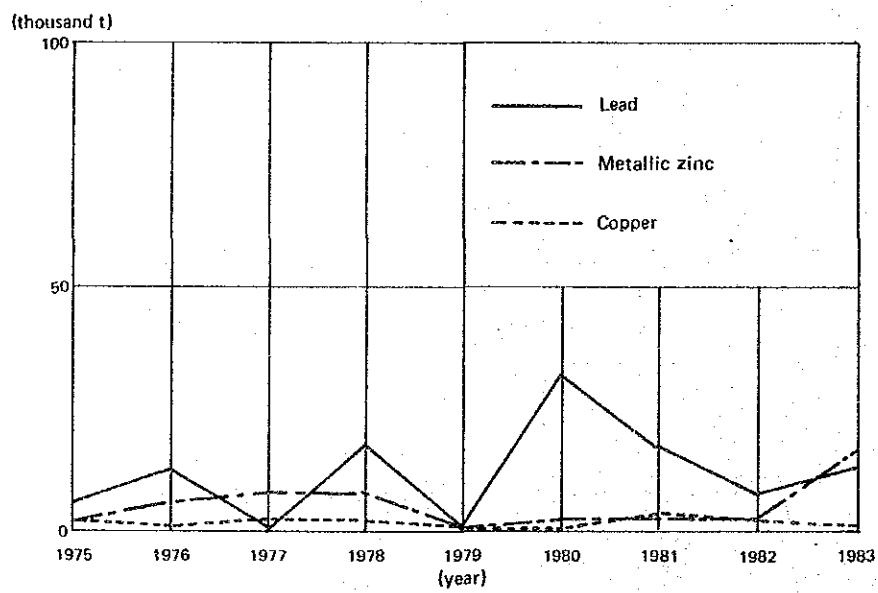Fig. VI-1(c) Cargo Handling Volume at Manzanillo Port [Import-3]

Fig. VI-2(a) Cargo Handling Volume at Manzanillo Port [Export-1]

(thousand t)

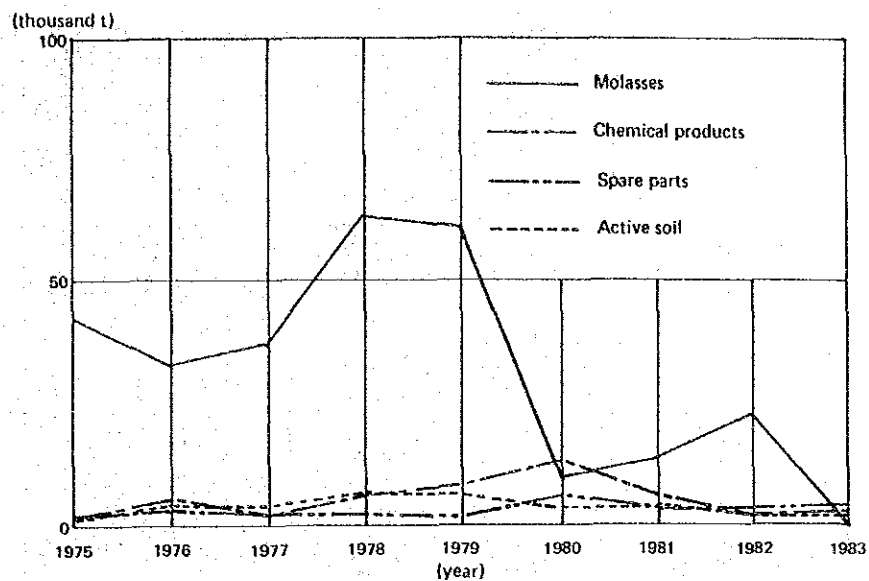Molasses
Chemical products
Spare parts
Active soil

Fig. VI-2(b) Cargo Handling Volume at Manzanillo Port [Export-2]

(thousand t)

Salt (In)
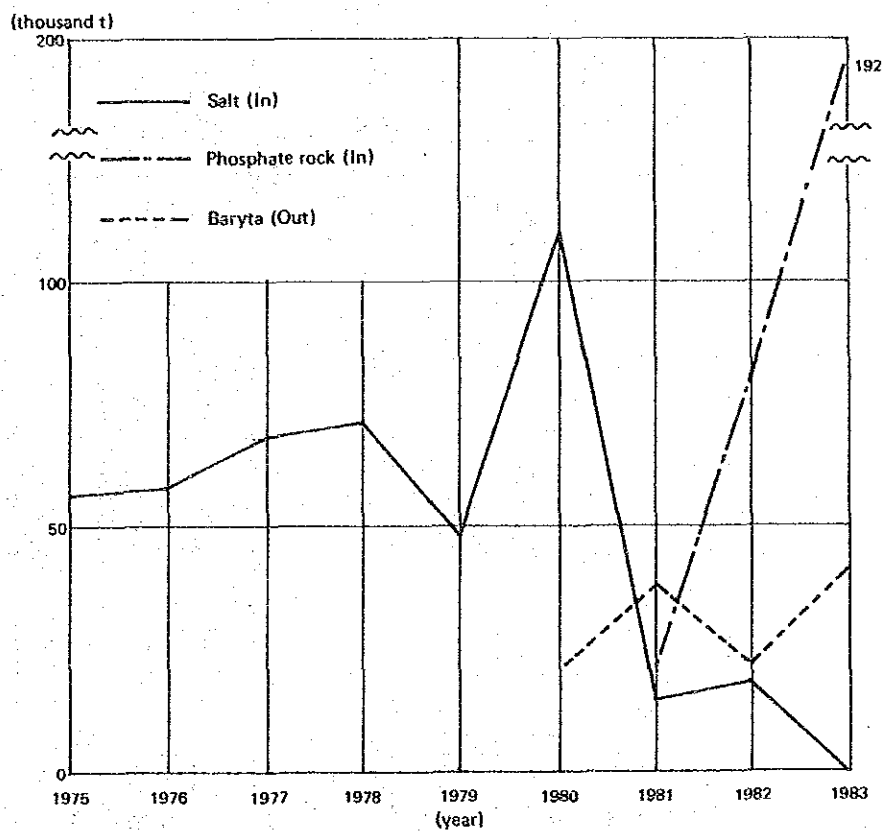Phosphate rock (In)
Baryta (Out)

Fig. VI-3 Cargo Handling Volume at Manzanillo Port [Domestic Trade]

Table VI-2 Cargo Handling Volume at Manzanillo Port (Package Type)

(Unit: t)

Trade		Package	1975	1976	1977	1978	1979	1980	1981	1982	1983
Foreign Trade	Import	General cargo	181,024	305,113	198,523	211,874	203,715	403,688	404,782	268,892	178,431
		Agricultural bulk	547,294	211,060	260,271	475,854	508,259	731,437	730,574	189,861	553,303
		Mineral bulk	120,711	148,031	239,898	116,191	201,173	104,064	122,917	105,632	42,149
		Fluid	—	7,045	—	—	1,002	889	—	6,520	4,205
		Perishable goods	—	—	—	—	—	—	—	—	—
		Total	849,029	671,249	698,692	803,919	914,149	1,240,078	1,258,273	570,905	778,088
	Export	General cargo	57,893	61,146	66,493	96,821	97,443	100,169	75,166	39,757	75,657
		Agricultural bulk	—	—	—	—	—	—	—	—	—
		Mineral bulk	9,772	4,792	6,996	11,705	—	—	—	—	—
		Fluid	42,439	33,653	37,032	63,624	60,824	9,508	13,339	22,392	—
		Perishable goods	—	—	—	112	100	—	—	—	956
		Total	110,104	99,591	110,521	172,262	158,367	109,677	88,505	62,149	76,613
Domestic Trade	In	General cargo	56,863	59,261	67,030	72,251	49,298	42,822	16,197	19,952	519
		Agricultural bulk	17,160	20,160	—	7,358	—	—	—	—	—
		Mineral bulk	—	—	4,325	—	—	72,701	22,446	81,131	192,268
		Total	74,023	79,421	71,355	79,609	49,298	115,523	38,643	101,083	192,787
	Out	General cargo	287	348	390	336	121	23,145	39,916	23,402	43,720
		Agricultural bulk	—	—	—	—	—	—	—	—	—
		Mineral bulk	—	2,082	—	—	—	—	—	—	—
		Total	287	2,430	390	336	121	23,145	39,916	23,402	43,720
Total		General cargo	296,067	425,868	332,436	381,282	350,577	569,524	536,061	352,003	298,327
		Agricultural bulk	564,454	231,220	260,271	483,212	508,259	731,437	730,574	189,861	553,303
		Mineral bulk	130,483	154,905	251,219	127,896	201,173	176,765	145,363	186,763	234,417
		Fluid	42,439	40,698	37,032	63,624	61,826	10,397	13,339	28,912	4,205
		Perishable goods	—	—	—	112	100	—	—	—	956
		Grand Total	1,033,443	852,691	880,958	1,056,126	1,121,935	1,488,423	1,425,337	757,539	1,091,208

Source: GDODP, "Estadísticas del Movimiento Portuario Nacional the Carga y Buques"

(thousand t)

Legend:
- Total
- General Cargo
- Agricultural bulk
- Mineral bulk
- Fluid

X-axis: 1975, 1976, 1977, 1978, 1979 (year), 1980, 1981, 1982, 1983
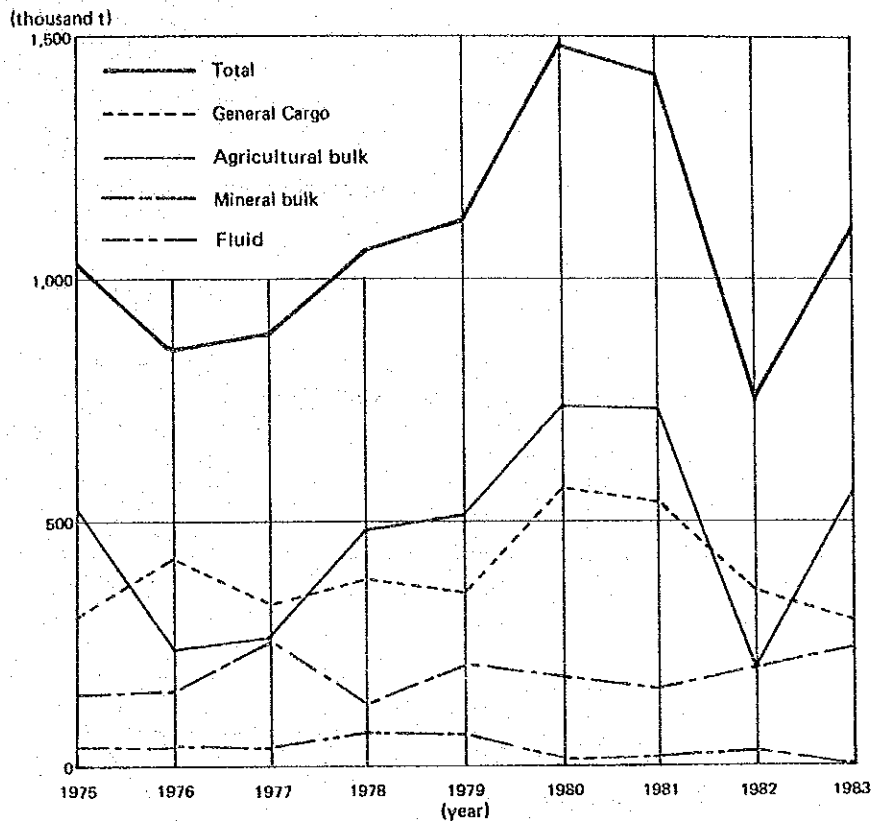
Y-axis: 0, 500, 1,000, 1,500

Fig. VI-4 Cargo Handling Volume at Manzanillo Port by
Package Type [Total]

1-2-3 Time Series Analysis

(1) Method

As shown in Fig. VI-1 to VI-3, the handling volume of each commodity at the port of Manzanillo varied greatly year by year showing no obvious trends. But as indicated in Fig. VI-4, the total foreign and domestic trade volume by each package type was relatively stable.

So the cargo volume for each package type for the target years will be forecast using time series analysis. There was, however, a significant drop in cargo volume in 1982 which seems to have been caused by the Mexican economic recession. Thus, data from 1982 and 1983 are disregarded as being abnormal, and only the data from 1975 to 1981 are used in the analysis.

(2) Result of forecast

The cargo volume is assumed to be expressed as:

$$V = a + bt \ \ldots\ldots\ldots\ldots\ldots\ldots \ \text{(VI-1)}$$

where   V :   Handling volume at Manzanillo Port

       a,b :   Constants

        t :   Year

The constants are decided by the least fitting method. The handling cargo volume is supposed to increase at the same growth rate as that from 1975 to 1981 starting from the initial value of 1983 as shown in Fig. VI-5.
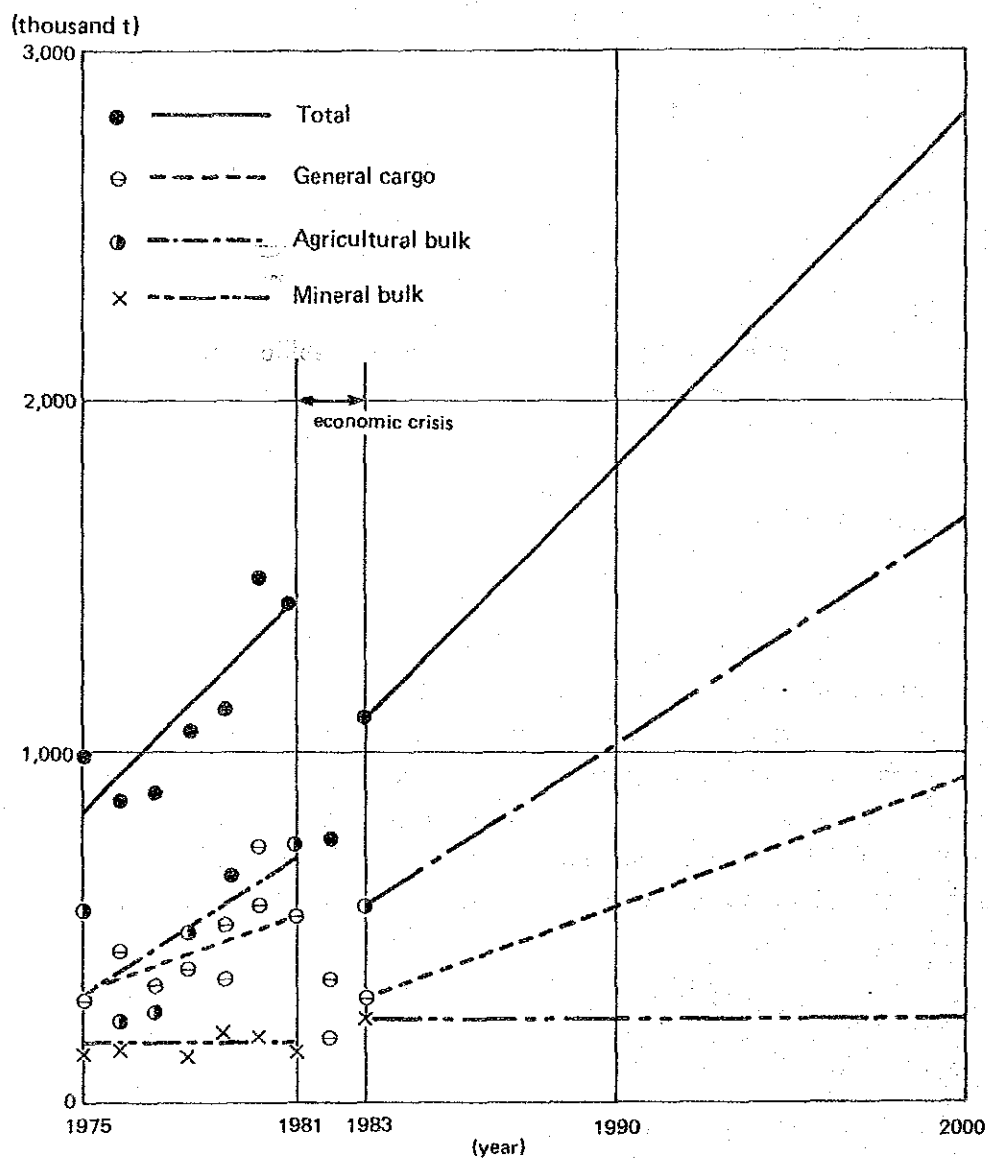

Fig. VI-5   Cargo Forecast by Time Series Analysis

Since perishable goods and liquid other than petroleum and its derivatives are both handled in small quantities and do not show any clear growth trends, the average values from 1975 to 1983 are adopted as the result of the forecast, that is 1 thousand tons and 31 thousand tons respectively.

Under the above assumptions, the cargo forecast obtained is shown in Table VI-3.

Table VI-3   Macro Forecast by Time Series Analysis

(Unit: '000 t)

Item		1983	1990	2000
Estimate by Total		1,091	1,784	3,609
Estimate by Package Type	General cargo	298	553	918
	Agricultural bulk	553	1,002	1,644
	Mineral bulk	235	230	226
	Fluid	4	31	31
	Perishable goods	1	1	1
	Total	1,091	1,817	2,820

1-2-4   Correlation with Social and Economical Indices

Generally speaking, the cargo handling volume of a port has a close relation with the social and economical indices of the country. In this section the cargo volume handled at the port of Manzanillo by each package type will be forecast by correlation of the past handling cargo with total Mexican GDP or population. However the data used here are limited to the years from 1975 through 1981 as in the former analysis.

(1)   Total cargo volume

The total cargo volume is forecast by the relation with GDP. Fig. VI-6 shows the relation between total handling volume at Manzanillo Port and national GDP. The dotted line in the figure shows the best fitted relation.

Using this line, the forecast of cargo volume to be handled at the port of Manzanillo is given by:

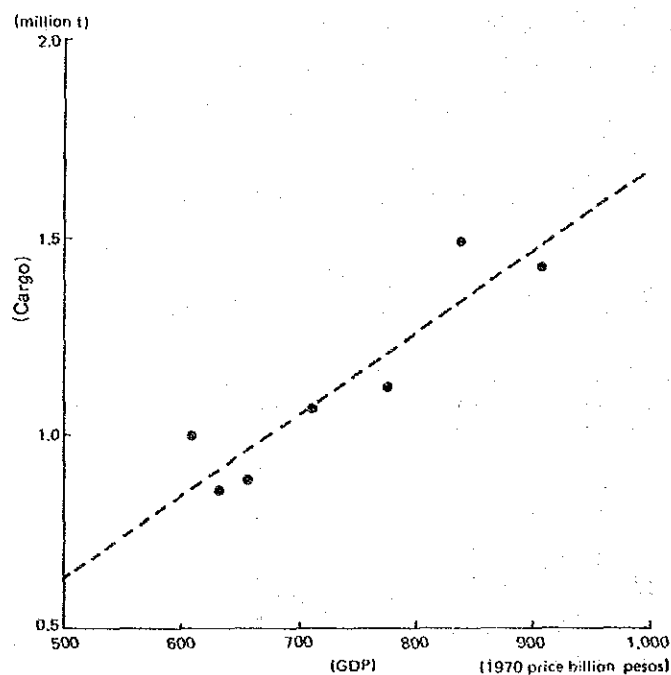| (Year)	1990	2000
Handling volume (thousand tons)	2,066	4,014

Fig. VI-6 Relation between Total Cargo Volume Handled at Manzanillo Port and GDP

(2) Cargo volume by package type

1) General cargo

General cargo is forecast by the relation with GDP. The result is listed in Table VI-4.

2) Agricultural bulk cargo

Since the agricultural bulk cargoes handled at the port of Manzanillo are mainly composed of grain imports such as maize, wheat and sorghum, future handling volume is estimated by the relation with the total Mexican population. The result is also shown in Table Table VI-4.

Table VI-4 Macro Forecast by Population and GDP Correlation

Year	General Cargo		Agricultural Bulk	
	GDP	Cargo Volume	Population	Cargo Volume
	(Billion pesos) (1970 prices)	('000 t)	(1970 = 100)	('000 t)
1975	610	296	118	564
1976	636	426	121	231
1977	658	332	125	260
1978	712	381	129	483
1979	777	351	133	508
1980	842	570	137	731
1981	909	536	142	730
1990	1,197	755	179	1,297
2000	2,145	1,456	214	1,859

3) Mineral bulk cargo

As for the mineral bulk cargo handled at Manzanillo Port, yearly variation is small but does not show any obvious growth trend. Therefore, handling volume is assumed to be the average volume handled at the port of Manzanillo from 1975 to 1981, 172 thousand tons, both in 1990 and 2000.

