

THE STUDY ON A DEVELOPMENT PLAN
FOR
PETPOCHEMICAL DOWN-STREAM INDUSTRIES
IN
THE EMPIRE OF IRAN

VOLUME I
EXECUTIVE SUMMARY

SEPTEMBER, 1978

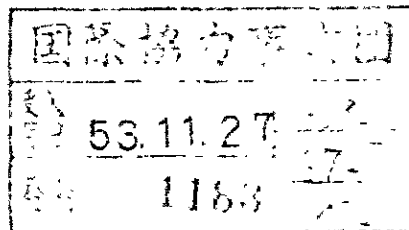
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PREFACE

In compliance with a request by the National Petrochemical Company of the Empire of Iran, the Government of Japan has decided to undertake a market survey for the development of petrochemical products in Iran, and has consigned the actual execution of the survey to the Japan International Cooperation Agency (JICA).

JICA formed a survey team consisting of 10 experts led by Mr. Takeshi Chino (Vice President of UNICO International Corporation), and the survey team visited Iran for 45 days from September 25, to November 20, 1977.

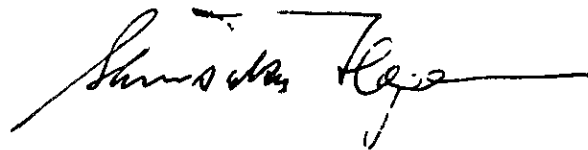
The field survey team held discussions with the National Petrochemical Company (NPC). At the same time, the team conducted market surveys in eight cities including Tehran, Isfahan, and Shiraz.

With scrutiny, survey team analyzed the data, information, and materials obtained through the survey and hereby compiled this report. In this report proposals are made concerning the market development and promotions of the processing industries for plastics and synthetic rubber (among other petrochemical products). Concerning synthetic fiber raw materials, anticipated problems are pointed out.

I sincerely hope that this report will effectively assist in the development of petrochemical products in the Empire of Iran and, at the same time, make a great contribution to the promotion of the friendly relationship between Iran and Japan.

I am deeply indebted to the members of the National Petrochemical Company who extended valuable cooperation to the execution of the field survey by the team. My deep appreciation is also expressed for the effective assistance given by the members of the Japanese Embassy in Iran, the officials of the Ministry of International Trade and Industry and the Ministry of Foreign Affairs of the Government of Japan.

SEPTEMBER 1978



Sinsaku Hogen
President
Japan International Cooperation
Agency

ABBREVIATIONS

General

C&F	Cost & Freight
FOB	Free on Board
GDP	Gross Domestic Products
GNP	Gross National Products
ROE	Return on Equity
ROI	Return on Investment
NA	Not available

Company & Organization

APC	Abadan Petrochemical Co.
ICDC	Iran Chemical Development Co.
IJPC	Iran Japan Petrochemical Co.
IRNIP	Iran Nippon Petrochemical Company
JETRO	Japan External Trade Organization
MITI	Ministry of International Trade & Industry, Japan
NIOC	National Iranian Oil Co.
NPC	National Petrochemical Co.
OPEC	Organization of Petroleum Exporting Countries

Units

ton	metric ton
lb	libra (pound)
bbl	barrel
MMBTU	million British Thermal Unit
KW	kilowatt
KWH	kilowatt hour

Plastics

ABS	Acrylonitrile-butadiene-styrene Copolymer
AS	Acrylonitrile-styrene Copolymer
DOP	Diocetyl Phthalate
EDC	Ethylene Dichloride
EVA	Ethylene-vinyl-acetate Copolymer
PE	Polyethylene
HDPE	High Density Polyethylene
LDPE	Low Density Polyethylene
PP	Polypropylene
OPP Film	Oriented PP Film
CPP Film	Cast PP Film
PS	Polystyrene
HI, HIPS	High Impact Polystyrene
GP, GPPS	General Purpose Polystyrene
FS	Foamed Polystyrene, Expandable Polystyrene
PU	Polyurethane
PVC	Polyvinyl Chloride
uPVC	Unplasticized PVC
SF	Structural Foam
VCM	Vinyl Chloride Monomer

Synthetic Rubber

BR	Butadiene Rubber
IIR	Isobutylene-isoprene Rubber
NR	Natural Rubber
SBR	Styrene Butadiene Rubber
H-SBR	High Styrene SBR
SBR-MB	SBR Master Batch
SR	Synthetic Rubber

Synthetic Fiber Raw Material

AH Salt	Nylon 66 Salt
AN	Acrylonitrile
DMT	Dimethyl Terephthalate
FY	Filament Yarn
o-Xylene	Ortho-xylene
p-Xylene	Para-xylene
SF	Staple Fiber
TPA	Terephthalic Acid
p-TPA	Pure Terephthalic Acid

TABLE OF CONTENTS

PREFACE

Execution Schedule of the Field Survey

Areal Distribution of the Survey

List of the Japanese Survey Team

I	INTRODUCTION	1
	1. Background of the Study	1
	2. Procedure of the Study	3
	3. Conclusion and Recommendations	4
II	MARKET FOR MAJOR PETROCHEMICAL PRODUCTS IN IRAN	6
	1. Plastics Materials	6
	2. Synthetic Rubber (SBR)	11
	3. Synthetic Fiber Raw Materials	12
III	THE PRESENT STATUS AND PROBLEMS OF THE PLASTICS AND SYNTHETIC RUBBER PROCESSING INDUSTRIES	15
IV	MARKET DEVELOPMENT	17
	1. Projects for the Demand Development	17
	2. The Policies for Development of the Processing Industries ..	21
	3. Actual Schedule and Project of Investment	24
V	SUGGESTED POLYMER SALES ORGANIZATION	31

LIST OF TABLES

II MARKET FOR MAJOR PETROCHEMICAL PRODUCTS IN IRAN

Table II-1	Demand and Demand Structure of Plastics Materials in Iran (1977)	8
Table II-2	Demand Prediction of Plastics Materials in Iran	9
Table II-3	Demand Forecast on Plastics Product by Cumulative Method in Iran (1980, 1985)	10
Table II-4	Demand for SBR in Iran (1976)	11
Table II-5	Demand Forecast of SBR in Iran (1977-1985)	12
Table II-6	Material-wise Textile Consumption in Iran (1976)	14
Table II-7	Forecast on Textile Consumption in Iran in 1980 and 1985	14
Table II-8	Forecast on Material-wise Synthetic Fiber Production in Iran	14

IV MARKET DEVELOPMENT

Table IV-1	Relation between Resin Price Increase and Plastics Product Price in Iran	19
Table IV-2	Relation between Product Price Increase and Demand Decrease in Japan	19
Table IV-3	Problems and Countermeasures in Plastics Processing Industry in Iran	22
Table IV-4	Current Status and Countermeasures for Development Project	25

LIST OF FIGURES

I INTRODUCTION

Figure I-1	Development of Market for Petrochemical Products and Necessity of Fostering Industry	2
------------	--	---

II MARKET FOR MAJOR PETROCHEMICAL PRODUCTS IN IRAN

Figure II-1	Trend of Plastics Material Consumption and Prices in Iran (1969~1976)	7
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IV MARKET DEVELOPMENT

Figure IV-1	Project Execution Schedule	28
-------------	----------------------------------	----

V FUNCTIONS AND ORGANIZATIONS WHICH PETROCHEMICAL ENTERPRISES SHOULD BE IN CHARGE OF FOR THE MARKET DEVELOPMENT AND FOSTERING OF THE PROCESSING INDUSTRY

Figure V-1	Suggested Polymer Sales Organization for the Domestic Market	32
Figure V-2	Outline of the Research Organization of Technical Service Laboratory and Inter-relation of Each Laboratory	33