4) Fluid, perishable goods

Fluid and perishable goods are also forecast as the average values during the data period.

5) Result of forecast

The forecast is shown in the Table VI-5.

Table VI-5　Macro Forecast by GDP and Population Correlation

(Unit: '000 t)

Item		1983	1990	2000
Estimate by Total		1,091	2,066	4,014
Estimate by Packing	General cargo	298	755	1,456
	Agricultural bulk	553	1,297	1,859
	Mineral bulk	235	172	172
	Fluid	4	31	31
	Perishable goods	1	1	1
Total		1,091	2,256	3,519

1-3 Micro Forecast

For this forecast, cargo handled at Manzanillo Port is classified according to package type: general cargo, agricultural bulk, mineral bulk and others. Micro forecasts are executed for each of these classifications.

The following two methods are used for the micro forecast:

① For cargoes which will be handled at Manzanillo Port in significant quantities, such as agricultural and mineral bulk, separate forecasts are made for each individual commodity. First the demand and supply of the entire nation are forecast for the target years. The difference between production and consumption is assumed to be equal to the total import or export volume.

Then, the cargo volume that will be handled at Manzanillo Port is estimated based on past data on the cargo handling ratio, that is the percentage of the total national import or export volume of the commodity which has been handled at Manzanillo Port in the past, and on other relevent factors.

② For other general cargoes that will not be handled at Manzanillo Port in substantial quantities, the cargo volume is forecast based on the correlation between the volume handled

at the Port in the past and forecast national indices such as GDP and population. This is the same method as is used for the macro forecast.

1-3-1 General Cargo

(1) Classifications

General cargo is classified into the following 11 categories:

① Agricultural products
② Forest products
③ Mineral products
④ Iron and steel products
⑤ Metal goods
⑥ Machinery
⑦ Chemical products
⑧ Fertilizer
⑨ Cement and ceramic
⑩ Industrial products
⑪ Others

Table VI-6 (a) ~ (c) show the cargo volume handled at Manzanillo Port by trade type according to the above mentioned classification. However, since domestic trade cargo involves very few commodities, it is shown by commodity.

Table VI-6(a)　General Cargo Volume Handled at Manzanillo Port (Import)

(Unit: '000 t)

Commodity	1975	1976	1977	1978	1979	1980	1981	1982	1983
Agricultural Products	49	59	23	23	42	103	101	86	120
Forest Products	8	8	11	15	34	31	20	9	2
Mineral Products	—	—	—	—	—	—	—	—	—
Iron and Steel Products	79	68	69	63	92	168	145	79	45
Metal Goods	—	3	10	4	3	2	1	—	—
Machinery	7	15	15	26	20	43	67	34	8
Chemical Products	12	3	7	9	5	10	11	10	2
Fertilizer	—	—	—	—	—	—	10	36	—
Cement and Ceramic	9	5	1	2	2	16	—	—	—
Other Industrial Products	2	2	4	2	2	17	23	2	1
Other General Cargo	—	6	4	5	4	11	20	12	1
Total	181	305	199	212	204	404	405	269	178

Source: GDODP "Estadísticas del Movimiento Portuario Nacional de Carga y Buques"

Table VI-6(b) General Cargo Volume Handled at Manzanillo Port (Export)

(Unit: '000 t)

Commodity	1975	1976	1977	1978	1979	1980	1981	1982	1983
Agricultural Products	7	4	3	7	28	9	2	2	4
Forest Products	2	–	1	–	1	1	–	1	–
Mineral Products	–	–	4	3	2	2	–	1	7
Iron and Steel Products	2	2	5	4	2	4	1	1	1
Metal Goods	21	27	19	41	23	36	23	12	31
Machinery	2	4	2	2	5	6	4	4	4
Chemical Products	8	11	8	15	11	16	25	9	20
Fertilizer	–	–	–	–	–	–	–	–	–
Cement and Ceramic	5	4	12	13	6	9	5	2	–
Other Industrial Products	5	3	1	–	2	3	5	–	2
Other General Cargo	6	6	11	12	12	12	9	6	6
Total	58	61	66	97	97	100	75	40	76

Source: GDODP, "Estadísticas del Movimiento Portuario Nacional de Carga y Buques"

Table VI-6(c) General Cargo Volume Handled at Manzanillo Port (Domestic Trade)

(Unit: '000 t)

	Commodity	1975	1976	1977	1978	1979	1980	1981	1982	1983
In	Salt	56.9	58.9	69.9	72.0	49.3	41.2	15.9	19.9	–
	Others	–	0.4	0.1	0.3	–	1.6	0.3	–	0.5
	Sub Total	56.9	59.3	67.0	72.3	49.3	42.8	16.2	19.9	0.5
Out	Baryta	–	–	–	–	–	22.4	39.8	22.7	42.1
	Machinery	–	–	–	–	–	0.6	–	–	–
	Others	0.2	0.3	0.4	0.3	0.1	0.2	0.1	0.7	1.6
	Sub Total	0.2	0.3	0.4	0.3	0.1	23.2	39.9	23.4	43.7
	Total	57.1	59.6	67.4	72.6	49.4	66.0	56.1	43.3	44.2

Source: GDODP, "Estadísticas del Movimiento Portuario Nacional de Carga y Buques"

(2) Import cargo

1) Agricultural products

Among the agricultural products handled at the port of Manzanillo, rice and sugar are the principal commodities as shown in Table VI-7. Therefore, the handling volume of rice and sugar will be forecast from a demand and supply analysis.

Table VI-7 Import of Agricultural Products

(Unit: '000 t)

Commodity	1975	1976	1977	1978	1979	1980	1981	1982	1983
Rice	—	—	—	—	—	26.3	58.4	9.5	—
Sugar	—	—	—	—	—	55.1	39.6	50.0	111.3
Others	49.2	59.3	23.0	23.3	44.2	21.3	3.2	26.7	8.4
Total	49.2	59.3	23.0	23.3	44.2	102.7	101.2	86.2	119.7

Source: GDODP, "Estadísticas del Movimiento Portuario Nacional de Carga y Buques"

a) Rice

Table VI-8 indicates the harvest area, yield rate, and total production of rice in Mexico from 1961 to 1982. Future production is estimated by multiplying the future harvest area by the future yield rate, which are predicted from the long-term trends.

Table VI-8   Area, Yield and Production of Rice and Sugar Cane

Year	Rice			Sugar Cane		
	Area	Yield	Production	Area	Yield	Production
	'000 ha	t/ha	'000 t	'000 ha	t/ha	'000 t
1961	143	2.300	328	348	55.078	19,167
1962	146	2.280	333	353	56.563	19,967
1963	134	2.270	304	365	59.000	21,535
1964	135	2.190	296	367	59.499	21,836
1965	133	2.070	274			
1966	157	2.440	383	456	59.500	27,140
1967	173	2.410	417	473	58.500	27,644
1968	139	2.500	347	504	62.800	31,635
1969	185	2.840	525	480	62.500	30,000
1970	185	2.860	530	480	62.500	30,000
1971	166	2.642	440	562	64.657	36,328
1972	165	2.452	404	559	65.000	36,341
1973	160	2.450	392	560	65.179	36,500
1974	173	2.707	469	491	68.159	33,499
1975	196	2.602	510	491	72.437	35,581
1976	155	2.903	450	480	70.408	33,796
1977	180	3.144	567	488	64.368	31,407
1978	121	3.286	397	480	71.625	34,380
1979	151	3.238	489	502	70.548	35,415
1980	132	3.456	456	546	66.875	36,480
1981	180	3.583	644	557	64.566	35,975
1982	175	3.423	600	450	82.222	37,000

Source: FAO, "Production Year Book"
       * assumed.

(i) Harvest area

Fig. VI-7 shows the yearly variation of rice harvest area. Three years running averages of area are plotted in order to eliminate short term variation. Assuming the long term inclination extrapolated from the figure, the estimated harvest areas of rice for the target years are:

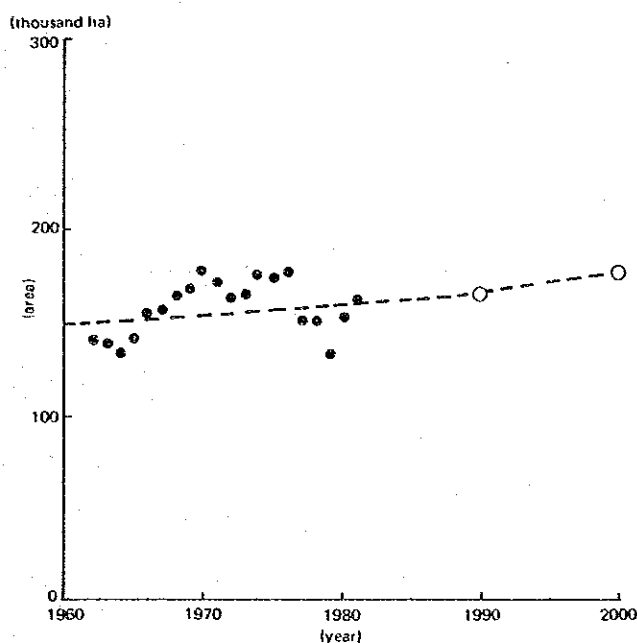| (Year)	1990	2000
Harvest area (thousand ha)	165	177

Fig. VI-7 Harvest Area of Rice

(ii) Yield rate

As is shown in Fig. VI-8, the yield rate of rice has a tendency to increase year by year. Assuming that the yield rate is approximated as the dotted line in the figure, the estimated yield rates for the target years are:

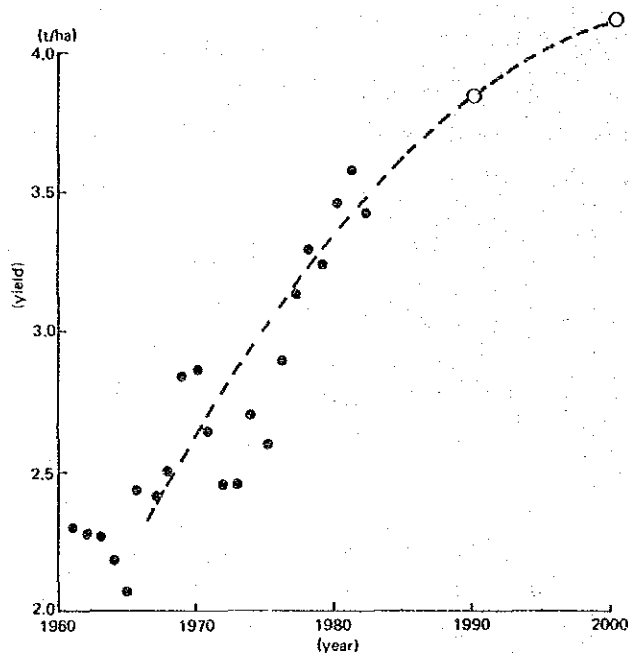| (Year)	1990	2000
Yield rate (t/ha)	3.83	4.10

Fig. VI-8 Yield Rate of Rice

(iii) Production

From the harvest areas and the yield rates mentioned above, rice production in Mexico can be forecast as follows:

(Year)	1990	2000
Production (thousand tons)	632	726

(iv) Per capita consumption

Total consumption is calculated by multiplying per capita consumption by total population. Per capita consumption can be expressed as:

$$(P + I - E)/Population \dots\dots\dots\dots\dots\dots (VI-2)$$

where
- P: Total production
- I: Import volume
- E: Export volume

Table VI-9 lists the data for calculating per capita consumption of rice from 1972 to 1982. Production is in terms of unhulled rice. For transforming these into refined rice volume the coefficient 0.66 (waste rate 25%, milling loss 12%) is used. Because of the big yearly fluctuation in per capita consumption, three year running average were plotted in Fig. VI-9.

From the figure, per capita consumption volume is forecast as:

(Year)	1990	2000
Per capita consumption of refined rice (kg/capita)	7.3	8.1

Table VI-9   Per Capita Consumption of Rice

Year	Population ('000)	Volume ('000 t)					Per Capita Consumption (kg/capita)
		Production	Refined Production	Import	Export	Consumption	
1972	51,450	404	267	1	12	256	5.0
1973	53,142	392	259	38	12	285	5.4
1974	54,891	469	310	71	4	377	6.9
1975	56,697	510	337	0	0	337	5.9
1976	58,562	450	297	0	0	297	5.1
1977	60,489	567	374	0	3	371	6.1
1978	62,479	397	262	0	6	256	4.1
1979	64,535	489	323	0	0	323	5.0
1980	67,383	456	301	93	0	394	5.8
1981	69,607	644	425	80	0	505	7.3
1982	73,011	600	396	22	0	418	5.7

Note: Population is assumed from decennial censuses.
        Refined production is calculated by multiplying production by 0.66.
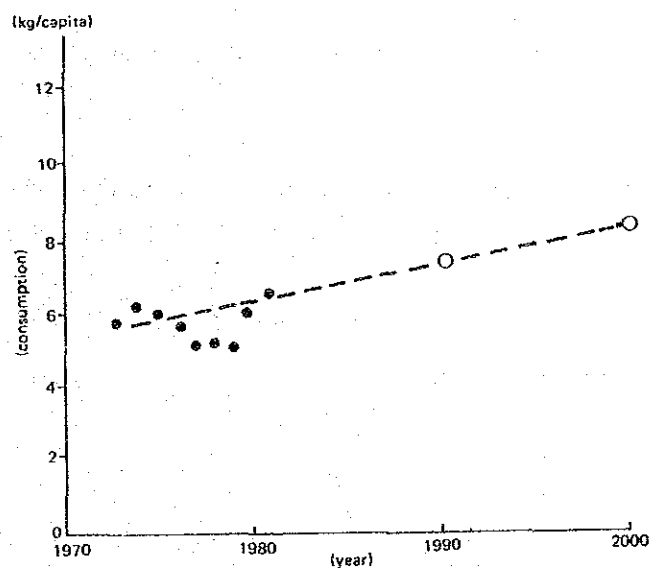Source: FAO, "Production Year Book"
        "Trade Year Book"

Fig. VI-9   Per Capita Consumption of Rice

(v) Total consumption

Total consumption can be calculated from the per capita consumption and the estimated population mentioned in Chapter V, Section 2-2.

(Year)	1990	2000
Total consumption (thousand tons)	627	829

(vi) Import

Imported rice is already refined. To calculate the import volume, we must first calculate the total domestic production of refined rice. We do this by multiplying the total production of unhulled rice by the coefficient.

Total domestic production (unhulled) x 0.66 = Total domestic production (refined)

Total consumption − Total domestic production (refined) = Total import volume

The estimates for the target years are:

(Year)	1990	2000
Import volume (thousand tons)	210	350

Of the total import volume, the percentage to be handled at Manzanillo Port will be estimated later.

b) Sugar

Harvest area, yield rate and production data of sugar cane in Mexico are already listed in Table VI-8.

(i) Harvest area

Fig. VI-10 shows the harvest area (three year running averages) of sugar cane. From the figure, the harvest areas of sugar cane for the target years will be:

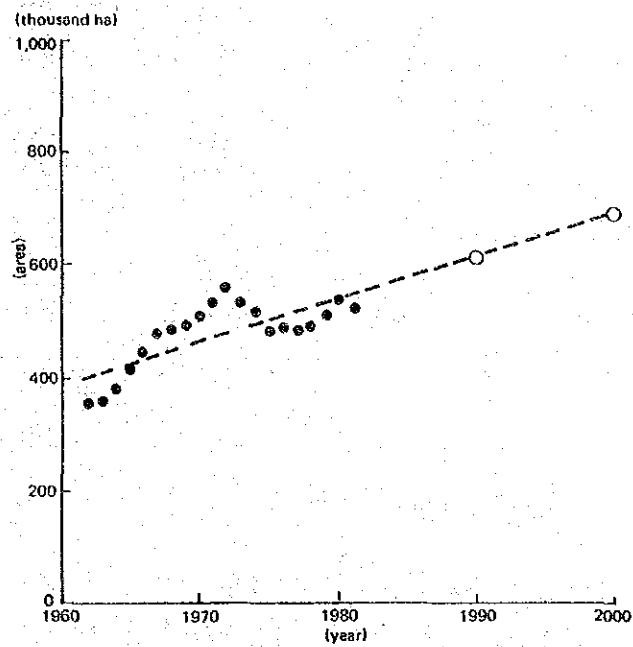| (Year)	1990	2000
Harvest area (thousand ha)	620	700

Fig. VI-10 Harvest Area of Sugar Cane

(ii) Yield rate

From Fig. VI-11, the yield rate in the target years will be:

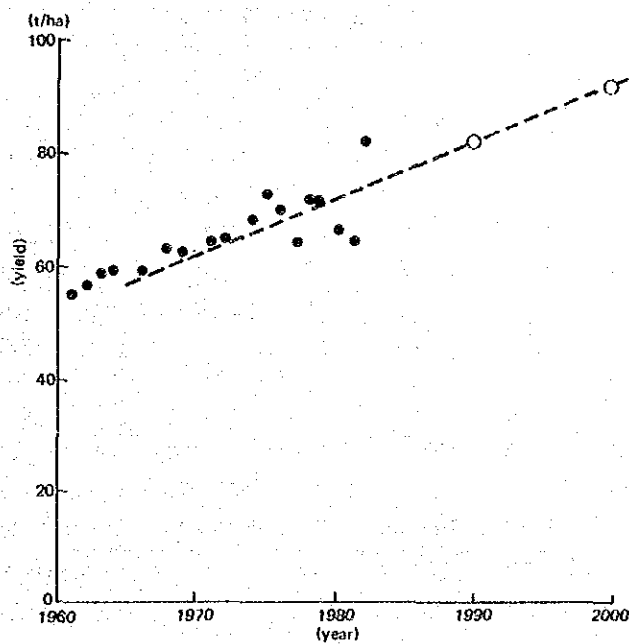| (Year)	1990	2000
Yield rate (t/ha)	82	92

Fig. VI-11 Yield Rate of Sugar Cane

(iii) Production

Multiplying the harvest area by the yield rate, the total estimated sugar cane production is obtained as:

(Year)	1990	2000
Production (million tons)	51	64

It is assumed that the ratio between sugar cane and refined sugar production is 0.08.

(Year)	1990	2000
Sugar production (million tons)	4.1	5.2

(iv) Per capita consumption

The per capita consumption volume of sugar in Mexico is shown in Table VI-10. Fig. VI-12 shows per capita consumption, smoothed by plotting three year running averages. As is shown in the figure, per capita consumption for the target years is forecast as follows:

(Year)	1990	2000
Per capita consumption (kg/capita)	55	63

Table VI-10   Per Capita Consumption of Sugar

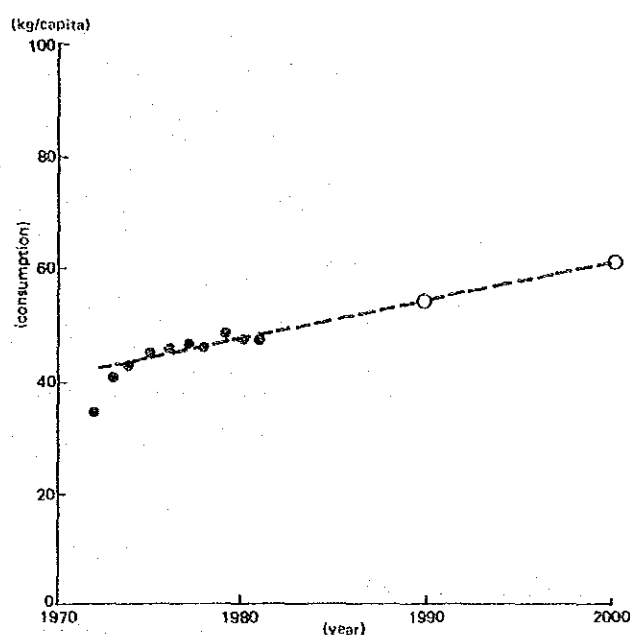| Year	Volume ('000 t)				Per Capita Consumption (kg/capita)
	Production	Import	Export	Consumption	
1971	1,738	—	546	1,192	23.9
1972	2,526	—	577	1,949	37.9
1973	2,821	—	607	2,214	41.7
1974	2,834	—	427	2,407	43.8
1975	2,713	—	185	2,528	44.6
1976	2,750	—	4	2,746	46.9
1977	2,728	—	—	2,728	45.1
1978	3,072	—	71	3,001	48.0
1979	3,060	—	101	2,959	45.9
1980	2,765	742	—	3,507	52.0
1981	2,586	552	—	3,138	45.1
1982	2,873	418	—	3,291	45.8

Source: Same as Table VI-9

Fig. VI-12 Per Capita Consumption of Sugar

(v) Total consumption

The total consumption forecast is given below.