List of Japanese Survey Team

Members	Title	Allocation of Responsibility
Mr. Takeshi CHINO (Team Leader)	Vice President UNICO International Corp.	General Management
Mr. Kikou NAGASAWA (Assistant Team Leader)	Vice President UNICO International Corp.	Synthetic fiber raw materials
Mr. Tadashi ITOH	Senior Expert UNICO International Corp.	PVC, PS
Mr. Shigeji TAKAZAWA	Senior Expert UNICO International Corp.	Synthetic rubber
Mr. Mitsuo ISHIKAWA	Manager, Petrochemical and Synthetic Fiber Dept. UNICO International Corp.	Engineering plastics
Mr. Masanobu SAKAKURA	Manager, Market Research Dept. UNICO International Corp.	Packaging materials
Mr. Koji SUGAHARA	Expert UNICO International Corp.	Polyolefins
Dr. Hirohisa SAITOH	Expert International Studies Dept. Nomura Research Institute	Development program
Mr. Masatake WADA	Assistant Director Chemical Products Div. Basic Industries Bureau Ministry of International Trade and Industry	Development plan
Mr. Yukitoshi NAGASAWA	Head, Industry Dept. Japan International Cooperation Agency	General coordination

Execution Schedule of the Field Survey

Date	T. CHINO	T. ITOH	K. SUGAWARA	M. ISHIKAWA	K. NAGASAWA	M. SAKAKURA	S. TAKAZAWA	H. SAITOH	M. WADA	Y. NAGASAWA
1 Sept. 27	Tue	Leave Tokyo (By PA 001)								
2	Wed	Arrive in Tehran: Courtesy visit to Japanese Embassy								
3	Thu	Meeting								
4	Fri									
5 Oct. 1	Sat	Kick-off Meeting at NPC office								
6	Sun	Meeting with counterparts of NPC								
7	Mon	Marubeni Iran, Mitsubishi International (Iran)								
8	Tue'	NIOC								
		C. Itoh & Co. (Iran)								
9	Wed	APC, Plasco-Kar			Aliaf-Sherkat Sahami					
		Azemayesh, Makkf			Ministry of Mining & Industry					
10	Thu	Sumitomo Trading (Iran)								
		Mitsui & Co. (Iran)								
11	Fri	Meeting								
12	Sat	Japanese Embassy			Pars Plast, Tehran Plastics, Fars Plast					
		NIOC			Shahreza Jadid Shanez Factory Simin Baresh					
13	Sun	(National holiday)								
		Tadi, Vatan Varitex, Golvash Mahoot, Parvin Nakk Tab								

Date	T. CHINO	T. ITOH	K. SUGAWARA	M. ISHIKAWA	K. NAGASAWA	M. SAKAKURA	S. TAKAZAWA	H. SAITOH	M. WADA	Y. NAGASWA
14 Oct. 10 Mon	NPC	Shahin Plastic	Derakshan	Zamyad Land Rover	Najahabad					
		Mitsui & Co. (Iran)								
		Plastiran								
15 Tue	IMDBI		Plasamco	General Ind. General Steel ARJ						
16 Wed	Chori Iran	Chori Iran		Chori Iran	Pars Carpet Iran Knitt					
	Sayaban Maher, Ebtekar				Iran Moquet Nez Nach			Leave Tokyo (By PA001)		
17 Thu	NPC	Karkhneh Varzide-Kar Pars Toshiba		Karkhneh Varzide-Kar Pars Toshiba	JETRO			Arrive in Tehran		
18 Fri	Meeting									
19 Sat	Meeting at NPC office	Honar Plastic Inter Plast Nylex	Tour Iran Ind. & Mfg.					Meeting at NPC office		
	Bazar		Bazar	Polyacryl				Bazar		
20 Sun	Wien Shoe	Shadanpur Shoe	Sasan Minaglass	NPC				Wien Shoe		NPC
21 Mon	Otafuku Iran	Doodman Viniflex Sport Shoe	Kisseh Iran Irapak Dun Roll	Iranian Textile Ind. Syndicate				Kisseh Iran Irapak Dun Roll		
22 Tue	ICDC	NPC	NPC					Setareh Shoe		IDRO
23 Wed	Viniflex	Polyvina	Vitana					General Tire		
24 Thu								Volkam		Development and Ind. Bank
25 Fri								Bridgestone		The Central Bank
										Meeting