(Year)	1990	2000
Total consumption (thousand tons)	4,752	6,489

(vi) Import

From production and consumption volume, we can deduce the import volume for the target years as follows:

(Year)	1990	2000
Import volume (thousand tons)	652	1,289

The future handling volume of sugar at Manzanillo Port will be forecast later together with the volumes of other goods.

2) Forest products

Table VI-11 shows the handling volume of forest products by commodity at Manzanillo Port. It is obvious that crude rubber accounts for most of the forest products handled. Therefore, separating forest products into crude rubber and others, the future handling volume of crude rubber at the port of Manzanillo will be forecast here. The volume of forest products other than crude rubber will be examined later.

Table VI-11 Import of Forest Products

(Unit: '000 t)

Item	1975	1976	1977	1978	1979	1980	1981	1982	1983
Rubber	6.9	7.3	10.4	14.6	27.4	31.0	18.2	8.4	1.6
Others	0.6	0.7	0.4	0.4	6.8	0.4	1.7	0.7	0
Total	7.5	8.0	10.8	15.0	34.2	31.4	19.9	9.1	1.6

Source: GDODP, "Estadísticas del Movimiento Portuario Nacional de Carga y Buques"

a) Crude rubber

(i) Production, consumption, trade volume

Production, consumption, import and seaborne transport volume of crude rubber in Mexico are shown in Table VI-12. From this, the following facts can be understood.

① Domestic production volume accounts for only 3% of domestic consumption. Almost all of the rubber consumed in Mexico is imported.

② The ratio of seaborne transport to total rubber import volume is fairly high except in 1978. Generally, the ratio ranges from 85 to 100%.

③ The share of rubber volume handled at Pacific coast ports varies from 45 to 75%.

Table IV-12 Production, Consumption and Seaborne Trade of Crude Rubber

Item / Year	Volume ('000 t)				Pacific Share (%)
	Production	Consumption	Import	Seaborne Transport	
1975				17.1	
1976				33.5	
1977				32.4	
1978	1.35	48.05	46.70	33.0	45
1979	1.04	50.38	49.34	41.0	71
1980	0.53	53.77	53.24	52.0	75 .
1981	0.50	58.49	57.99	55.0	51
1982	1.32	52.23	50.91	53.9	

Source: CNCP, "Previsiones de Trafico Maritimo"
GDODP, "Estadísticas del Movimiento Portuario Nacional de Carga y Buques"

(ii) Forecast of import volume

The above facts may allow us to consider that shipping import volume is nearly equal to total national consumption. The forecast of future import volume is decided by the relation between import volume and GDP. Fig. VI-13 shows the relation between seaborne import volume and GDP. If import volume is assumed to be expressed as the dotted line in the figure, we may calculate the future import volume using the GDP forecast for the target years as follows:

(Year)	1990	2000
Seaborne import volume (thousand tons)	90	201

Just as for rice and sugar, the volume of crude rubber to be handled at Manzanillo Port will be calculated later.
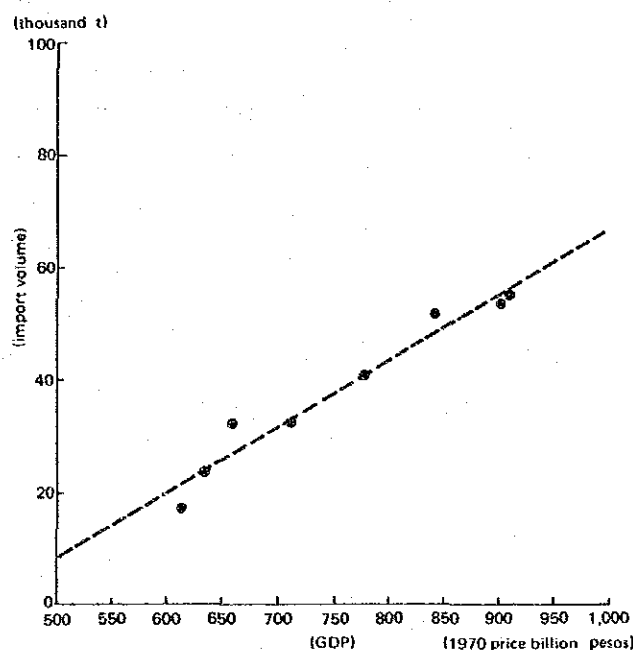
Fig. VI-13 Relation between Crude Rubber Import Volume and GDP

3) Iron and steel products

a) Forecast of consumption

Total consumption volume calculated by production, import and export volume is shown in Table VI-13. In order to forecast future consumption volume, the relation between past consumption volume and GDP is shown in Fig. VI-14, where the data of 1980 and 1981 are excluded because of the enormous import volume. For consumption, three year running averages are used.

Based on the relation expressed as a dotted line in the figure, we can estimate the consumption volume in the target years as follows:

(Year)	1990	2000
Consumption (thousand tons)	15,700	30,900

These volumes are transformed into the following product level volumes by multiplying by the coefficient of 0.7.

(Year)	1990	2000
Consumption (thousand tons)	11,000	21,600

Table VI-13   Production, Foreign Trade Cargo and Consumption Volume
of Steel and Iron Products

(Unit: '000 t)

Item / Year	Production	Import	Export	Consumption
1970	2,881			3,965
1971	3,821			3,735
1972	4,431			4,276
1973	4,760			5,351
1974	5,138	529	142	6,205
1975	5,272	576	76	6,444
1976	5,298	467	154	5,951
1977	5,601	1,255	258	7,019
1978	6,775	1,221	382	8,053
1979	7,156	1,443	270	9,170
1980	–	2,524	78	10,931
1981	7,673	3,092	52	12,071
1982				9,259

Note: Consumption volume differs from (Production) + (Import) – (Export) because different data sources were used.

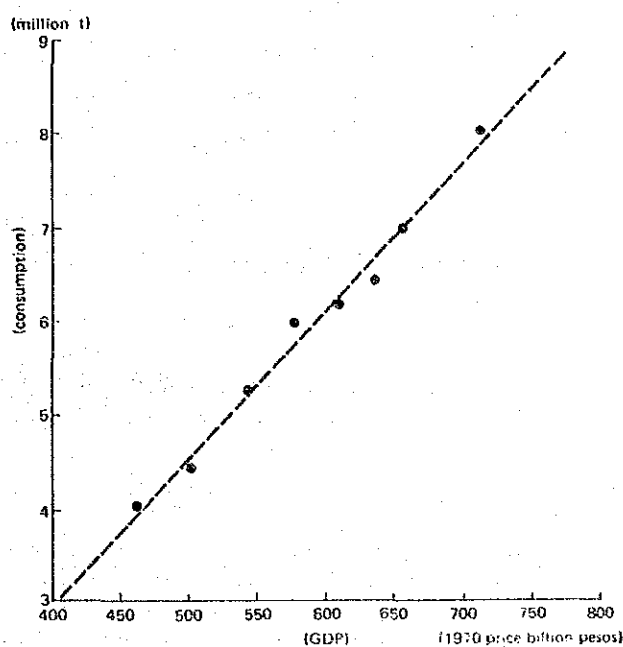Source: CNCP, "Previsiones de Trafico Maritimo"

Fig. VI-14 Relation between Iron and Steel Product
Consumption Volume and GDP

b) Forecast of production

The present production capacity and capacity as of 1990 for iron and steel products
are shown in Table VI-14. Assuming that the production ratio is 80% of the capacity, the
production in 1990 will be 11,400 thousand tons. As for the production in 2000, assuming
the same growth rate of 8.5% per year described in the "Programa Nacional de Foments
Industrial y Comercio Exterior 1984~1988" from 1990 to 2000, the production in 2000
will be 25,700 thousand tons.

Table VI-14 Production Capacity for Iron and Steel Products

(Unit: '000 t)

Group	Present	1990
AHMSA	3,750	4,200
FMSA	2,000	2,000
SICARTSA	1,300	3,300
HYLSA	1,500	2,800
TAMSA	500	750
Others	1,050	1,150
Total	10,100	14,200

Source: CNCP, "Previsiones de Trafico Maritimo"

—183—

c) Forecast of export volume

Mexico exported about 400 thousand tons of iron and steel products in 1978, mainly to U.S.A. CANACERO expects future export volume will reach 700 to 1,000 thousand tons. The study team estimates the export volume as:

(Year)	1990	2000
Export volume (thousand tons)	700	1,000

d) Forecast of import volume

From a) through c) above, the import volumes of iron and steel products for the target years are calculated.

(Year)	1990	2000
Import volume (thousand tons)	2,580	2,000

4) Percentage of total import cargo that will pass through Manzanillo Port

Total import cargo volume for all Mexico has been forecast for rice, sugar, crude rubber and iron and steel products. Now the cargo volume handled at Manzanillo Port will be determined.

a) Way of distribution

The cargo volume handled at Manzanillo Port is assumed to be expressed as:

$$V_{MANZ} = \alpha\, V_{total} \times \Sigma\, (\beta\gamma\delta) \ldots\ldots\ldots\ldots\ldots\ldots\ldots (VI\text{-}3)$$

where V_{MANZ} :   Handling volume at Manzanillo Port

      V_{total} :   Total import volume into Mexico

      α: Ratio of seaborne transport to total import volume

      β: Ratio of Pacific coast ports handling volume to total seaborne transport

      b: Ratio of Manzanillo Port handling volume to total Pacific coast volume

      δ: Ratio of consumption in the area to the national total

b) Determination of the coefficients

α seems to vary depending upon the nation of origin of the commodity. For example, if the commodity is imported mainly from U.S.A., a considerable volume will be transported on land by truck and train. In such a case, α remains low. α is estimated based on past data.

β is mainly affected by the location, that is, by the proximity of each state to the Paacific coast. For states along the Pacific coast, β approaches 1. On the contrary for states along the Gulf coast, β becomes almost 0. Of course, β is also affected by the origin of the commodity and trade routes, but we consider β as primarily a function of location.

γ is the allocation factor of Manzanillo Port among the Pacific coast ports. It is natural that this is also a function of location. The closer the area to the port of Manzanillo, the bigger the ratio.

Table VI-15 Present Coefficients

Area	State	β	γ				
			Mazatlan	Manzanillo	Lázaro Cárdenas	Acapulco	Salina Cruz
Hinterland	Aguascalientes	0.4	0.2	0.5	0.3		
	Colima	1.0	—	1.0	—	—	—
	Jalisco	0.7	0.1	0.7	0.2	—	—
Influence Area	Nayarito	1.0	0.6	0.4	—	—	—
	Guanajuato	0.3	0.2	0.6	0.2	—	—
	Querétaro	0.2	0.1	0.5	0.4	—	—
	Michoacán	1.0	—	0.3	0.6	0.1	—
	D.F.	0.2	0.2	0.4	0.2	0.1	0.1
	México	0.2	0.2	0.4	0.2	0.1	0.1

Table VI-15 shows the estimated coefficients at present. We considered that the cargo passing through the port of Manzanillo will flow mainly into the hinterland or influence area of the port (see Chapter V).

Outside those regions, β and γ almost approach 0. By the target years of 1990 and 2000, Coahuila State and Nuevo León State will also be incorporated into the influence area due to railway improvement and new road construction. Considering these conditions, the predicted coefficients for the target years are shown in Table VI-16.

δ is estimated from existing data. When there are no data available, the values are assumed from social or economical indices. Table VI-17 lists such indices. The share to the national total for the target years is assumed to be the same as that at present, although the absolute values will change.

Table VI-16 Target Year Coefficients

Area	State	β	γ				
			Mazatlan	Manzanillo	Lázaro Cárdenas	Acapulco	Salina Cruz
Hinterland	Aguascalientes	0.8	—	1.0	—	—	—
	Colima	1.0	—	1.0	—	—	—
	Jalisco	1.0	—	1.0	—	—	—
Influence Area	Nayarito	1.0	0.5	0.5	—	—	—
	Guanajuato	0.5	0.1	0.4	0.5	—	—
	Querétaro	0.4	0.1	0.4	0.5	—	—
	Michoacán	1.0	—	0.2	0.8	—	—
	D.F.	0.4	0.1	0.4	0.4	—	0.1
	México	0.4	0.1	0.4	0.4	—	0.1
	Coahuila	0.1	—	1.0	—	—	—
	Nuevo León	0.1	—	1.0	—	—	—

Table VI-17 Social and Economic Indices

Location	Area ('000 km²)	Population ('000 person)	GDP (1970 price billion pesos)				Cultivated Area ('000 km²)	Sugar Consumption ('000 t)
			Total	Agricultural	Manufacturing	Construction		
United Mexican States	1,958	73,011	842	76	210	46	355	1,463
Area / State			Share to the total national (%)					
Hinterland — Aguascalientes	0.28	0.76	0.61	0.79	0.54	1.91	0.60	2.02
Colima	0.27	0.50	0.54	1.00	0.15	0.95	0.64	0.59
Jalisco	4.13	6.27	6.52	9.28	6.95	4.11	7.15	9.36
Nayarito	1.38	1.10	0.74	2.04	0.34	0.89	1.82	0.54
Guanajuato	1.56	4.51	3.10	4.26	3.04	3.40	3.83	4.19
Querétaro	0.58	1.10	0.93	1.55	1.21	1.18	0.86	1.72
Influence Area — Michoacan	3.06	4.49	2.46	6.97	1.23	2.45	5.96	3.77
D.F.	0.08	13.77	25.14	0.36	28.24	18.62	0.14	31.06
México	1.09	5.73	9.79	5.06	18.14	11.13	3.29	4.93
Coahuila	7.66	2.33	2.95	2.34	2.82	3.32	3.30	2.19
Nuevo León	3.31	3.64	5.86	2.47	9.36	3.86	3.03	6.27

Note: Population in 1982. GDP in 1980

c) Cargo volume handled at Manzanillo Port

Now, the cargo volume handled at the port of Manzanillo will be calculated from total import volume. First, if rice consumption is assumed to be proportional to the population, the share of Manzanillo Port is estimated as 13.6% of the national total for the target years. Similarly, using sugar consumption and the manufacturing sector of GDP as variables, the handling ratios and volumes of sugar, crude rubber and steel iron products at the port of Manzanillo are estimated as shown in Table VI-18.

Table VI-18 Handling Volume of Principal Commodities

Commodity	α	Handling Ratio (%)	Cargo Volume ('000 t)			
			Total Import		Manzanillo	
			1990	2000	1990	2000
Rice	1.0	13.6	210	250	29	48
Sugar	1.0	20.3	652	1,289	132	262
Crude Rubber	0.9	17.4	90	201	14	35
Iron and Steel	0.9	17.4	2,580	2,000	404	313

5) Machinery

The future cargo volume of machinery handled at Manzanillo Port is estimated based on the import data of Manzanillo Port. Machinery import cargo at Manznaillo Port showed a steady increase till 1981, before the economic recession, as shown in Table VI-6.

As for future trade volume, it is expected that machinery imports will increase because plant equipment and other machinery are indispensable for further industrial development.

Fig. VI-15 shows the relation between machinery import volume at Manzanillo Port and GDP. Using the relation expressed as the dotted line in the figure, machinery import volume at Manzanillo Port can be forecast as follows:

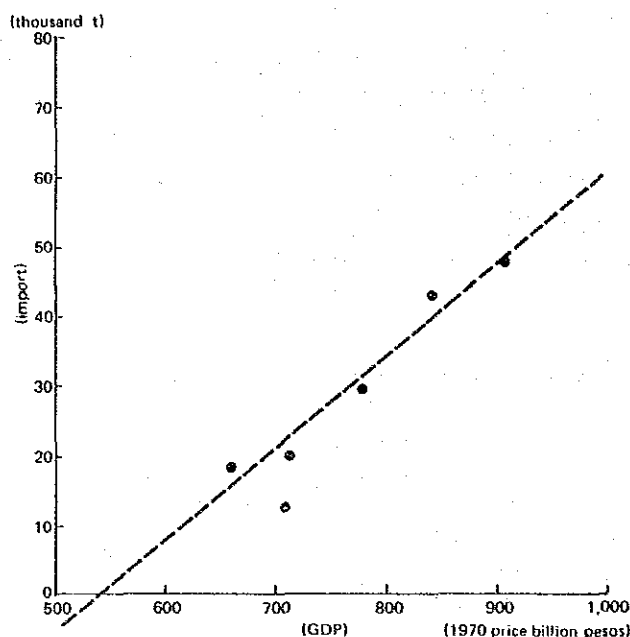| (Year)	1990	2000
Import volume (thousand tons)	87	212

Fig. VI-15   Relation between Machinery Import Volume
at Manzanillo Port and GDP

6)   Others

Commodities other than those specifically mentioned above include a great variety of goods with a low cargo volume. These goods are classified into the below three groups. The handling volume of these commodities is forecast separately for each group.

①   Agricultural and Forest products: Agricultural products other than rice and sguar, and forest products other than crude rubber

②   Industrial products: Metal goods, chemical products, cement and ceramic

③   Others

As for salt and fertilizer, a considerable volume were handled in the past at Manzanillo Port as general cargo. But considering that these goods will be handled as bulk cargo in the future, they will be forecast in the section on mineral bulk cargo.

a)   Forecast method

These goods have the following characteristics:

①   Handling volume does not show a remarkable variation from 1975 to 1980.

②   Generally, handling volume in 1980 and 1981 were big.

③   From 1981 to 1983, the volume decreased rapidly.

We may regard the recent drop of import cargo volume as caused by the temporary economic recession. So, import volume should recover with the overall economic recovery. We suppose that the average level of cargo volume handled at the port of Manzanillo from 1975 to 1979 will be recovered by 1985, and after that, the volume will continue to increase at the same growth rate as the related GDP sector.

b) Forecast

The forecast cargo volumes of these goods are listed in Table VI-19.

Table VI-19 Other Products (Import)

Item	Unit	Agriculture, Forestry	Industry	Others
Average Volume	('000 t)	40.1	14.2	5.8
Term	(Year)	1975 ~ 1980	1975 ~ 1979	1976 ~ 1980
GDP	(Sector)	Agriculture	Manufacturing	Total
Increase Ratio				
1985 ~ 1990	(%)	1.22	1.42	1.32
1985 ~ 2000	(%)	1.90	3.05	2.36
Handling Volume				
1990	('000 t)	49	20	8
2000	('000 t)	76	43	14

(3) Export cargo

Of all the export cargo handled at the port of Manzanillo, metal goods and chemical products are examined in detail. Other export goods are considered afterwords by category.

1) Metal goods

The main commodities handled at the port of Manzanillo are lead and metallic zinc. The export of these goods at Manzanillo Port amounts to 70 to 90% of the total volume of the Pacific coast ports.

a) Lead

(i) Production

Total production and export volume of lead in Mexico is shown in Fig. VI-16. Production and export volume show no clear growth trend. World lead demand is stagnant as is shown in Table VI-20.

We assume that the future demand will remain at the present level. Chihuahua State produces almost 60% of total Mexican lead production, followed by Zacatecas with 9% and Coahuila and Guerrero with 8%.

It is reasonable to assume that the lead production in Mexico will remain at the current level.
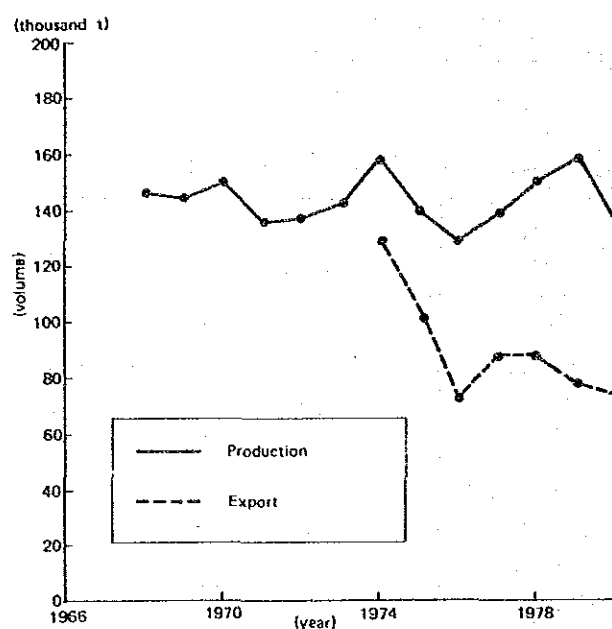
Fig. VI-16 Production and Export of Lead

Table VI-20 World Lead Production

(Unit: '000 t)

Item	1970	1971	1972	1973	1974	1975	1976	1977	1978
Production	3,280	3,190	3,370	3,340	3,370	3,200	3,310	3,380	3,490

Source: United Nations, "Statistical Year Book 1978"

(ii) Export

Considering past data, the total export volume of Mexican lead is forecast to be about 80 thousand tons.