	Date	T. CHINO	T. ITOH	K. SUCAMARA	M. ISHIKAWA	K. NAGASAWA	M. SAKAKURA	S. TAKAZAWA	H. SAITOH	M. WABA	Y. NAGASAWA
26	Oct. 22	Sat	NPC				Pars Oil Shapur Chem.	NPC			
27	23	Sun	NPC					NPC			
28	24	Mon	Mitsui & Co. NIOC (Rey)	NPC			NPC	JETRO	NPC		
29	25	Tue	NPC NIOC (Rey)	Leave Tehran							
30	26	Wed	Yachiyo	Arrive in Tokyo							
31	27	Thu									
32	28	Fri									
33	29	Sat	Japanese Embassy				Iran Dairy	Jam Shoe	IMDBI		Leave Tokyo (By PA001)
34	30	Sun	Iran National				Iran Paper	B.F. Goodrich			Arrive in Tehran Japanese Embassy
35	31	Mon	IRNIP IJPC				Moheb Harim Packing Esfahan PVC	IRNIP IJPC	Moheb Harim Packing Esfahan PVC	IRNIP IJPC	Moheb Harim Packing Esfahan PVC
36	Nov. 1	Tue	(Lv. Abadan) (Av. at Shiraz)				(Lv. Isfahan) (Av. at Tehran)	(Lv. Abadan) (Av. at Shiraz)	(Lv. Isfahan) (Av. at Tehran)	(Lv. Abadan) (Av. at Shiraz)	(Lv. Isfahan) (Av. at Tehran)
37	2	Wed	Bridgeston Iran Fayla Shiraz Plastic				Paxan Iran Milk Ministry of Agriculture	Bridgeston Iran Fayla Shiraz Plastic	NPC	Bridgeston Iran Fayla Shiraz Plastic	NPC
38	3	Thu	Meeting								Meeting Saveh Industrial Estate

	Date	T. CHINO	T. ITOH	K. SUGAWARA	M. ISHIKAWA	K. NAGASAWA	M. SAKAKURA	S. TAKAZAWA	H. SAITOH	M. WADA	Y. NAGASAWA						
39	Nov. 4	Fri Meeting	Meeting														
40	5	Sat IDRO NPC															
41	6	Sun NPC															
42	7	Mon IEM Japanese Embassy NPC										(Preparation of Interim Report)		NPC		Japanese Embassy NPC	
43	8	Tue Final meeting with NPC															
44	9	Wed Leave Tehran										Final meeting with NPC		NPC		Leave Tehran	
45	10	Thu Arrive in Tokyo															

Areal Distribution of the Survey

		CHINO	ITOH	SUGAWARA	ISHIKAWA	K. NAGASAWA	SAKAKURA	TAKAZAWA	SAITOH	WADA	Y. NAGASAWA
1	Sept. 27			Lv. Tokyo							
2	28			Av. Tehran							
3	29										
4	30										
5	Oct. 1										
6	2										
7	3										
8	4			Tehran							
9	5										
10	6										
11	7										
12	8										
13	9										
14	10										
15	11										
16	12										
17	13		Rasht		Rasht						
18	14										
19	15			Qom							
20	16										
21	17			Qazvin							
22	18										
23	19	Qazvin									
24	20										
25	21										
26	22										
27	23										
28	24										
29	25			Lv. Tehran							
30	26			Av. Tokyo							
31	27										
32	28										
33	29										
34	30										
35	31	Abadan									
36	Nov. 1										
37	2	Shiraz									
38	3										
39	4										
40	5										
41	6										
42	7										
43	8										
44	9	Lv. Tehran									
45	10	Av. Tokyo									

I INTRODUCTION

1. Background of the Study

Fig. I-1-1 shows the background of the necessity for the development of domestic markets for petrochemical products and the urgency of development of plastics and synthetic rubber processing industries for Iran.

It is highly possible that the Middle and Near East countries will gradually expand their production share in the world in order to meet the growing demand for ethylene. The Middle and Near East countries can easily obtain natural gas $C_2 - C_3$ which is not used effectively at present as a raw material and investment for the construction of petrochemical industries.

However, with the overall stagnation of the world economy, the market for petrochemical products has also been reduced, thereby causing low operational rate and compelling low-price selling. Therefore, the reasonable profit is not at present secured for the operation even for the plant constructed before Oil Crisis. This trend is particularly conspicuous in the exportation of the petrochemical products. It is further expected that this situation will persist for some time to come.

Particularly in the case of the petrochemical industry in the oil producing countries, the fixed cost portion in the total production cost is extremely high¹⁾, thereby making the fall of the operational rate almost vital to the overall production activities²⁾. This therefore implies the extreme importance of the development of domestic market outlets for the products.

When compared to other oil producing countries of the world today, Iran has a much greater population and larger scale of national economy, so that the size of the potential domestic market is accordingly high.

Note 1) Because of the following reasons, the fixed cost portion in the Iranian operation is rather high:

- (1) The necessary coverage for plant and facility investment in Iran is quite broad, thereby increasing the construction cost.
- (2) Main production facilities are imported.
- (3) Because of shortage in staffs for construction works, foreigner staffs should be employed.
- (4) The plant cost since 1973 has increased by more than two-fold.