(iii) Handling volume

The following hypothesis derived from past data are used to estimate the cargo volume handled at the port of Manzanillo.

① The seaborne traffic ratio is 80%.

② One third of the seaborne traffic will be handled at the Pacific coast ports.

③ Of the Pacific coast ports cargo volume, 80% will be handled at Manzanillo Port.

These assumptions lead to the following estimates of lead cargo volume handled at the port of Manzanillo in the target years:

(Year)	1990	2000
Cargo volume (thousand tons)	17	17

b) Metallic zinc

(i) Production

Production and export volume of metallic zinc in Mexico are shown in Fig. VI-17. World production is increasing slightly as shown in Fig. VI-18. From the figure, we forecast world consumption in the target years as follows:

(Year)	1990	2000
World consumption (thousand tons)	6,016	6,624
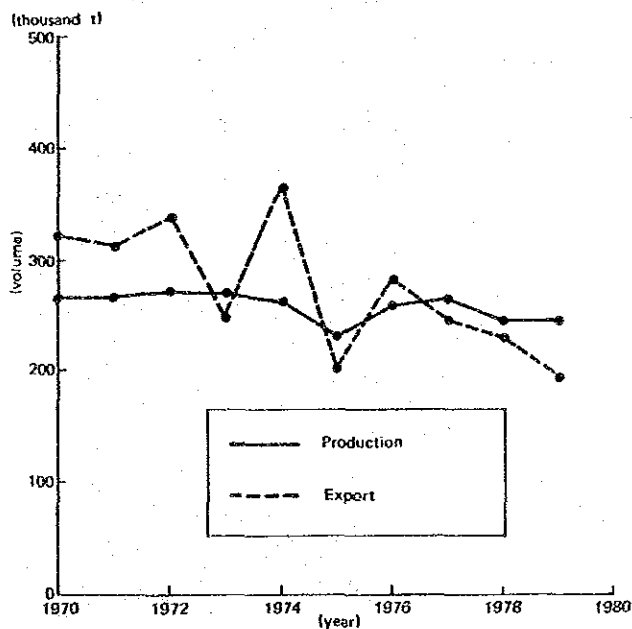
Fig. VI-17 Production and Export of Zinc
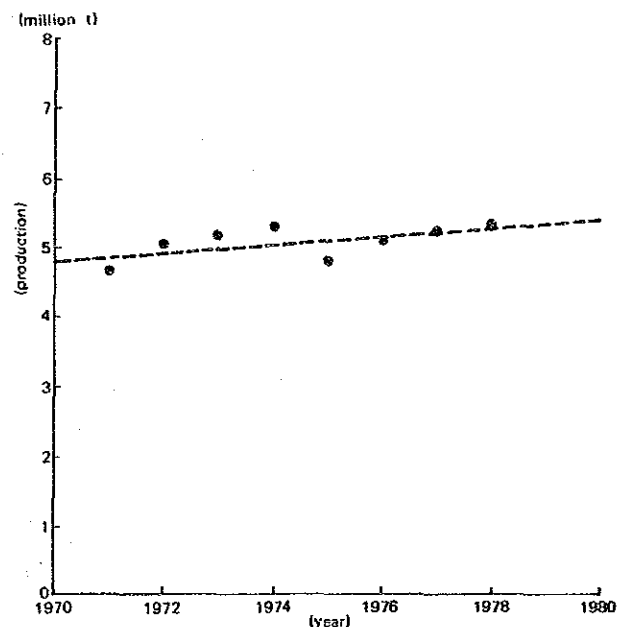
Fig. VI-18 World Production of Zinc

(ii) Export

The export volume of metallic zinc from Mexico represents 4.2 to 8.1% of total world consumption volume from 1970 to 1978. Assuming a 5.8% ratio of Mexican export volume to the total world consumption, which is the average share during the term, the following forecast of export volume is obtained.

(Year)	1990	2000
Export volume (thousand tons)	349	384

(iii) Handling volume

   Based on the data from 1977 to 1981, the average ratio of lead seaborne trans-
port to total lead export volume was 16%. Assuming a small increase in the future
of seaborne transport ratio, we estimate a ratio of 20%, and 20% of seaborne transport
are assumed to be handled at Manzanillo Port. Handling volume at the port of Man-
zanillo is calculated as:

(Year)	1990	2000
Handling volume (thousand tons)	14	15

2) Chemical products

   The commodities of this group seem to be polyester and solid plastic, but detailed informa-
tion is not available.

   The export volumes of chemical products at the port of Manzanillo are shown in Table VI-6.
Relation of these values with GDP is shown in Fig. VI-19. Based on the figure we assume the
export volume to be handled at the port of Manzanillo as:

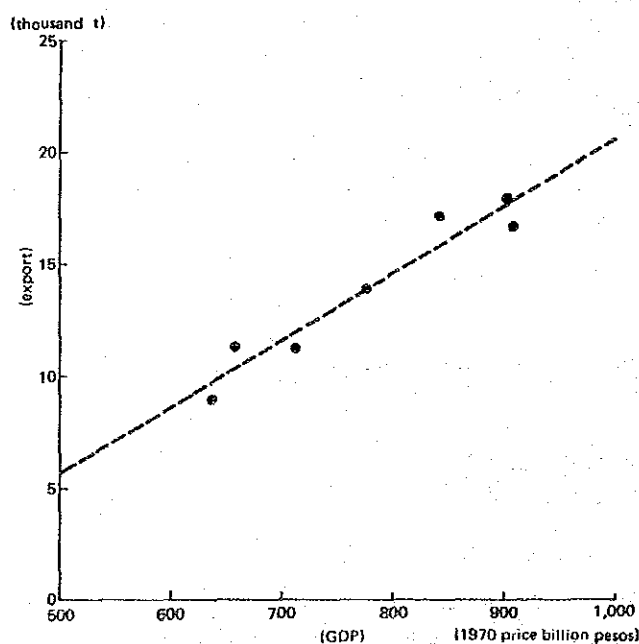| (Year)	1990	2000
Handling volume (thousand tons)	27	55

Fig. VI-19   Relation between Chemical Goods Export
and GDP

3) Others

There are a variety of export commodities handled in small volumes at the port of Manzanillo other than those mentioned above. As with import cargoes, the exports are classified into following groups:

① Agricultural and forest products

② Mineral products

③ Industrial products: Iron and steel products, Machinery, Light industrial products.

④ Cement, Ceramic

⑤ Others

Unlike imports, which recovered in 1985, we assume that the recovery year for exports was 1984 in accordance with recent statistics. Assuming continued growth after the recovery year, the forecasts are as shown in Table VI-21.

Table VI-21   Other Products (Export)

Item	Unit	Agriculture, Forestry	Mineral Products	Industrial Products	Cement, Ceramic	Others
Average Volume	('000 t)	6.8	2.7	8.3	7.7	8.9
Term	(Year)	1975 ~ 1980	1977 ~ 1983	1975 ~ 1983	1975 ~ 1981	1975 ~ 1983
GDP	(Sector)	Agriculture	Mining	Manufacturing	Construction	Total
Increase Ratio						
1984 ~ 1990	(%)	1.25	1.26	1.50	1.50	1.37
1984 ~ 2000	(%)	1.94	2.0	3.22	3.55	2.45
Handling Volume						
1990	('000 t)	9	3	13	12	12
2000	(.000 t)	13	5	27	27	22

Note: Cement and ceramic figures are considered to return to normal levels in 1985 instead of in 1984.

(4)   Domestic trade cargo

It is obvious from Table VI-6 shown previously that the principal commodities of domestic trade cargo handled at the port of Manzanillo were baryta and salt. However, salt will be considered in the section on mineral bulk cargo. So in this section, only baryta will be examined.

1)   Baryta

a)   Domestic production

Table VI-22 shows domestic production of baryta and domestic trade volume at Manzanillo Port. According to the 1982 statistics, the main production states in Mexico were as follows:

Coahuila	40.9%
Nuevo León	28.3
Michoacán	13.0
Jalisco	11.7
Others	6.1

The baryta shipped from Manzanillo Port is landed at the port of Salina Cruz and may be transported to the crude oil production area in Oaxaca State.

The production forecast derived from the trend shown in Fig. VI-20 is:

	(Year)	1990	2000
Production (thousand tons)		420	450

Table VI-22   Baryta Production

(Unit: '000 t)

Year	Production	Out
1970	319	—
1971	280	—
1972	261	—
1973	255	—
1974	272	—
1975	300	—
1976	270	—
1977	270	—
1978	231	—
1979	151	—
1980	269	22.4
1981	318	39.8
1982	324	22.7

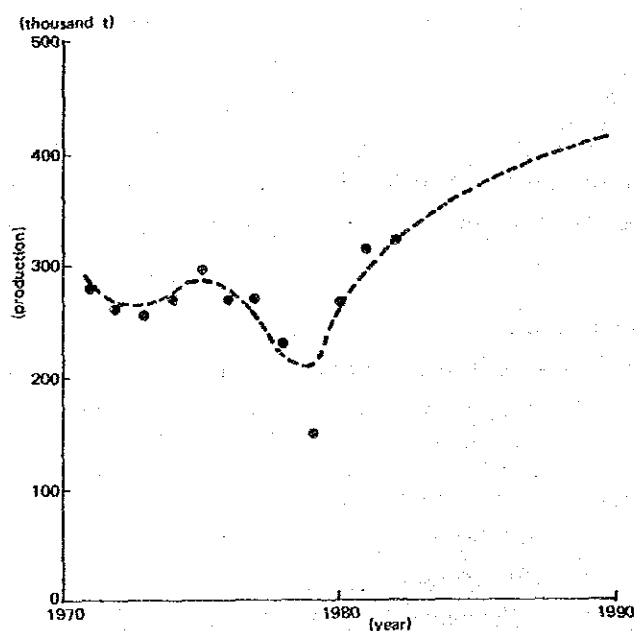Source: CNCP, "Previsiones de Trafico Maritimo"

Fig. VI-20   Production of Baryta

b)　Handling volume

We will assume that the handling volume of baryta at Manzanillo Port will remain at the present level because of the expected stagnation of oil production in Oaxaca State. So the handling volume of baryta at the port of Manzanillo in 1990 is forecast as 37 thousand tons. After 1990, the volume will increase at the same rate as the growth of national baryta production. Under this assumption, the forecast of handling cargo volume at Manzanillo Port is:

(Year)	1990	2000
Handling volume (thousand tons)	37	39

1-3-2　Agricultural Bulk

(1)　Forecast methodology

As expressed in Chapter III, in terms of volume, agricultural bulk cargo is the largest cargo handled at Manzanillo port after petroleum and its derivatives.

A major question is whether Mexico will continue grain imports in the future, or will stop importing and possibly begin exporting. The grain trade will be affected by Mexican governmental policy, meteorological conditions and other factors. Beside these, we must take into account the grain import base in Lázaro Cárdenas Port, where CONASUPO is constructing a grain storage silo with an 80 thousand ton capacity as well as a specialized grain pier. The following steps are taken to forecast agricultural bulk cargo handled at the port of Manzanillo for the target years.

①　Based on the past data, four agricultural commodities, maize, wheat, sorghum and soybeans are considered.

This does not mean that these crops are the only ones which will be handled at Manzanillo Port as agricultural bulk cargo, but they are the main crops handled in the greater volume.

②　The method of forecasting the handling volume of each crop at Manzanillo Port is shown as a flow chart in Fig. VI-21.

⑥ Production data

① Total cultivated area by trend

⑦ Import and export volume data

② Ratio of harvest area to total cultivated area by trend

⑧ Total consumption in the past

③ Harvest area

⑨ Population data

④ Crop yield by trend

⑩ Per capita consumption by trend

⑪ Population (in future)

⑤ Total production

⑫ Total consumption (in future)

⑭ Expected import (export) volume

⑬ Production variation

⑮ Seaborne transport to total import volume

⑰ Lázaro Cárdenas grain storage silo

⑯ Volume at the pacific coast ports

⑱ Estimate of cargo volume for the target year

Note: ⑥ ~ ⑨, ⑮, ⑯ are past data. Except these, all data are forecast for the target year.

Fig. VI-21 Methodology of Agricultural Bulk Cargo Volume Forecast

(2) Cultivated area forecast

1) Total cultivated area forecast

The total national cultivated area from 1970 through 1980 is shown in Fig. VI-22. Although cultivated area fluctuated annually, there was a tendency to increase over time.
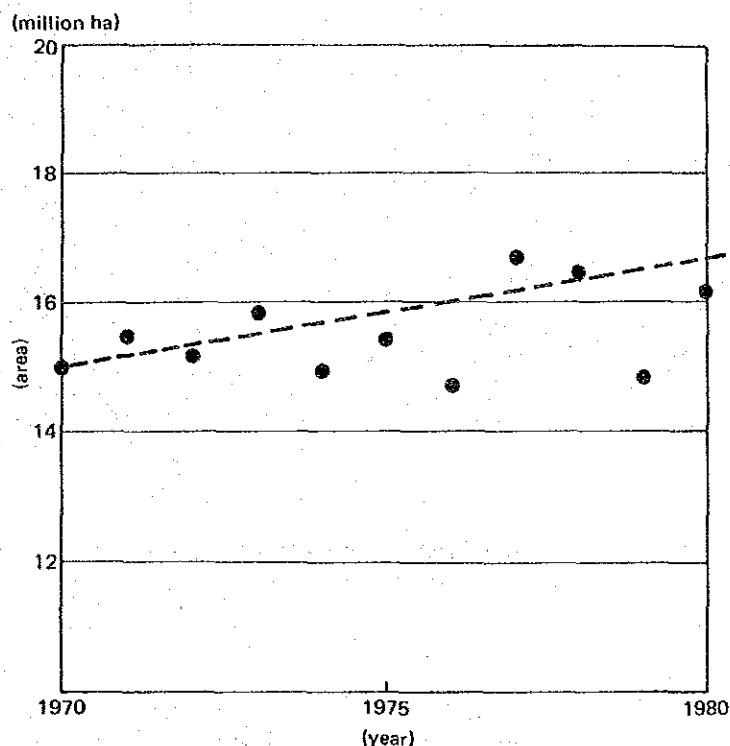
Fig. VI-22 Cultivated Area

We assume that the cultivated area in the future will increase at the pace shown as the dotted line in the figure. 1980 area and forecast area for the target years are shown below.

(Year)	(Million ha)
1980	16.2
1990	17.7
2000	19.0

2) Cultivated area ratio for each crop

Fig. VI-23 show the ratios of the cultivated area for each crop to the total cultivated area. From the long term tendencies, the share of the cultivated area for each crop is estimated as shown in Table VI-23.
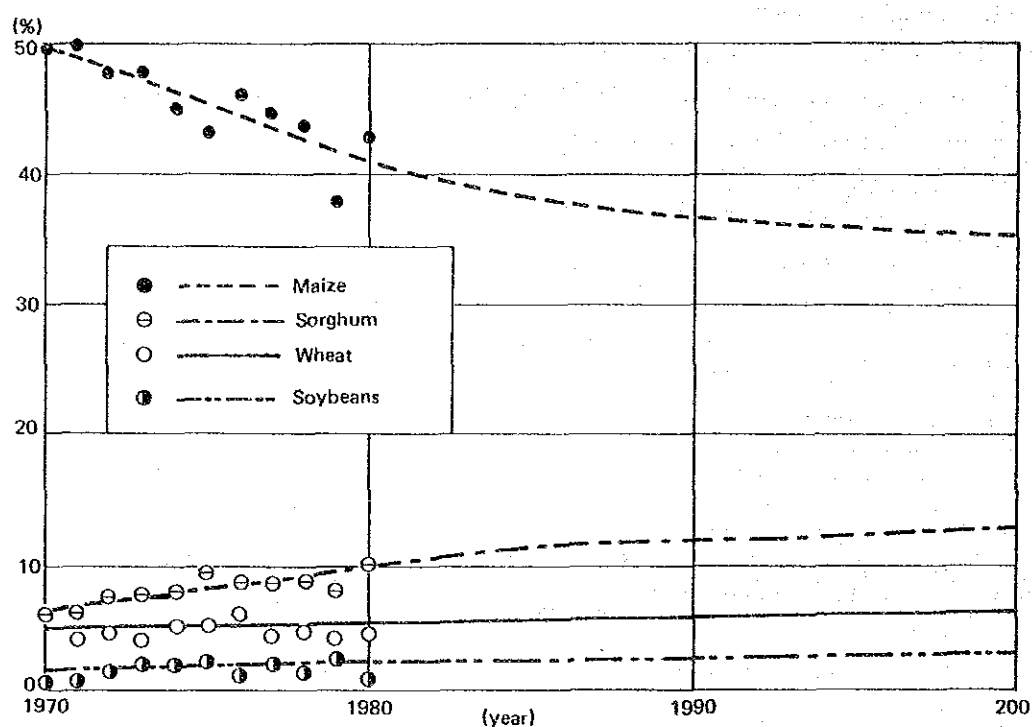
Fig. VI-23   Cultivated Area Ratio to the Total Cultivated Area

Table VI-23   Ratio of the Cultivated Area for Each Crop
to the Total Cultivated Area

(Unit: %)

Crop	1980	1990	2000
Maize	42.8	36.5	35.0
Wheat	4.5	5.4	6.0
Sorghum	9.7	11.8	15.0
Soybean	1.8	2.5	3.0

3)   Cultivated area for each crop

From the estimates calculated in 1) and 2) above, the forecast of the cultivated area for each crop is given in Table VI-24.