2) Appendix II

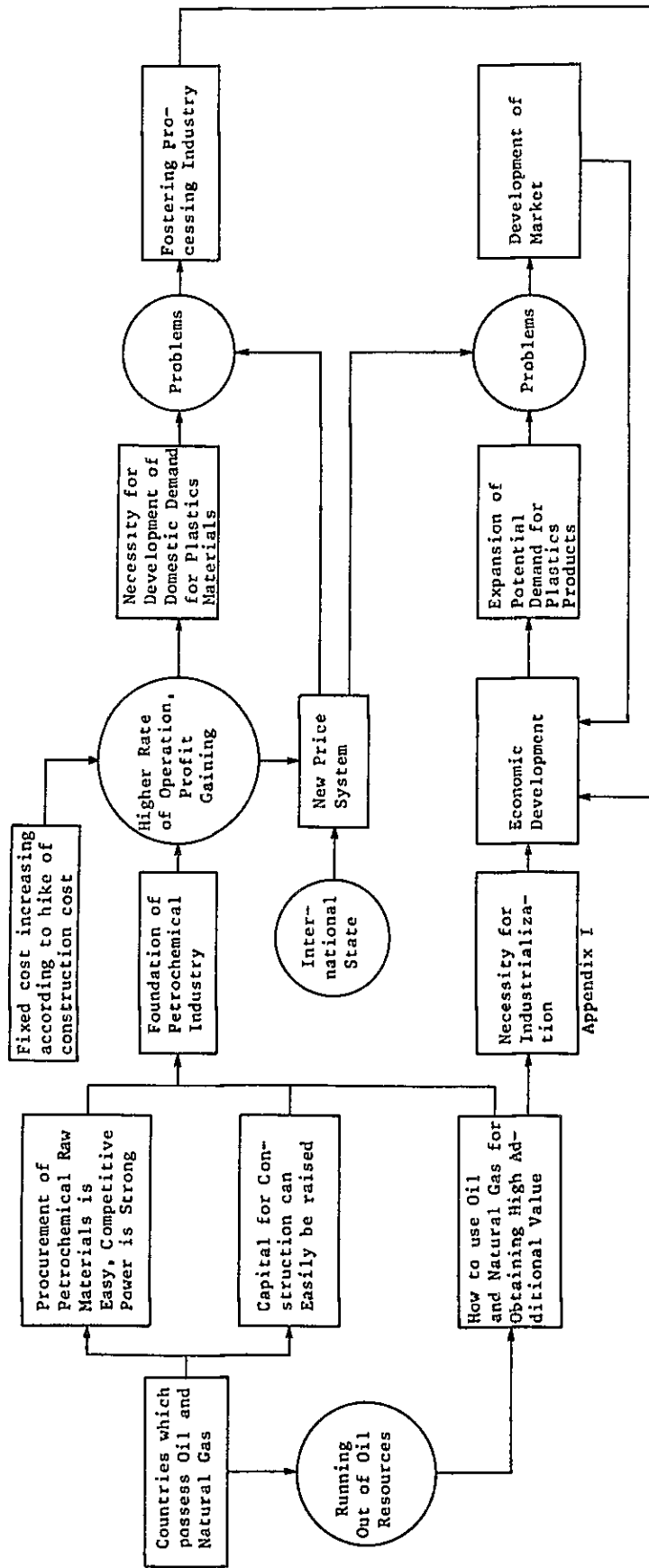


Fig. I-1 Development of Market for Petrochemical Products and Necessity of Fostering Industry

Generally speaking, the plastics and synthetic rubber processing industries are almost naturally created and developed based on the production of consumable goods which had been imported. In order to take off this stage of development and form a fullfledged industry including production of industrial goods, the participation of industrial capital into the operation will be necessary. Also, the governmental administration for implementing the preparation of industrial standards, the guidance for rationalization, financial provisions, etc. will become imperative.

The plastics and synthetic rubber processing industries are mechanized and modern industries. By fostering these industries, modernization of the industrial structure is to be promoted. Fostering the processing industry also accelerates development of its supporting industries such as machine industry, mold making industry, and industries for auxiliary materials such as coloring agent, blending agent, etc.

2. Procedure of the Study

The study is composed of the following three parts:

- (1) Field survey
- (2) Demand forecast
- (3) Recommendations

Concerning the plastics and synthetic rubber industries, the Survey Team visited about 50 companies among about 130 processors on the list of the National Petrochemical Company and studied their activities and existing problems.

The field survey covered eight cities such as Isfahan, Shiraz and Rasht as well as Tehran and industrial estates (Qazvin, Qom and Saveh) surrounding it.

In forecasting the demand, the Team used the macroscopic analysis together with the cumulative method by application. In forecasting by the cumulative method, the Team also made a survey on the end-users of plastics and synthetic rubber products.

Taking the existing problems into consideration, which were found in the field survey, some recommendations were given concerning necessary measures to be taken for demand development and for fostering of the processing industries.

Concerning synthetic fiber raw materials, because of the limited time allocated to the survey, we could only make preliminary studies on the existing domestic demand in order to forecast the future demand and point out existing problems.

3. Conclusion and Recommendations

(1) Plastics and synthetic rubber processing industries

In Iran, demand for plastics and synthetic rubber products is just beginning to surface. In general, those products are not fully utilized as industrial materials. Likewise, the idea of quality control is not prevalent, and productivity is not always high in the processing industries except for some cases. It is also pointed out that as there tends to be a sellers' market concerning these products, there is not much incentive for expanding demand and developing new products.

Potential demand for plastics and synthetic rubber is considerable because consumption will increase with the development of the Iranian economy which will necessarily bring about the development of new areas of demand. According to the estimates of our Survey Team, 50 to 60% of IJPC polymerization products¹⁾ will be consumed domestically in 1980 and 100% in 1985, if the processing industries are properly fostered.

However, the cultivation of new areas of demand can be carried out only with much effort. Petrochemical company should cooperate with downstream enterprises in the development of new demand. In order to foster the growth of processing industries, which are direct users of petrochemical products, incentives should be given to investments in processing industries, which include investments in completely new facilities as well as investments for expansion of existing facilities. It is also necessary for the petrochemical enterprise

Note 1) Production Scheme of IJPC
(Unit: 1,000 tons/year)

LPG	1910
CaOH (100%)	262
Ethylene	(332)
EDC	(294) 170
VCM	150
LDPE	100
HDPE	60
Propylene	(114) 56
PP	50
Butadiene	(25)
SBR	40
Benzene	351
m-Xylene	144
Steam cracked	-
Naphtha	71

Source: IJPC

to give useful advices to members of downstream industries on management and technology.

(2) Synthetic fiber raw materials

Concerning materials for synthetic fiber production, it is estimated that the volume of demand will reach an economical level for production in 1985. It is desirable to make future investigations²⁾ in this area to assess the possibilities for investment in an enterprise.

Note 2): Following studies are necessary for the feasibility study of Synthetic fiber raw materials:

- (a) Survey on the availability of the raw materials
- (b) Formulation of the production manufacturing schemes for the synthetic fiber raw material manufacturing plants
- (c) Market survey
- (d) Evaluation of the economic viability of the products to be produced
- (e) Formulation of project schedule

II MARKET FOR MAJOR PETROCHEMICAL PRODUCTS IN IRAN

1. Plastics Materials

As Fig. II-1 shows, demand for the main plastics materials in Iran is generally on the uptrend, except in the year 1974 just after the Oil Crisis.

Table II-1 shows the structure of demand and it can be seen that each item is demanded for specific fields, namely, LDPE for general packaging films, HDPE for injection molding, PP for woven bags, PS for daily necessities, and AS and ABS for home electric appliance parts. Other than these, most applications have yet to be fully developed.1)

As PVC has rather long been produced domestically, the field of its demand has a better variety than the other plastic materials. However, the main applications of PVC are still limited for pipes, footwears, and electric wires.

Here, pipes are used only for plumbing at houses and buildings, and for irrigation. Pipes are not used for a waterwork system at all.

According to the macroscopic elasticity analysis of each plastic material on the basis of the data of the last seven years, it can be seen that the price elasticity of each material is pretty high, but GDP elasticity is relatively low, reflecting the structure of GDP in an oil producing country. Taking these conditions and the future development of Iranian industrialization into consideration, we undertook macroscopic forecasting, the result of which is shown in Table II-2. The result of the forecast coincide with the result of a cross-section analysis based on the relation between per capita GDP and the amount of consumption of plastic materials in all the nations of the world.

Table II-3 shows the result of forecasting by the cumulative method of each application, such as agricultural materials, packaging materials, and civil construction and building materials, which are thought to become important areas of use in Iran.

Note 1): Most of the following items are imported:

Laminated products, electric wire and cable which are made from LDPE, blow bottles made from HDPE, injection molded articles and films made from PP, machine parts and car parts of styrene polymers.