Table VI-24　Cultivated Area of Each Crop

(Unit: '000 ha)

Crop	1980	1990	2000
Maize	6,409	6,461	6,650
Wheat	673	955	1,140
Sorghum	1,452	2,089	2,850
Soybeans	150	443	570

(3)　Yield rate forecast

The yield rate of each crop from 1960 to 1980 is drawn in Fig. VI-24(a) to (d). Based on these figures, the yield rate of each crop for the target year is forecast as shown in Table VI-25.
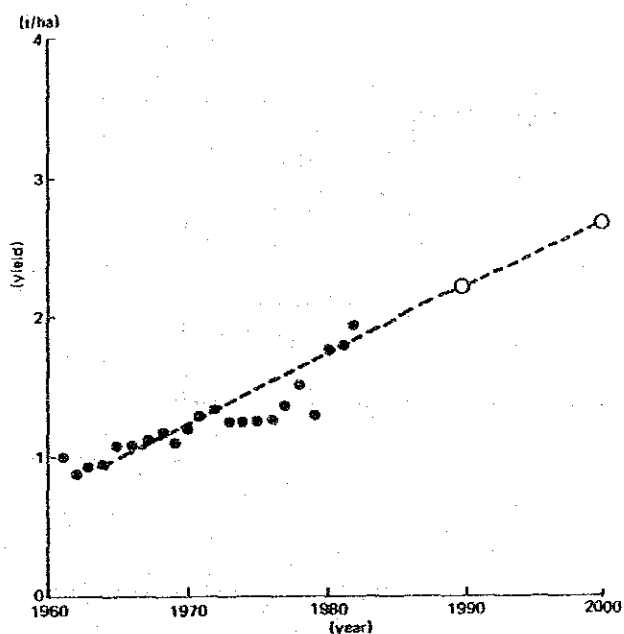
Fig. VI-24 (a)　Yield Rate of Maize
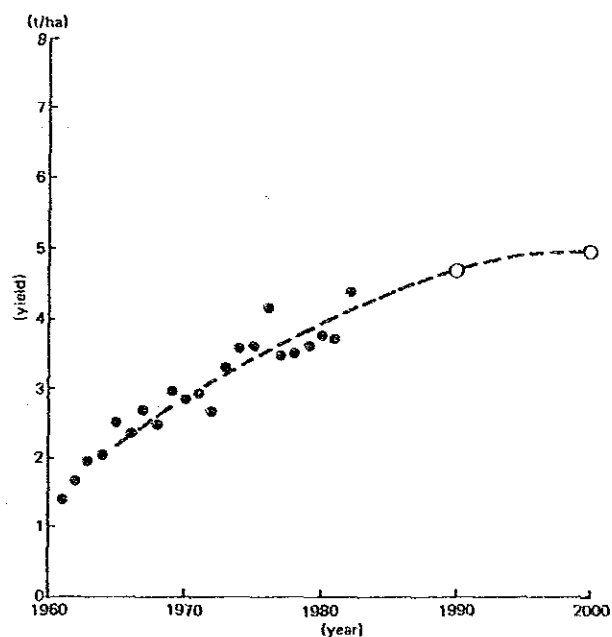
Fig. VI-24 (b)　Yield Rate of Wheat
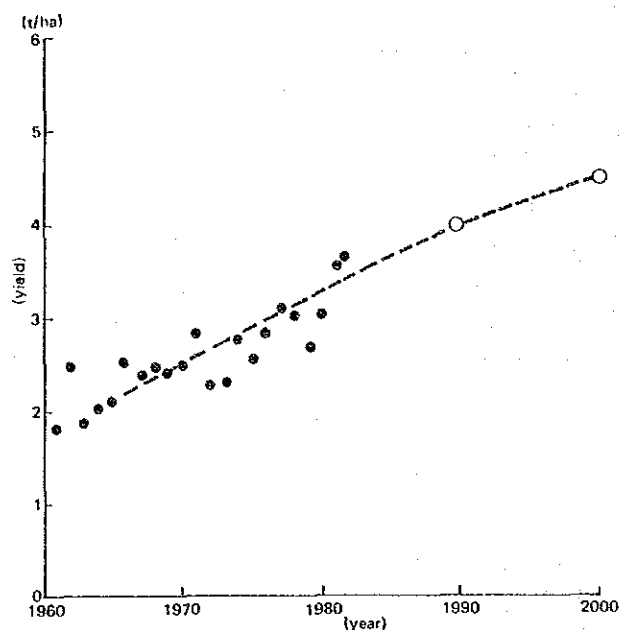
Fig. VI-24 (c) Yield Rate of Sorghum
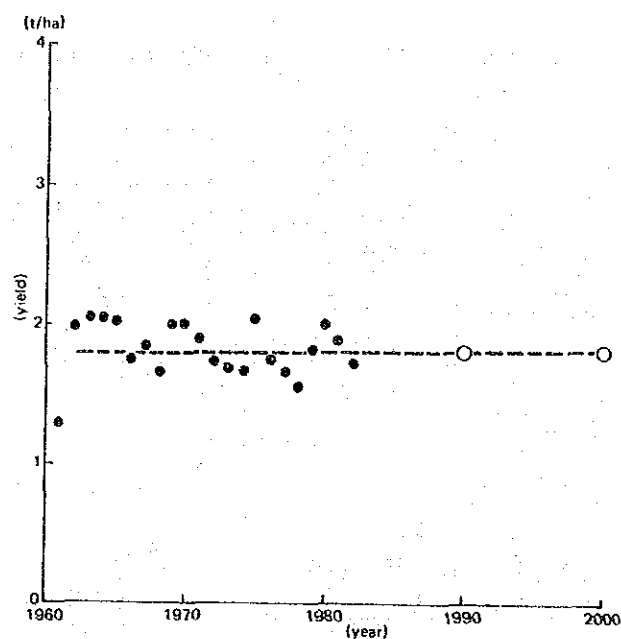
Fig. VI-24 (d) Yield Rate of Soybeans

Table VI-25 Yield Rate of Each Crop

(Unit: t/ha)

Crop	1980	1990	2000
Maize	1.780	2.240	2.670
Wheat	3.771	4.700	5.000
Sorghum	3.048	4.000	4.500
Soybeans	2.014	1.800	1.800

(4) Production forecast

Production of each crop in the target year is obtained by multiplying forecast cultivated area by forecast yield rate as shown in Table VI-26.

Table VI-26 Forecast Agricultural Production

Crop	1990			2000		
	Area ('000 ha)	Yield Rate (t/ha)	Production ('000 t)	Area ('000 ha)	Yield Rate (t/ha)	Production ('000 t)
Maize	6,461	2.240	14,470	6,650	2.670	17,760
Wheat	955	4.700	4,490	1,140	5.000	5,700
Sorghum	2,089	4.000	8,356	2,850	4.500	12,830
Soybeans	443	1.800	797	570	1.800	1,026

—200—

(5) Consumption forecast

Production, import, export, total consumption and per capita consumption for each crop are listed in Table VI-27. As the annual per capita consumption varies greatly for each crop, three year running average values are plotted in Fig. VI-25. Considering various conditions, we estimated the per capita consumption of each crop as shown in Table VI-28. Total consumption forecast for each crop is calculated in Table VI-29.

Table VI-27 (a)   Per Capita Consumption (Maize)

| Year | Volume ('000 t) | | | | Per Capita Consumption (kg/capita) |
	Production	Import	Export	Total Consumption	
1970					
1971		17	277		
1972	7,026	197	424	6,799	132
1973	7,520	1,144	27	8,637	163
1974	7,784	1,278	0	9,062	165
1975	8,459	2,627	3	11,083	195
1976	8,945	902	1	9,846	168
1977	10,138	1,754	0	11,892	197
1978	10,909	1,418	0	12,327	197
1979	9,255	744	0	9,999	155
1980	12,383	3,777	0	16,160	240
1981	14,766	3,065	1	17,832	256
1982	12,215	233	0	12,448	173

Source: FAO, "Trade Year Book", 1974, 1976, 1979, 1982
"Production Year Book", 1974, 1976, 1979, 1982

Table VI-27 (b)   Per Capital Consumption (Wheat)

| Year | Volume ('000 t) | | | | Per Capita Consumption (kg/capita) |
	Production	Import	Export	Total Consumption	
1970		59	42		
1971		55	86		
1972	1,672	74	16	1,730	33.6
1973	2,091	54	11	2,134	40.2
1974	2,789	576	19	3,346	60.9
1975	2,798	86	31	2,853	50.3
1976	3,354	1	13	3,342	57.0
1977	2,456	476	23	2,909	48.1
1978	2,654	506	16	3,144	50.3
1979	2,272	1,148	14	3,406	52.8
1980	2,785	822	23	3,584	53.2
1981	3,189	1,128	0	4,317	62.0
1982	4,468	398	0	4,866	67.7

Source: Same as Table VI-27 (a)

Table VI-27(c)   Per Capital Consumption (Sorghum)

| Year | Volume ('000 t) | | | | Per Capita Consumption (kg/capita) |
	Production	Import	Export	Total Consumption	
1970	2,747				
1971	2,516				
1972	2,612				
1973	3,270				
1974	3,499				
1975	4,126				
1976	4,027				
1977	4,325	749	0	5,074	83.9
1978	4,193	922	0	5,115	81.8
1979	3,988	1,174	0	5,162	80.0
1980	4,689	2,405	0	7,094	105.3
1981	6,086	2,301	0	8,387	120.5
1982	4,717	1,370	0	6,087	84.7

Source: Same as Table VI-27(a)

Table VI-27(d)   Per Capita Consumption (Soybeans)

| Year | Volume ('000 t) | | | | Per Capita Consumption (kg/capita) |
	Production	Import	Export	Total Consumption	
1970	215				
1971	232	68	0	300	6.0
1972	366	11	0	377	7.3
1973	375	42	0	417	7.9
1974	491	435	0	926	16.9
1975	699	22	0	721	12.7
1976	260	348	0	608	10.4
1977	516	520	0	1,036	17.1
1978	334	681	0	1,015	16.2
1979	701	519	0	1,220	18.9
1980	312	522	0	834	12.4
1981	712	1,110	0	1,822	26.2
1982	672	518	0	1,190	16.6

Source: Same as Table VI-27(a)
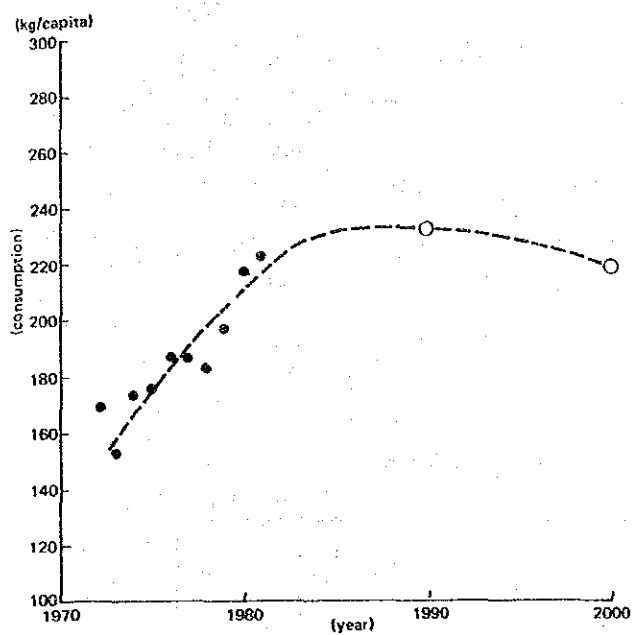
Fig. VI-25 (a) Per Capita Consumption (Maize)
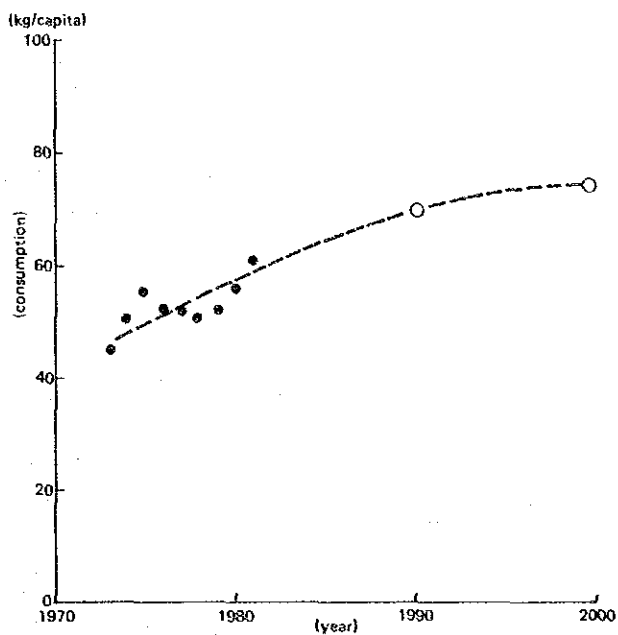
Fig. VI-25 (b) Per Capita Consumption (Wheat)
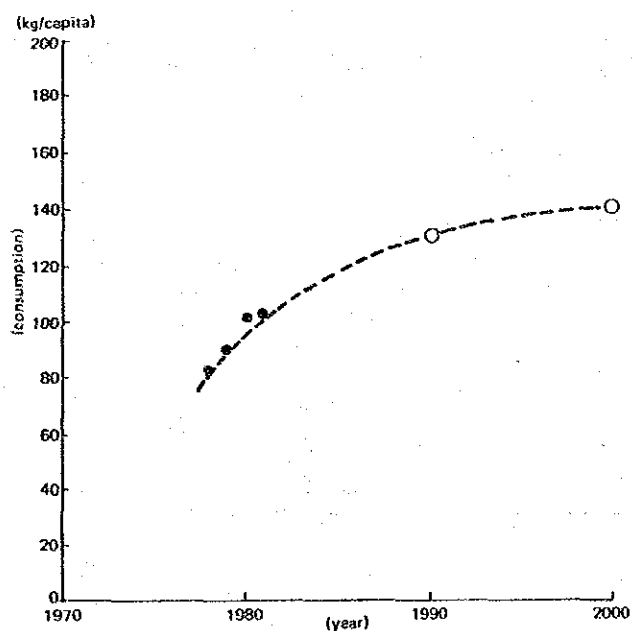
Fig. VI-25 (c) Per Capita Consumption (Sorghum)
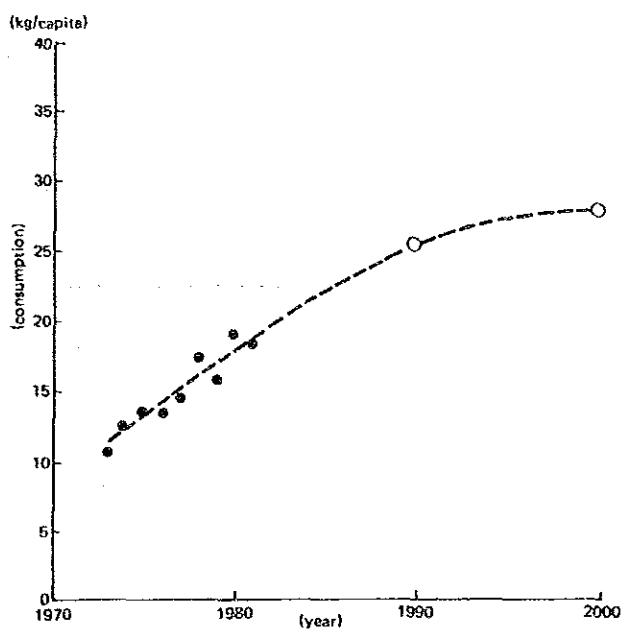
Fig. VI-25 (d) Per Capita Consumption (Soybeans)

Table VI-28　Forecast Per Capita Consumption of Each Crop

(Unit: kg/capita)

Crop	1980	1990	2000
Maize	180	230	220
Wheat	59	72	77
Sorghum	93	132	140
Soybeans	14.6	25.5	28.0

Table VI-29　Demand Forecast of Each Crop

(Unit: '000 t)

Crop	1990	2000
Maize	19,870	22,660
Wheat	6,220	7,931
Sorghum	11,404	14,420
Soybeans	2,203	2,884

(6)　Total import volume

From Table VI-29 and VI-26, the total deficit (import) volume of each crop is shown in Table VI-30.

Table VI-30　Import Volume

(Unit: '000 t)

Crop	1990	2000
Maize	5,400	4,900
Wheat	1,730	2,231
Sorghum	3,048	1,590
Soybeans	1,406	1,858

(7)　Production variation

As a rule, agricultural harvest varies greatly according to meteorological conditions. Especially as Mexico has a large percentage of non-irrigated area, this tendency is pronounced. We regard it as necessary to prepare for bad crop years. Thus we recommended facilities with extra capacity capable of handling extra volumes of import cereals in bad crop years. In determining the necessary capacity we take the following steps:

①　Maize and wheat are the major grains in Mexico. So we investigate past total crop production of these crops.

② Total production of these crops from 1960 to 1982 are shown in Fig. VI-26 together with the best fitted straight line.

③ Fig. VI-27 shows how the actual production deviates from the average value. In the figure, the deviation is considered as the difference between the assumed average value and actual production. The deviation is indicated as a percentage of the average values.

④ The figure indicates that 12% production variation can be expected with an occurrence probability of about 33%, on the average once in three years.

⑤ Assuming that in the future such production variation occurs, we estimate that a 12% extra import capacity is necessary for bad crop years.
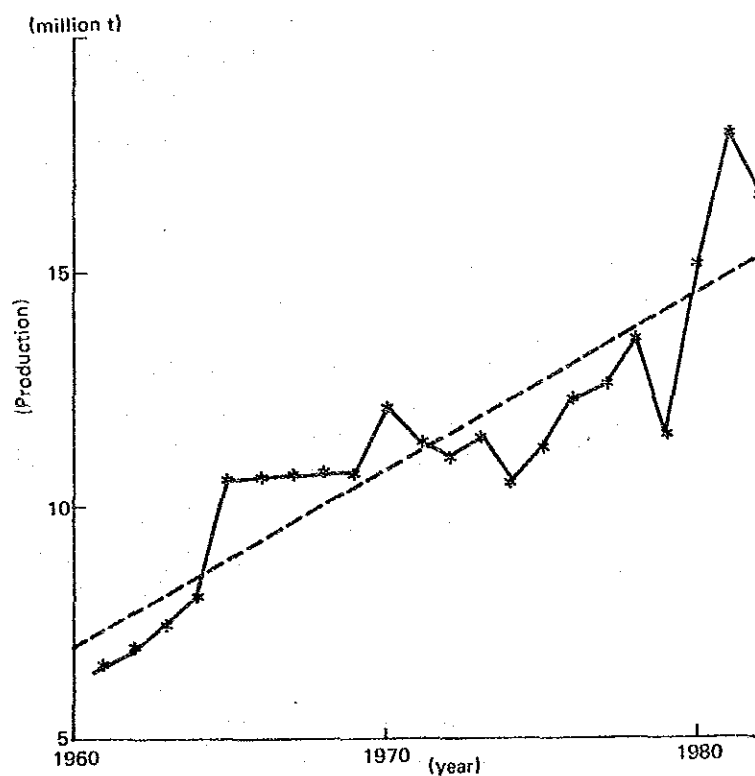
Fig. VI-26 Yearly Variation of Principal Grain Production
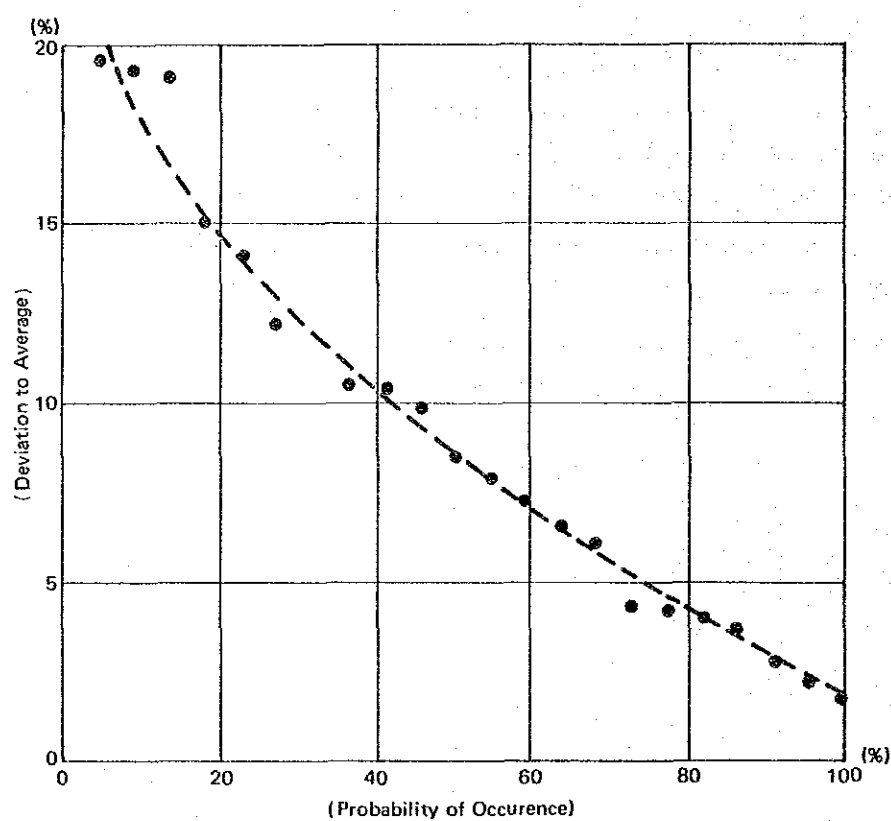
Fig. VI-27 Statistical Distribution of Deviation

⑥ The expected import volume of the main agricultural products is shown in Table VI-30. Table VI-31 shows the forecast volume including a margin for bad crop years.

Table VI-31 Total Import Volume Including
Production Variation

(Unit: '000 t)

Crop	1990	2000
Maize	6,050	5,490
Wheat	1,940	2,500
Sorghum	3,040	1,590
Soybean	1,400	1,860

Note: Only the import volumes of maize and wheat are increased.

(8) Handling volume at Manzanillo Port

The figures listed in Table VI-31 are the total volume forecast to be imported to Mexico by land and seaborne transportation. Past data indicates that most of these crops are mainly imported from U.S.A.

The percent of total import volume transported by ship, the percent of total shipping volume handled by Pacific coast ports, and the percent of total volume handled at Manzanillo Port are shown in Table VI-32. The figures presented are averages for the years 1977 ～ 1981. Assuming that these percentages remain about the same, we can forecast the volume of agricultural bulk that will be handled at Manzanillo Port in the target years.

However we must consider the projected increased handling volume at Lázaro Cárdenas Port where a specialized pier for imported grain and a grain storage silo are under construction. We can estimate the total agricultural bulk cargo volume to be handled by this new facility.

According to Japanese examples, grain storage silos can be loaded and unloaded 7 to 9 times per year. If we adopt the figure of 9 times per year, the maximum possible handling volume of agricultural bulk at the new silo is 720 thousand tons per year.

In determining the share of agricultural bulk which will be handled at Manzanillo Port, the following factors are considered:

① Among the Pacific coast ports, Lázaro Cárdenas Port will play the most important role in the near future for handling agricultural bulk cargo.

② Due to existing trade patterns, the port of Mazatlan as well as Guaymas will have the key position for imported grains.

③ Manzanillo Port will retain a certain share of the total import of agricultural cargo because it possesses a fairly big consumption area (hinterland) including the states of Colima, Jalisco and Aguascalientes. In 1980, the percent of the national total population in those states is about 6%.

Considering these conditions, we adopted the following shares of Pacific coast volume to be handled at Manzanillo Port for the target years:

(Crop)	(Percent)
Maize	20
Wheat	20
Sorghum	20
Soybeans	12

Assuming the shipping transport ratio, and the percent of total shipping handled at Pacific coast ports are as expressed in Table VI-32, the handling volume at Manzanillo Port for the target years are forecast as shown in Table VI-33.

Table VI-32 Share of Transportation

(Unit: %)

	Seaborn to Total	Pacific Coast to Seaborne	Manzanillo to Pacific Coast
Maize	83	39	41.7
Wheat	75	22	20.9
Sorghum	76	57	19.6
Soy bean	100	60	12.4

Table VI-33 Agricultural Bulk Cargo Volume Forecast

(Unit: '000 t)

Crop	Share of Manzanillo to Total Import (%)	1990		2000	
		Total	Manzanillo	Total	Manzanillo
Maize	6.4	6,050	387	5,490	351
Wheat	3.3	1,940	64	2,500	83
Sorghum	8.6	3,040	261	1,590	137
Soybean	7.2	1,400	101	1,860	134
Total			813		705

1-3-3 Mineral Bulk

(1) Object cargo

As shown in Table VI-1, the principal mineral bulk cargoes handled at the port of Manzanillo are as follows:

Import: Phosphate rock and raw materials for fertilizer such as ammonium sulphate, ammonium nitrate, urea, super phosphate, ammonium phosphate, potasium chloride

Domestic Import: Phosphate rock, salt

Therefore it is sufficient to examine phosphate rock, fertilizer and salt.

(2) Phosphate rock

1) Import

At Manzanillo Port, phosphate rock was imported in 1976, 1978 and 1979 at a volume of 22 to 85 thousand tons. On the other hand, nationally Mexico imported about 1 to 1.4 million tons of phosphate rock every year of which more than 90% was handled at the specialized pier of FERTIMEX in the port of Pajaritos. The phosphate rock was mainly imported from Morocco

and Florida. Considering these facts, we estimate that virtually all of the phosphate rock will continue to be imported to Gulf coast ports, primarily Pajaritos Port. Therefore we estimate no phosphate handling volume at Manzanillo Port.

2) Domestic import

The handling volume of phosphate rock in domestic trade import cargo at the port of Manzanillo has been increasing since 1980 and reached 192 thousand tons in 1983. The reason for this sharp increase in cargo is the development of phosphate mining in San Juan de la Costa, Baja California Sur.

The possible output of phosphate rock from the mining resources suggests a potential output of 700 thousand tons in 1990 and 1,500 thousand tons in 2000. This production will partly be substituted for some of the imported phosphate and it is reasonable to assume that all the domestic production will be transported into Pacific coast ports, among which only Manzanillo Port and Lázaro Cárdenas Port are near consumption areas. The raw materials shipped from Baja California Sur to Lázaro Cárdenas Port will be used at a new fertilizer factory which will be built at Lázaro Cárdenas. The raw materials shipped to Manzanillo Port will be transported by land to a fertilizer factory located in Toluquilla, Guadalajara. The expected production capacity of the new plant at Lázaro Cárdenas will be 700 thousand tons. Assuming a 90% operating rate, the demand at the new factory in 1990 will be 630 thousand tons, and thus shipments to Lázaro Cárdenas Port are forecast as 630 thousand tons in 1990. The remaining 70 thousand tons are forecast to be shipped to Manzanillo Port for use at the Guadalajara plant. Assuming that the increased production of raw materials in Baja California Sur will promote fertilizer production capacity in Lázaro Cárdenas and Guadalajara plants at the same rate, we assume that the volume of phosphate rock shipped through Manzanillo Port will remain 10% of the total Baja California Sur production.

Thus the handling volume at Manzanillo Port is estimated as follows:

(Year)	1990	2000
Handling volume (thousand tons)	70	150

(3) Fertilizer

1) Forecast method

The handling volume of fertilizer at Manzanillo Port is forecast using the following steps.

① We calculate the consumption of fertilizer per unit of area using past data, dividing the amount of fertilizer actually used by the area of land cultivated. Then, by observing trends over time, we predict the future consumption of fertilizer per unit area for the target years.

② We forecast the total consumption for the target years by multiplying the consumption of fertilizer per unit area determined above by the projected total cultivated area, estimated in section 1-3-2 of this chapter.

③ As for production, the forecast for 1990 is calculated by combining the production capacity of existing fertilizer plants and the projected production capacity of planned

plants. The production estimate for 2000 is determined by multiplyimg the estimated production for 1990 by a certain growth ratio.

④ The deficit volume between production and consumption is considered as the total import volume.

⑤ The percentage of total fertilizer imports which are transported by ship and the ratio of the volume handled at Manzanillo Port to the total ocean transport volume are estimated from past data.

⑥ The volume of fertilizer to be handled at Manzanillo Port can be forecast using the estimated total import volume and handling ratios.

2) Per area consumption

Fig. VI-28 shows per area fertilizer consumption from 1970 to 1980. Based on the figure, we estimate per area fertilizer consumption for the target years as:

(Year)	1990	2000
Per area fertilizer consumption (kg/ha)	360	455
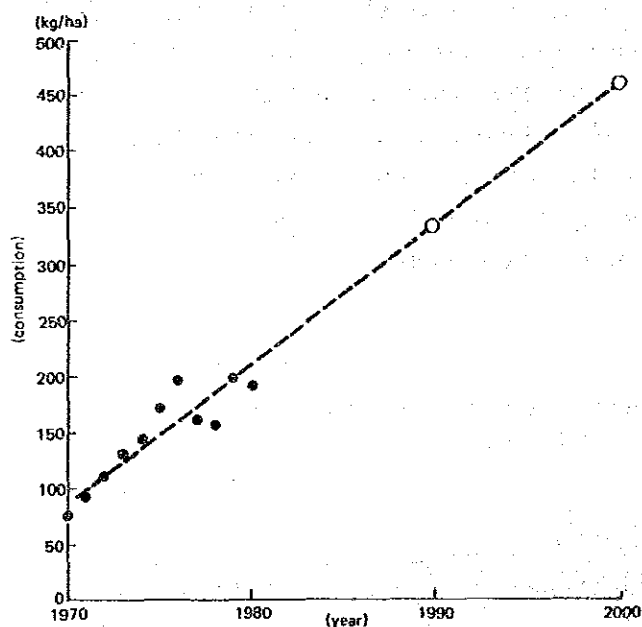
Fig. VI-28 Fertilizer Consumption per Unit Area

3) Demand forecast

As was stated in 1-3-2 of this Chapter, the total cultivated area in Mexico is estimated as 17.7 and 19.0 million ha in the years 1990 and 2000 respectively.

Therefore total fertilizer consumption in the target years are:

(Year)	1990	2000
Total demand (thousand tons)	6,372	8,645

Fig. VI-29 shows the above mentioned forecast together with that past data.
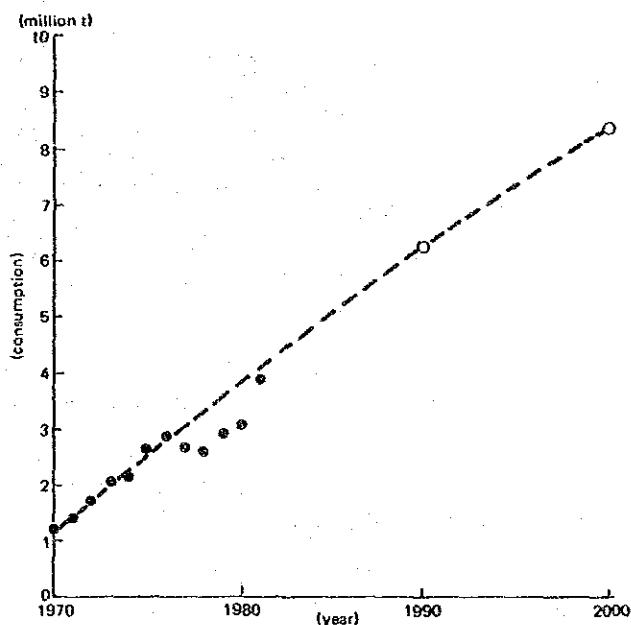
Fig. VI-29 Total Fertilizer Consumption

4)   Production forecast

Total fertilizer production capacity in Mexico in 1982 is 4,438 thousand tons as shown in Table VI-34. Combined with planned plant capacity, total fertilizer production capacity will amount to 5,533 thousand tons. The production is estimated to be 5 million tons in 1990, assuming an operating ratio of 90%.

Assuming that production will increase at an annual growth rate of 3% from 1990 to 2000, production will reach 6.7 million tons in the year 2000. As a result, the production forecast becomes:

(Year)	1990	2000
Production (million tons)	5.0	6.7

Table VI-34   Fertilizer Production Capacity

(Unit: '000 t)

Kind of Fertilizer	Existent	Planned	Total
Ammonium sulphate	1,862	—	1,862
Urea	1,258	370	1,628
Ammonium nitrate	168	200	368
Phosphate of ammonium manure	163	275	438
NPK complex	315	250	565
Super phosphate (simple)	482	—	482
Super phosphate (triple)	190	—	190
Total	4,438	1,095	5,533

Source: CNCP, "Previsiones de Trafico Maritimo"

5)   Import

The import volume is calculated from the difference between supply and demand as:

(Year)	1990	2000
Import volume (thousand tons)	1,370	1,950

6)   Handling volume

In determining the handling volume at Manzanillo Port, we will apply the same method used for imported general cargo.

First, all the imported volume is assumed to be transported by ship. Next, the coefficient δ is assumed to represent the cultivated area ratio shown in Table VI-17. Thus the distribution ratio for Manzanillo Port is calculated to be 12.5% of the total shipping transport volume. Handling volume at Manzanillo Port is calculated as:

(Year)	1990	2000
Handling volume (thousand tons)	171	244

Judging from past records, it is probable that part of the fertilizer will be imported as general cargo. Past data show the ratio of general cargo to total is about 15%, and we predict a decrease to 10%. Therefore the entire import volume of fertilizer to be handled at Manzanillo Port is forecast by packing type as follows:

(Year)	1990	2000
Handling volume (thousand tons)	171	244
Bulk cargo	154	220
General cargo	17	24

(4) Salt

1) Handling volume in the past

Salt handling volume at Manzanillo Port has decreased sharply since 1981 as shown in Fig. VI-3. First, the reason for this acute decline should be investigated. Table VI-35 shows the salt volume handled at the ports of Manzanillo and Mazatlan.

The decrease in handling volume at Manzanillo Port after 1981 was partially caused by cargo shift from Manzanillo to Mazatlan Port. The salt originates from Isla Cedros, Baja California.

Table VI-35 Salt Handling Volume

Port	Package Type	1975	1976	1977	1978	1979	1980	1981	1982	1983
Manzanillo	General cargo	56.9	58.9	69.9	72.0	49.3	41.2	15.9	19.9	0
	Bulk	—	—	—	—	—	72.7	—	—	0
	Sub-total	56.9	58.9	69.9	72.0	49.3	113.9	15.9	19.9	0
Mazatlan	General cargo	2.0	1.8	3.5	1.5	—	0.7	—	—	0
	Bulk	—	—	—	—	—	44.8	68.0	51.6	0
	Sub-total	2.0	1.8	3.5	1.5	—	45.5	68.0	51.6	0
Total		58.9	60.7	73.4	73.5	49.3	159.4	83.9	71.5	0

Source: DGODP, "Estadisticas del Movimiento Portuario Nacional de Carga y Buques"

2) Forecast of handling volume

Salt is consumed as a raw material for caustic soda production. Generally, there is a close relation between salt handling volume and caustic soda production. Fig. VI-30 shows the relation between caustic soda production and GDP. Based on the relation drawn in the figure as the dotted line, caustic soda production is forecast as follows:

	(Year)	1990	2000
Production (thousand tons)		433	774

During the study period, the sum of the volumes of salt handled at Manzanillo and Mazatlan Port varied from 49 to 84 thousand tons except in 1980 and 1983. We assume that in 1985 the total handling volume at both ports together will be restored to 70 thousand tons. After 1985, we predict the volume will increase at the same rate as total Mexican caustic soda production.

The total volume of salt to be handled both at Manzanillo and Mazatlan Port is estimated as:

	(Year)	1990	2000
Inward salt (thousand tons)		92	165
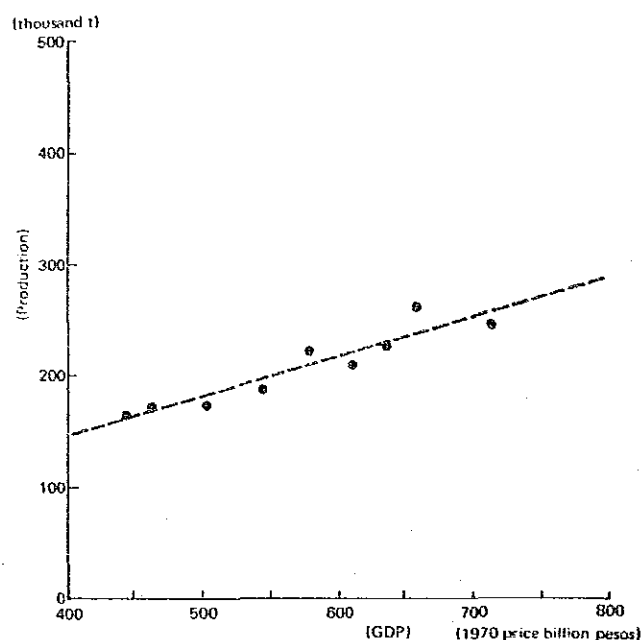
Fig. VI-30 Relation between Caustic Soda Production
and GDP

As for the share of transport between the ports of Manzanillo and Mazatlan, we estimate that Manzanillo Port will regain 40% of the total.

(Year)	1990	2000
Handling volume at Manzanillo Port (thousand tons)	37	66

1-3-4 Other Liquid Bulk and Perishable Goods

Molasses is the principal commodity of liquid bulk cargo other than petroleum and its derivatives.

The volume of perishable goods is so small (less than 1 thousand tons per year) that we can neglect it. So, in this section, we will only consider the handling volume of molasses.

As was indicated in Section 1-2 of this Chapter, molasses was a major export cargo from 1975 to 1979. Since 1980 the volume of molasses handled at the port of Manzanillo has decreased greatly. Considering that Mexico will import a rather large volume of sugar, we expect that Mexico will stop exporting molasses, and that all Mexican molasses production will be diverted to internal consumption. So the handling volume for the target years is estimated as zero.

1-3-5 Possible Future Utilization of Manzanillo Port by Enterprises in the Hinterland

The team visited some enterprises in Guadalajara and Aguascalientes City, one of the industrial core areas of the hinterland, and discussed on the possibility of future utilization of the

port of Manzanillo with concerned officials.

In this section, some enterprises that intend to construct new port facilities in Manzanillo Port or to utilize Manzanillo Port are listed. Then the future cargo volume of these enterprises is estimated for the target years. Although there are many enterprises which plan to use Manzanillo Port, here we will only consider enterprises which may handle a considerable volume of cargo.

(1) Cement

"Cement Guadalajara, S.A." has a capacity of 1.8 million tons per year. According to a person responsible for transport affairs, this enterprise plans to export their products domestically and internationally. They intended to handle 180 thousand tons for export and 36 thousand tons for domestic export as bulk cargo of clinker or cement. The company hopes to construct some port facilities including a cement silo within 1985.

Based on these expectations, we considered that the planned volume of foreign and domestic trade export will be handled up till 1990.

After 1990, we assumed that the volume will increase at the same pace as the manufacturing sector of GDP. The handling volume is forecast as follows:

(Year)	1990	2000
Handling volume (thousand tons)		
Export	180	383
Domestic export	36	77

(2) Steel products

"Siderurgica de Guadalajara, S.A." produces steel products totaling about 250 thousand tons in a year. As for raw materials, it consumes 300 thousand tons of scrap iron per year of which 60 thousand tons comes from U.S.A. by land transport. The company wants to change from land to maritime transport of scrap iron to economize transportation costs. They also plan to export 36 to 60 thousand tons per year to Japan and to U.S.A. by ship.

Corresponding to these plans we forecast the handling volume as follows:

(Year)	1990	2000
Handling volume (thousand tons)		
Scrap iron (general cargo) (Import)	60	128
Steel products (general cargo) (Export)	50	106

The volume of scrap iron and steel products between 1990 and 2000 is estimated to expand at the same rate as the manufacturing sector of GDP.

1-3-6 Container Cargo

In this section, the container cargo volume portion of general cargo is estimated.

(1) Present situation

As is shown in Table VI-36, about 80% of the container cargo volume in Mexico is handled at the Gulf coast ports. Table VI-37 shows the ratio of container cargo to total general cargo (hereinafter this ratio is referred to as the "containerized ratio").

The containerized ratios in Mexico in 1983 are about 25% for both import and export. The containerized ratios are much higher at the Gulf coast ports than at the Pacific coast ports.

Table VI-36   Volume of Container Cargo (All Mexican Ports)

(Unit: '000 t)

Year	National Total		Pacific Coast		Gulf Coast	
	Export	Import	Export	Import	Export	Import
1979	77	189	14	3	63	187
1980	138	357	20	27	118	331
1981	143	687	25	39	117	648
1982	393	498	80	12	313	486
1983	361	492	142	14	219	478

Source: DGODP, "Estadísticas de Movimiento Portuario Nacional de Carga y Buques"

Table VI-37   Ratio of Containerized Cargo to General Cargo

(Unit: %)

Year	National Total		Pacific Coast		Gulf Coast	
	Export	Import	Export	Import	Export	Import
1979	5.4	8.1	2.3	0.6	7.7	9.8
1980	12.2	9.9	5.0	3.7	15.9	11.5
1981	13.8	14.3	7.6	4.3	16.6	16.6
1982	32.0	19.3	21.1	2.1	36.8	24.2
1983	23.5	25.7	22.6	2.6	24.1	34.9

In the Pacific coast ports, Lázaro Cárdenas and Salina Cruz are equipped with container cranes. The containerized ratio for exports at the Pacific coast ports is higher than the ratio for imports. This is because the chemical products exported from Salina Cruz Port began to be containerized in 1982, and have significantly elevated the export containerization rate. The ports of Manzanillo, Lázaro Cárdenas and Salina Cruz handle most of the Pacific container cargo as shown in Table VI-38.

There is no data about what sort of commodities are transported as container cargo. However, chemical products at Salina Cruz Port and chemical products, machinery and other industrial products at the ports of Manzanillo and Lázaro Cárdenas are probably the main commodities transported.

At present, "Johnson Scan Star Shipping Company", the only container cargo liner along the Pacific coast, connects Lázaro Cárdenas Port with North America and Europe. "TMM" has a regular service exporting chemical products from Salina Cruz Port to South East Asia utilizing multi-purpose ships.

Table VI-38   Container Cargo Volume at Pacific Coast Ports

(Unit: '000 t)

Port	Export Import	1979	1980	1981	1982	1983
Guaymas	Export	2.7	0.3	—	0.2	0.1
	Import	—	—	—	—	—
Mazatlan	Export	4.2	—	—	0.1	5.1
	Import	—	—	0.1	0.3	0.9
Manzanillo	Export	7.1	19.3	22.3	7.8	21.6
	Import	1.3	23.8	36.8	6.6	1.3
Lázaro Cárdenas	Export	—	—	1.4	4.5	23.1
	Import	—	0.2	0.9	3.7	9.4
Acapulco	Export	—	0.3	0.2	0.2	—
	Import	1.4	2.7	1.1	1.0	0.2
Salina Cruz	Export	—	—	—	66.0	91.1
	Import	—	—	—	0.2	1.7
Pacific Total	Export	14.0	19.9	25.4	80.3	142.2
	Import	2.7	26.7	38.9	12.0	13.9

Source: DGODP, "Estadísticas del Movimiento Portuario Nacional de Carga y Buques"

(2)   Forecast
The general cargo commodities handled at the Pacific coast ports are shown in Tables VI-39 and VI-40. Main commodities for export are iron and steel, and agricultural and chemical products. Main import commodities are agricultural products, iron and steel, and machinery.

Table VI-41 shows the estimated percentage of cargoes which can be containerized for different types of general cargo at the Pacific coast ports. Fig. VI-31 indicates the progress rate of containerization which is defined as the ratio of containerized volume to containerizable volume.

It is clear that containerization at Lázaro Cárdenas Port has progressed year by year, but at Manzanillo Port containerization has been stagnating since 1982. This is due to the container ship service calling at Lázaro Cárdenas Port provided by Johnson Scan Star. Also, some agricultural cargo, especially fresh goods, has been diverted from Manzanillo to Lázaro Cárdenas Port.

Table VI-39　General Cargo Handled at the Pacific Coast Ports (Export)

(Unit: '000 t, %)

Commodity	1980	1981	1982	1983
Agricultural Products	281 (71.3)	232 (69.4)	103 (27.1)	90 (14.3)
Forest Products	–	–	2 (0.5)	1 (0.2)
Mineral Products	–	–	–	–
Iron and Steel	4 (1.0)	2 (0.6)	155 (40.8)	328 (52.3)
Other Metal	41 (10.4)	27 (8.1)	17 (4.5)	35 (5.6)
Machinery	15 (3.8)	10 (3.0)	8 (2.1)	10 (1.6)
Chemical Products	19 (4.8)	36 (10.8)	81 (21.3)	120 (19.1)
Fertilizer	2 (0.5)	–	–	16 (2.6)
Cement and Ceramic	9 (2.3)	5 (1.5)	2 (0.5)	–
Other Industrial Products	4 (1.0)	8 (2.4)	4 (1.1)	12 (1.9)
Other General Cargo	19 (4.9)	14 (4.2)	8 (2.1)	15 (2.4)
Total	394 (100)	334 (100)	380 (100)	627 (100)

Source: DGODP, "Estadísticas del Movimiento Portuario Nacional de Carga y Buques"

Table VI-40　General Cargo Handled at the Pacific Coast Ports (Import)

(Unit: '000 t, %)

Commodity	1980	1981	1982	1983
Agricultural Products	169 (23.3)	313 (34.5)	195 (34.0)	341 (58.3)
Forest Products	41 (5.7)	33 (3.6)	10 (1.7)	7 (1.2)
Mineral Products	–	1 (0.1)	–	–
Iron and Steel	238 (32.9)	209 (23.0)	119 (20.8)	88 (15.0)
Other Metal	3 (0.4)	5 (0.6)	3 (0.5)	3 (0.5)
Machinery	118 (16.3)	222 (24.4)	127 (22.2)	82 (14.0)
Chemical Products	21 (2.9)	36 (4.0)	11 (1.9)	7 (1.2)
Fertilizer	–	–	64 (11.2)	–
Cement and Ceramic	85 (11.7)	30 (3.3)	13 (2.3)	1 (0.2)
Other Industrial Products	22 (3.0)	26 (2.9)	4 (0.7)	5 (0.9)
Other General Cargo	26 (3.3)	33 (3.6)	27 (4.7)	15 (2.4)
Total	723 (100)	908 (100)	573 (100)	549 (100)

Source: DGODP, "Estadísticas del Movimiento Portuario Nacional de Carga y Buques"

Table VI-41 Containerizable Ratio

(Unit: %)

Cargo	Export	Import
Agricultural Products	100	50
Forest Products	100	100
Mineral Products	—	—
Iron and Steel	10	10
Other Metal	50	50
Machinery	50	50
Chemical Products	100	100
Fertilizer	100	100
Cement and Ceramic	100	100
Other Industrial Products	100	100
Other General Cargo	100	100
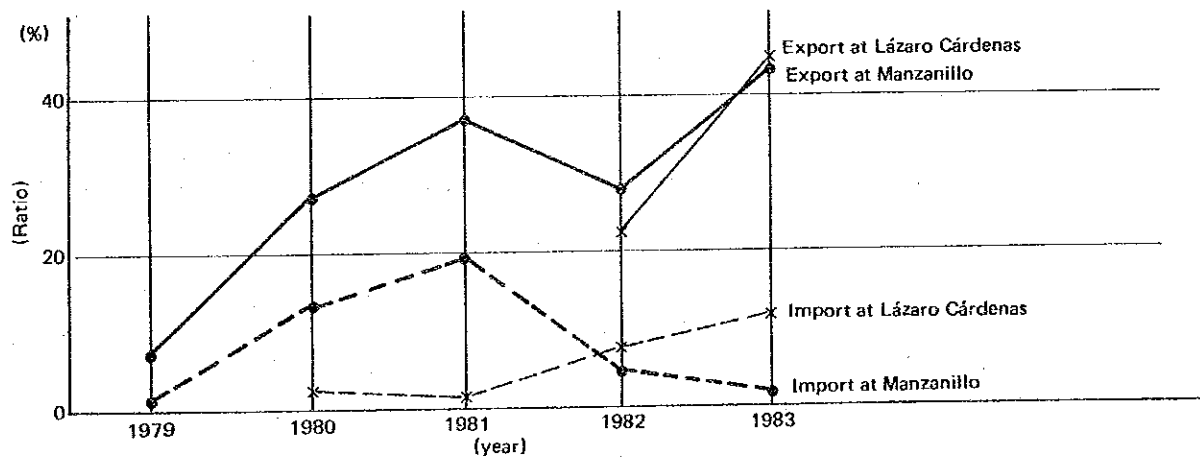
Fig. VI-31 Containerized Ratio at Manzanillo and Lazaro Cardenas Ports

Here, in estimating the containerized ratio, we will consider the ports of Manzanillo and Lázaro Cárdenas together.

Table VI-42 shows containerizable volume, already containerized volume, and the progress rate of containerization for both ports.

According a shipping company, automobile spare parts and steel plate for automobile bodies coming from Japan may be containerized in 1985.

A container service by semicontainer ship between Mexico and Japan and the Far East is being considered.

Table VI-42 Progress Rate of Containerization

| Year | Cargo Volume ('000 t) | | | | Progress Rate (%) | |
| | Containerizable | | Containerized | | | |
	Export	Import	Export	Import	Export	Import
1979	85	99	7.1	1.3	8.3	1.3
1980	73	183	19.3	24.0	26.4	13.1
1981	61	255	23.7	37.7	38.9	14.8
1982	48	185	12.3	10.3	25.6	5.6
1983	102	154	44.7	10.7	43.8	6.9

Figures VI-32(a) and VI-32(b) show the estimated curve for the progress rate of containerization for export and import cargo at the ports of Manzanillo and Lázaro Cárdenas. In these curves, the progress rate of containerization for the target years is forecast as follows:

(Year)	1990	2000
Export (%)	76	89
Import (%)	50	85

The container cargo volume at Manzanillo Port is forecast for the target years based on this progress rate as follows:

(Year)	1990	2000
Export (thousand tons)	66	141
Import (thousand tons)	124	375
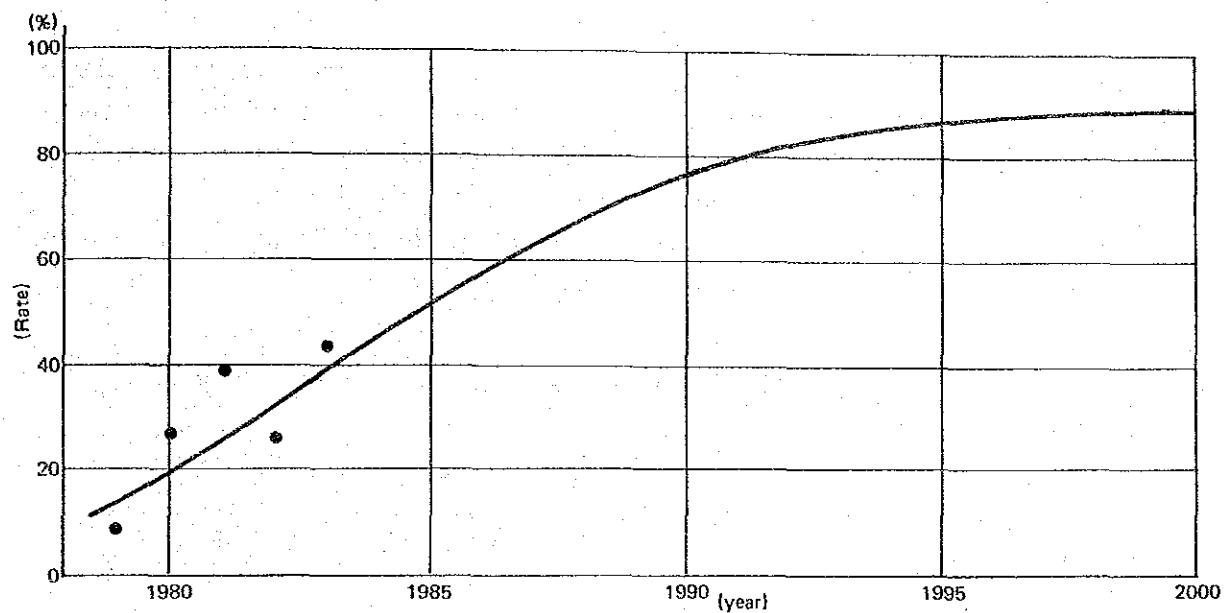
Fig. VI-32(a)   Progress Rate of Containerization (Export)
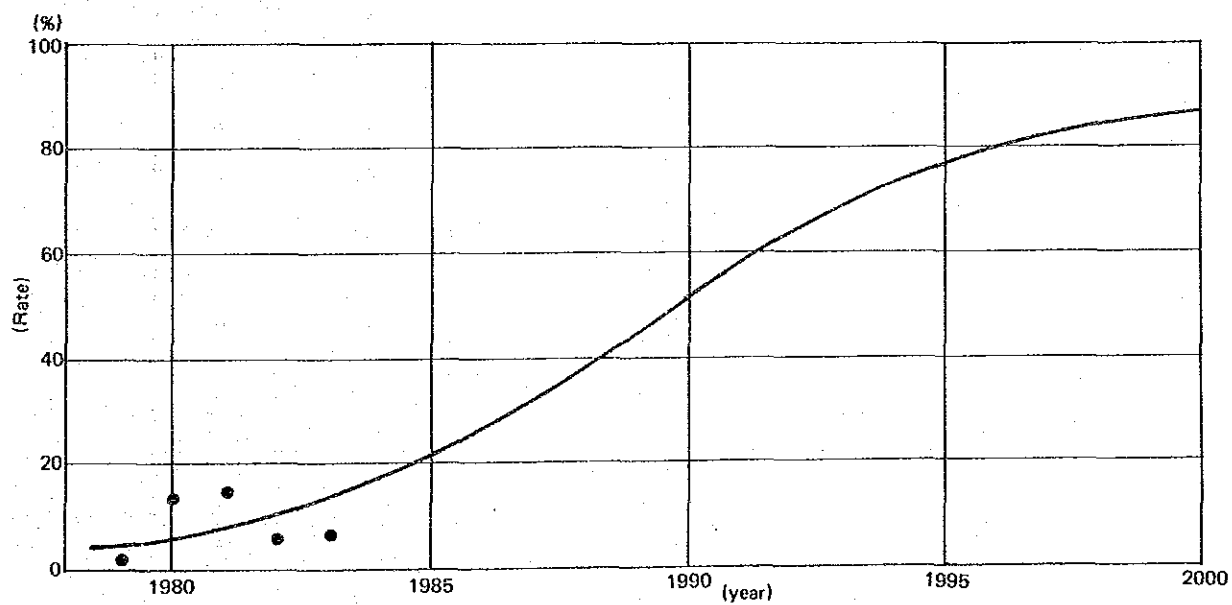
Fig. VI-32(b)   Progress Rate of Containerization (Import)

1-4　Cargo Forecast

As a conclusion, Table VI-43 shows a summary of the cargo forecasts. Furthermore, Table VI-44 is a comparison of cargo volumes obtained by the macro and micro forecast methods described in Sections 1-2 and 1-3. Although some cargoes show a big discrepancy between macro and micro forecasts, total cargo volumes seem to be within an allowable difference.

Herein, the cargo volumes handled at the port of Manzanillo for the target years will be forecast as those obtained by the micro forecast method.

Table VI-43　Cargo Forecast Summary

(Unit: '000 t)

Package Type	Trade	Commodity	Cargo Volume 1990	Cargo Volume 2000
General Cargo	Import	Rice	29	48
		Sugar	132	262
		Crude rubber	14	35
		Iron and steel	404	313
		Fertilizer	17	24
		Machinery	87	212
		Other Agriculture	49	76
		Other Industry	20	43
		Others	8	14
		Scrapped iron	60	128
	Sub-total		820	1,155
	Export	Lead	17	17
		Metallic zinc	14	15
		Chemical products	27	55
		Other Agriculture	9	13
		Other Mineral	3	5
		Other Industrial	13	27
		Cement, Glass	12	27
		Others	12	22
		Steel bar	50	106
	Sub-total		157	287
	Out	Baryta	37	39
	Total		1,014	1,481
Package Type		Non container	824	965
		Container	190	516
Agricultural Bulk	Import	Maize	387	351
		Wheat	64	83
		Sorghum	261	137
		Soybean	101	134
	Total		813	705
Mineral Bulk	Import	Fertilizer	154	220
	Export	Cement	180	383
	In	Phosphate rock	70	150
		Salt	37	66
	Out	Cement	36	77
	Total		477	896
Grand Total			2,304	3,082

Table VI-44 Comparison of Macro and Micro Cargo Forecasts

(Unit: '000 t)

Item		1983	Macro Forecast				Micro Forecast	
			Time Series		Correlation			
			1990	2000	1990	2000	1990	2000
Estimate by Total		1,091	1,784	3,609	2,066	4,014	—	—
Estimate by Package Type	General cargo	298	553	918	755	1,456	1,014	1,481
	Agricultural bulk	553	1,002	1,644	1,297	1,859	813	705
	Mineral bulk	235	230	226	172	172	477	896
	Fluid	4	31	31	31	31	—	—
	Perishable goods	1	1	1	1	1	—	—
Total		1,091	1,817	2,820	2,256	3,519	2,304	3,082

2. Fish Catch

2-1 Methodology

2-1-1 Quantity of Fish Catch in Mexico

Three different figures on fish catch in Mexico were obtained from the statistical literature.

As shown in Table VI-45, one figure is indicated as A to represent the catch quantity at the time of catching, another is indicated as B to represent landed quantity and another is indicated as C to shown registered fish catch, that is, landed quantity B minus fish catch achieved by non-registered shipping boats.

The catch was about 1,500 thousand tons in 1982 as mentioned in Chapter III and given in Table VI-45 as the A value.

Table VI-45 Quantity of Fish Catch

(Unit: t)

Item / Year	Quantity of Fish Catch		
	A	B	C
1970	—	—	254,240
1971	—	—	285,654
1972	—	—	301,890
1973	—	—	358,000
1974	—	—	389,969
1975	—	—	451,330
1976	—	—	524,684
1977	—	—	562,106
1978	818,511	703,501	623,501
1979	1,002,925	850,525	770,525
1980	1,257,146	1,058,556	953,361
1981	1,565,465	1,363,976	1,192,341
1982	1,502,300	1,285,539	1,084,491

Note:　— indicates no available data.
Source:　SPP, "10 Años de Indicadores Economicos y Sociales de México"
　　　　　"Anuario Estadístico de los Estados Unidos Méxicanos 1983"

The following forecast of fish catch in 1990 and 2000 will only deal with registered fishery for data handling convenience, so only data C in Table VI-45 will be used.

2-1-2 Forecast Method

In forecasting fish catch, first of all, the fish catch of all Mexico for the target year must be determined. There are two methods to estimate the total fish catch.

(Method-A)   The quantity of direct consumption and industrial use is estimated. Their ag-
             gregate volume is the forecast volume. In this case, the forecast volume for
             direct consumption is gained through time-series analysis and that for
             industrial use is calculated through GDP correlation analysis.

(Method-B)   The forecast volume for industrial use is calculated in the same way as in
             Method-A. The forecasting volume for direct consumption is determined
             considering estimated per-capita fish consumption as a variable factor.

On the basis of the estimated fish catch of all Mexico, the fish catch at Manzanillo Port is
then estimated considering various factors.

2-2   Fish Catch of All Mexico

2-2-1   Method-A

The annual fish catch and utilization are shown in Table VI-46.

Table VI-46   Fish Utilization

(Unit: t)

Year	Fish Catch (c)	Direct Consumption	Industrial Use
1970	254,240	201,211	53,029
1971	285,654	232,074	53,580
1972	301,890	241,786	60,104
1973	358,000	268,079	89,921
1974	389,969	259,166	130,803
1975	451,330	293,535	157,795
1976	524,684	282,355	242,329
1977	562,106	278,579	283,527
1978	623,501	319,786	303,715
1979	770,525	382,662	387,863
1980	953,361	455,605	497,756
1981	1,192,341	671,564	520,777
1982	1,084,491	516,879	567,612

Source: Same source as Table VI-45

(1) Forecast of direct consumption

Figure VI-33 shows the year-by-year change in direct consumption.
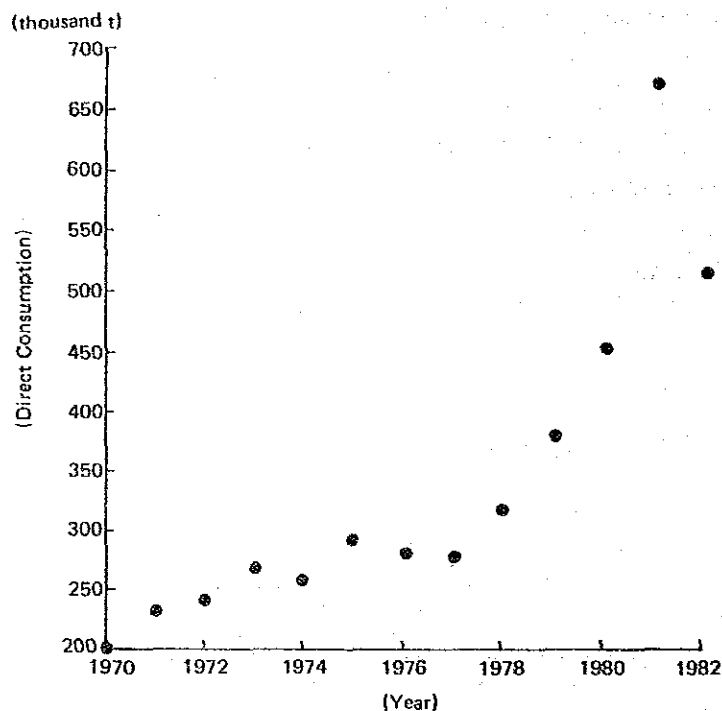
Fig. VI-33 Direct Consumption

This figure shows that direct consumption is increasing. The data for 1981 will be disposed of as an abnormal value, since there were exceptional conditions at that time as described in Chapter III.

By applying the index curve to this annual change of direct consumption, the following correlation equation is obtained:

$$\log Y = -55.3103 + 0.03078T \ (r = 0.89) \ \ldots\ldots\ldots\ldots\ldots\ldots\ldots (VI\text{-}4)$$

where   Y: Direct consumption quantity (tons)

T: Year

When the forecasting year is input into this equation, direct consumption quantity can be estimated.

(2) Forecast of industrial use quantity

Industrial use quantity is forecast in correlation with Mexico's GDP. The correlation between the past data and the GDP is shown in Fig. VI-34. The following equation of correlation is gained.

$$Y = -507,639 + 1.159X \ (r = 0.98) \ \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \ (VI-5)$$

where　Y: Industrial use quantity (tons)

　　　　X: GDP (million pesos)

By substituting the target year GDP into this equation, the industrial use quantity can be estimated.
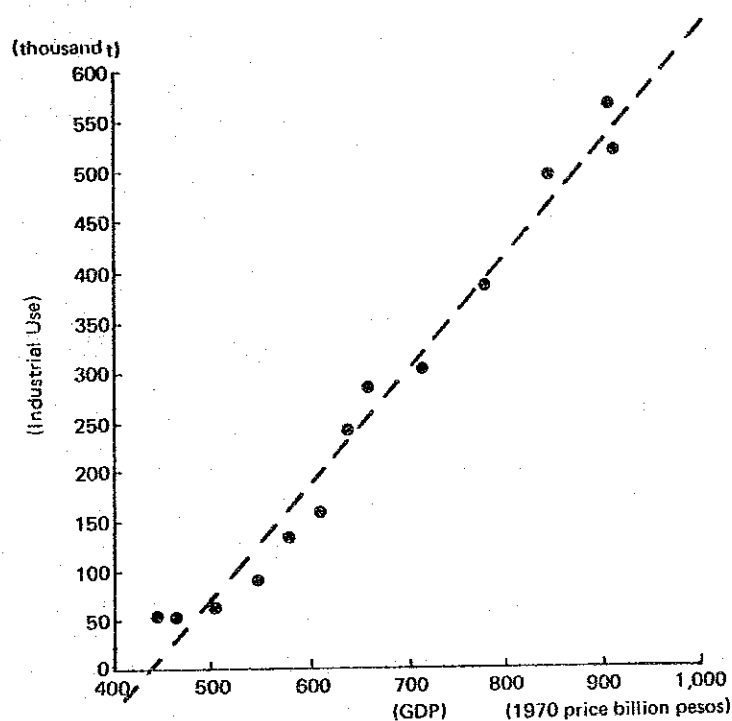
Fig. VI-34　Relation between Industrial Use and G.D.P.

(3) Forecasting results

The forecast of the entire fish catch of Mexico using Method-A is shown in Table VI-47.

Table VI-47　Forecast of Fish Catch by Method-A

(Unit: '000 t)

Year	Total	Direct Consumption	Industrial Use
1990	1,755	875	880
2000	3,760	1,780	1,980

2-2-2 Method-B

Table VI-48 shows total consumption of fish in Mexico, per capita fish consumption and per capita GDP.

Table VI-48 Fish Consumption and GDP Per Capita

Year	Direct Consumption (t)	Import (t)	Export (t)	Total Domestic Consumption (t)	Consumption per Capita (kg)	GDP per Capita (pesos)
1970	201,211	3,554	37,901	166,864	3.460	9,212
1971 232	232,074	1,038	40,146	192,966	3.460	8,823
1972	241,786	1,330	46,421	196,695	3.624	9,251
1973	268,079	1,193	42,746	226,526	4.034	9,692
1974	259,166	1,347	38,355	222,158	3.823	9,938
1975	293,535	3,670	47,552	249,653	4.151	10,142
1976	282,355	1,833	46,907	237,281	3.807	10,201
1977	278,579	1,777	51,757	228,599	3.539	10,182
1978	319,786	8,579	52,631	275,734	4.119	10,635
1979	382,662	11,205	54,542	339,325	4.891	11,201

(1) Forecast of total domestic consumption for the target year
According to Table VI-48,

① Annual growth rate of per capita fish consumption from 1970 to 1979: 3.9%

② Annual growth rate of per capita GDP from 1970 to 1979: 2.2%

For this period, the ratio of increased fish consumption per capita to increased GDP per capita works out to be 3.9%/2.2% = 1.77.

In view of the trend toward increased fish consumption, an increased ratio of 2.0 is assumed and used for future forecasting. Judging by the forecast figures of population and GDP mentioned in Chapter V, the growth in the annual GDP per capita in the period from 1979 to 2000 will be 3%.

The growth in the annual rate of fish consumption per person during the period up to the year 2000 would be:

$$\text{(per capita consumption in 1979)} \times (1.06)^n \cdots\cdots\cdots\cdots \text{(VI-6)}$$

where   n: Number of Period $2.0 \times 3\% = 6.0\%$.

Using this annual rate, the per capita fish consumption for the target year can be obtained from the following equation:

Accordingly, by multiplying the forecast per capita fish consumption by the forecast population for the target year, total consumption is determined.

(2) Forecast of direct consumption for the target year

As shown in Table VI-48, total domestic consumption and direct consumption are related as follows:

Direct consumption = Total domestic consumption + (Exports – Imports)

From the ratio of exports minus imports over total domestic consumption, direct consumption quantity can be calculated. This ratio for the past five years is given below.

1977	21.9%
1978	16.0%
1979	12.8%
1980	not available
1981	11.1%

As shown above, the rate is decreasing. However, in view of the trend towards increased exports, the ratio will not continue to decrease significantly. A rate of 10% will be used for forecasting calculations at this time.

The direct consumption quantity for the target year is:

Total domestic consumption +10% of total domestic consumption or
1.1 times the total domestic consumption estimated in (1).

(3) Forecasting results

The fish catch of all Mexico forecast using Method-B is shown in Table VI-49. As for industrial use quantity, the value forecast with Method-A is used.

Table VI-49   Forecast of Fish Catch by Method-B

(Unit: '000 t)

Year	Total	Direct Consumption	Industrial Use
1990	1,765	885	880
2000	3,910	1,930	1,980

2-2-3 Fish Catch in Mexico in 1990 and 2000

Considering the forecast results (Table VI-47, Table VI-49) obtained with Method-A and -B, the total fish catch of Mexico in 1990 and 2000 is forecast as follow Table VI-50:

Table VI-50 Forecast of Total Fish Catch of Mexico

(Unit: '000 t)

Year	Total	Direct Consumption	Industrial Use
1990	1,760	880	880
2000	3,900	1,920	1,980

2-3 Landing Volume at Manzanillo Port

The forecast of fish catch at Manzanillo Port in 1990 and 2000 is made based on the following ideas:

① The fish catch at Manzanillo Port is estimated as a portion of the entire fish catch of Mexico forecast above.

② First of all, we must consider what percentage of the total Mexican fish catch is currently landed at Manzanillo Port.
Colima, Jalisco and Aguascalientes State can be considered the direct consumption and distribution zone for Manzanillo Port. However, the consumption and distribution zone for fresh fish is limited due to the difficulty of retaining freshness and the dense distribution of fishing ports.

③ As for these three provinces' dependence on Manzanillo Port, 100% is presumed for Colima, and 50% for the adjoining provinces.

④ Population and GDP are used as variables.

⑤ As Colima State represents 0.50% of the national population and Jalisco and Aguascalientes have 6.27 and 0.76 of the population, respectively, the overall dependence Rate for the three states is:

$$(0.50) + 1/2 (6.27 + 0.76) \text{ or about } 4\%$$

Similar calculations for GDP also give an approximate rate of 4% as shown in Table VI-51.

Table VI-51 Dependence Rate of Manzanillo Port

(Unit: %)

State	Percent of Population	Percent of GDP	Dependence Rate		Note
			Population	GDP	
Colima	0.50	0.54	0.50	0.54	100%
Jalisco	6.27	6.52	3.13	3.26	50%
Aguascalientes	0.76	0.61	0.38	0.30	50%
Total	7.53	7.67	4.01	4.1	

⑥ When this dependence rate is multiplied by the forecast value for each year, the forecast fish catch at Manzanillo Port in 1990 and 2000 is determined.

Since direct consumption depends on population in no small measure, the population dependence rate of 4% is used to forecast the direct consumption quantity and the remainder is presumed to be the quantity for industrial use.

In conclusion, the fish catch at Manzanillo Port in 1990 and 2000 is forecast as shown in Table VI-52.

Table VI-52 Forecast of Fish Catch at Manzanillo Port

(Unit: '000 t)

Year	Total	Direct Consumption	Industrial Use
1990	70	36	34
2000	156	77	79

3. Tourists

The number of tourists visiting Colima State in 1990 and 2000 is estimated using time-series analysis. The correlation equation is as follows:

$$Y = -30,933,000 + 15,867.3T \ (r = 0.93) \quad\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots \ \text{(VI-7)}$$
$$\text{where} \quad Y: \quad \text{Number of tourists}$$
$$T: \quad \text{Year}$$

When the target years are input into this equation, the number of tourists to Colima State can be estimated as shown in Table VI-53.

Table VI-53   Forecast of Tourists of Colima State

(Unit: '000 persons)

Year	Number of Tourists
1990	640
2000	800

The percent of tourists visiting Colima State who will come to the Manzanillo region will be 50 ~ 70% in the future, judging from the present situation of tourist activities described in Chapter III.

Assuming that the percent of tourists who will come to the Manzanillo region to the total number of tourists visiting Colima State will be 50% in 1990 and 60% in 2000, the number of tourists who will visit the Manzanillo region in 1990 and 2000 are forecast as follows:

1990:   320 thousand persons
2000:   480 thousand persons

Tourists visit the Manzanillo region with various purposes including sightseeing, cruising, fishing, swimming and the like. The number of these tourists who will engage in coastal sports and leisure activities should be estimated. However, sufficient data can not be obtained for such a forecast. So, as for the ratio of tourists engaging in coastal leisure activities to the total number of tourists visiting the Manzanillo region, a 50% rate is assumed.

Accordingly, the number of tourists estimated to take part in coastal leisure activities in Manzanillo region in 1990 and 2000 are:

1990:   160 thousand persons
2000:   240 thousand persons

CHAPTER VII. MASTER PLAN

CHAPTER VII MASTER PLAN

1. Land Use

1-1 Planning Concepts

Proposed land use is divided into four categories: port, industry, tourism and other. The area is divided into two main regions, the outer port and the inner port. The functions of each region are:

Outer Port   Port (Touristic port), Tourism, and Others

Inner Port   Port (Commercial port, Fishery port), Industry, and Others

To support these functions, each port will need the following facilities:

Outer Port
- Touristic port : Passenger terminal and Shopping center
- Tourism : Leisure facilities, Marina
- Others : Roads, Terminal for buses and taxies, Parking lot, Promenade

Inner Port
- Port : Commercial port, Fishery port, Future expansion zone
- Industry : Factories
- Others : Roads, Railways, Marshalling yard, Green zone

1-2 Industrial Location

The industries to be located in the industrial zone around the port of Manzanillo will be selected in accordance with the following procedure.

① Reviewing the advantages of industrial location around Manzanillo

② Reviewing the primary products around Manzanillo

③ Reviewing the Specially Favored Industries in the National Program

④ Considering the criteria for selecting industrial firms

⑤ Selecting industrial firms which meet the criteria well

1-2-1 Advantages and Disadvantages of Industrial Location

The attractive conditions for industrial location in the area are as follows:

① Location on the Pacific coast from which trade with the west coast of U.S.A. and

Asian continent are convenient

② Proximity to Guadalajara which has the second largest population and is well connected with Mexico City with the largest population and greatest concentration of industries

③ Railway to central Mexico and roads which are in good condition including four lane highway (Manzanillo ~ Colima ~ Guadalajara) which is under construction

④ Sufficient electric power

Next, the disadvantageous conditions for industrial location are as follows:

① Need to coexist with touristic activities

② Need to coexist with the natural reserve Garzas Lagoon and not pollute the environment (especially air and water)

③ Being unable to use much water because the supply of potable water is limited

④ Limited available land

1-2-2 Primary Products

Primary products around Manzanillo are as follows:

① Agricultural products
   - Grain: Maize, Sesame, Rice, Sugar Cane
   - Fruit: Coconut, Lemon, Banana

② Stock raising products
   - Beef, Pork, Milk, Honey

③ Marine products
   - Tune

④ Mineral products
   - Salt, Iron pellets

1-2-3 Specially Favored Industries

Manzanillo is designated as a "Centros Metrices de Impulso Industrial Selectivo" (as shown in Fig. VII-1) in the "Programa Nacional de Fomento Industrial y Comercio Exterior 1984~ 1988" based on the "Plan Nacional de Desarrollo 1983~1988", which designates "Patron Indicativo de Especializacion" as follows:

① Preparation of fruits and vegetables

② Milling of maize

③ Production of honey

④　Sugar

⑤　Oil and edible grease

⑥　Preparation and packing of fish and shellfish

⑦　Other food

⑧　Pharmaceutical chemicals

⑨　Soap, detergents and cosmetics

⑩　Glass and glass products

⑪　Basic steel and iron industries

⑫　Basic nonferrous metals industries

⑬　Other manufacturing industries

1-2-4 Criteria for Selecting Industrial Firms

The following criteria for selecting industrial firms can be considered:

①　Industries which produce and process goods capable of utilizing the port for foreign trade

②　Industries which produce goods necessary to support the hinterland

③　Industries which produce and process products which utilize local resources and products

④　Industries which support the production of local resources and products

⑤　Industries which are selected as Specially Favored Industries in PNFICE*

⑥　Industries which are oriented towards the port and coastal area

1-2-5 Selections of Industries

49 kinds of industries are listed in Table VII-1, and checked according to the above six criteria.

In this list, the industries which meet more than four criteria are:
① Seafood products, ② Maize flour, ③ Vegetable oils and fats, ④ Sugar products and honey, ⑤ Soaps and detergents. Here, Maize flour, Vegetable oils and fats and Sugar products and honey are all considered as part of the food industry complex.

Then, the three selected industries are as follows:

①　Seafood products

②　Food industry complex

③　Soaps and detergents

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* PNFICE: Programa Nacional de Fomento Industrial y Comercio Exterior 1984 ~ 1988

Legend

Industrial Decetralization Center ○

Export Center ▲

Center to Promote Selected Industry ◉

Center to Promote Regional Industry ●
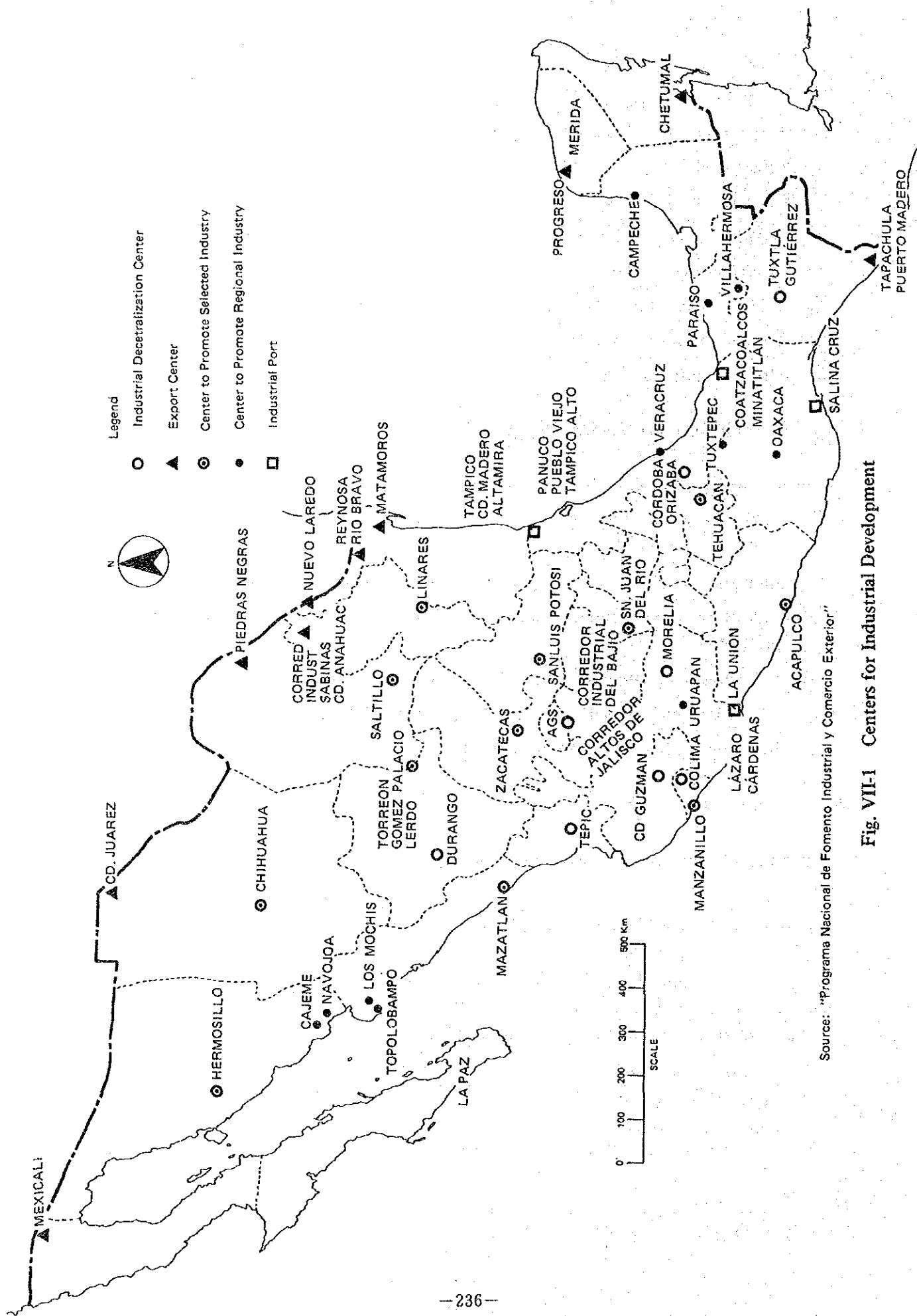
Industrial Port ☐

Fig. VII-1 Centers for Industrial Development

Source: "Programa Nacional de Fomento Industrial y Comercio Exterior"

MEXICALI

CD. JUAREZ

HERMOSILLO

CAJEME
NAVOJOA

LOS MOCHIS
TOPOLOBAMPO

LA PAZ

CHIHUAHUA

MAZATLAN

TEPIC

DURANGO

TORREON
GOMEZ PALACIO
LERDO

SALTILLO

ZACATECAS

AGS.

SANLUIS POTOSI

CORREDOR
INDUSTRIAL
DEL BAJIO

CORREDOR
ALTOS DE
JALISCO

CD GUZMAN

COLIMA

MANZANILLO

LAZARO
CARDENAS

LA UNION

URUAPAN

MORELIA

SN. JUAN
DEL RIO

ACAPULCO

PIEDRAS NEGRAS

NUEVO LAREDO

CORRED
INDUST
SABINAS
CD. ANAHUAC

REYNOSA
RIO BRAVO

MATAMOROS

LINARES

TAMPICO
CD. MADERO
ALTAMIRA

PANUCO
PUEBLO VIEJO
TAMPICO ALTO

TEHUACAN

TUXTEPEC

OAXACA

SALINA CRUZ

CORDOBA
ORIZABA

VERACRUZ

PARAISO

COATZACOALCOS
MINATITLAN

VILLAHERMOSA

TUXTLA
GUTIÉRREZ

CAMPECHE

PROGRESO

MERIDA

CHETUMAL

TAPACHULA
PUERTO MADERO

N

SCALE

0 100 200 300 400 500 Km

Table VII-1　List of Selected Industries

Industry	Capable of Utilizing the port for foreign trade	Required to support the hinterland	Utilize local resources and products	Support local production	Industries Selected in PNFICE*	Port & coastal area oriented industries	Remark
1. Seafood products	O			O	O	O	
2. Marine animal meal						O	
3. Maize flour		O		O	O	O	Food industry complex
4. Vegetable oils and fats		O		O	O	O	
5. Sugar products and honey	O	O		O	O	O	
6. Feed		O				O	
7. Agricultural chemicals		O				O	
8. Machinery and equipment for land and sea prospecting and drilling						O	
9. Valves, valvetrees, connections, etc.		O				O	
10. Motor pumps, motor compressors, etc.		O				O	
11. Tubular heaters						O	
12. Drilling, strut and processing pipes		O				O	
13. Machinery and equipment for generation, conduction, etc.		O				O	
14. Boiler injection and high volume pumps						O	
15. Machinery and equipment for the construction industry		O				O	
16. Diesel engines, tractors, etc.		O				O	
17. Motor vehicles						O	
18. Shipbuilding						O	
19. Parts and components for the shipbuilding industries						O	
20. Heavy bending, machining and welding equipment						O	
21. Industrial boilers and heat exchangers						O	
22. Soaps and detergents	O			O	O	O	
23. Paper and cardboard			O			O	
24. Fibers derived from petrochemicals						O	
25. Widely used intermediate petrochemicals						O	
26. Synthetic rubber and resins, etc.						O	

Industry	Capable of Utilizing the port for foreign trade	Required to support the hinterland	Utilize local resources and products	Support local production	Industries Selected in PNFICE*	Port & coastal area oriented industries	Remark
27. Inorganic acid and salts			O			O	
28. Glass and glass products		O			O	O	
29. pressboard and plywood		O				O	
30. General sawing						O	
31. Iron and steel	O				O	O	
32. Cement		O				O	
33. Petroleum refining						O	
34. Natural milk, cream etc.				O			
35. Processing, packing and packaging of meat				O			
36. Processing of fruits and vegetables				O			
37. Ingredients for the preparation of foodstuffs		O					
38. Machinery and equipment for food processing		O					
39. Wheeled tractors, harvesters, etc.		O					
40. Pumps, valves, connections, etc.		O					
41. Leather goods				O			
42. Cardboard, plastic and tinplate		O					
43. Equipment and instruments for medical and hospital use		O					
44. Pharmaceutical products etc.		O			O		
45. Plastic products for construction		O					
46. Bricks, roof tiles, etc.		O					
47. Cement based construction materials		O					
48. Clay, tile and porcelain bathroom facilities		O					
49. Crackers and food paste				O			

*PNFICE: Programa Nacional de Fomento Industrial y Comercio Exterior 1984 ~ 1988