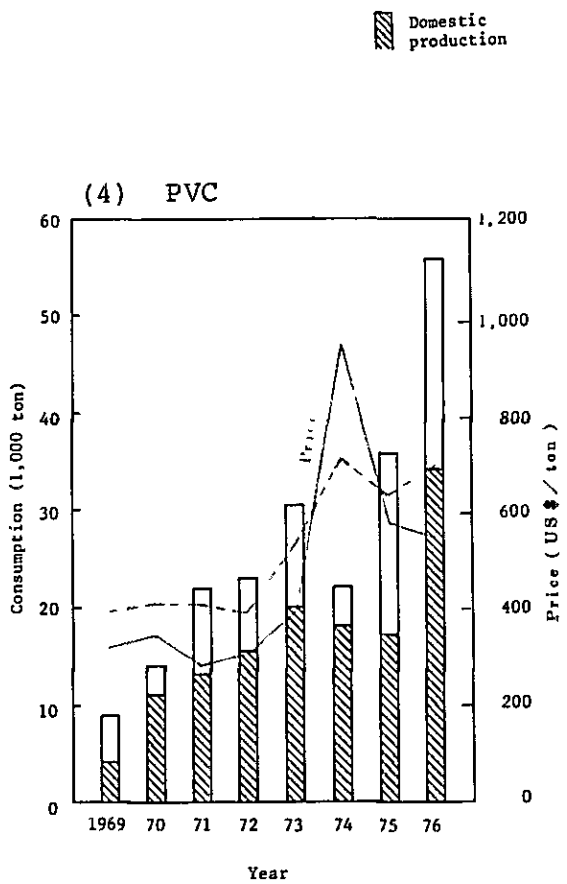
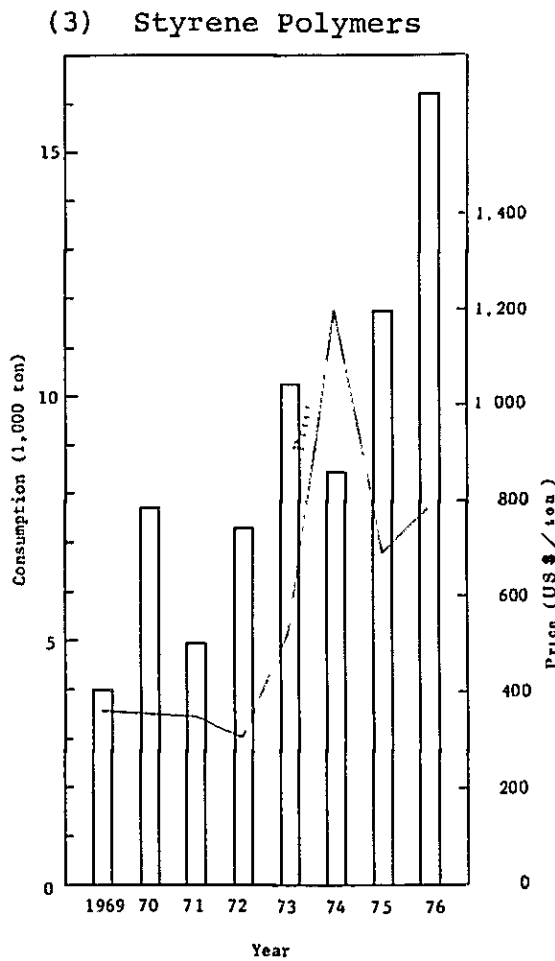
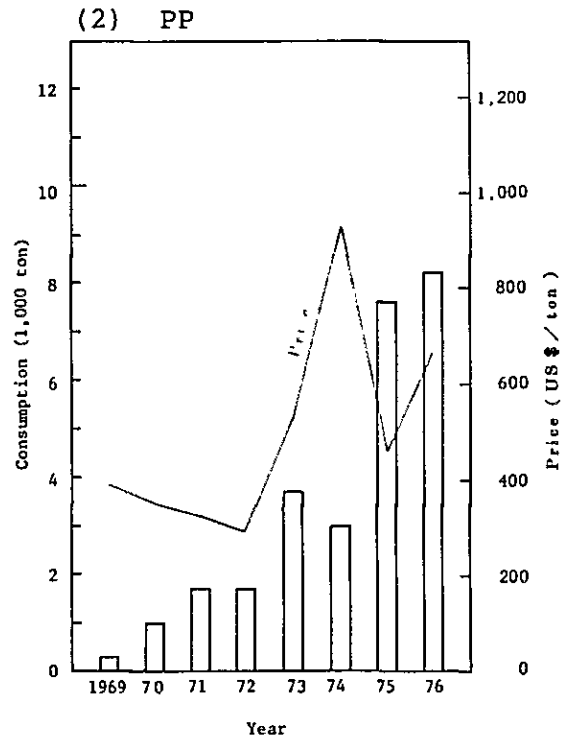
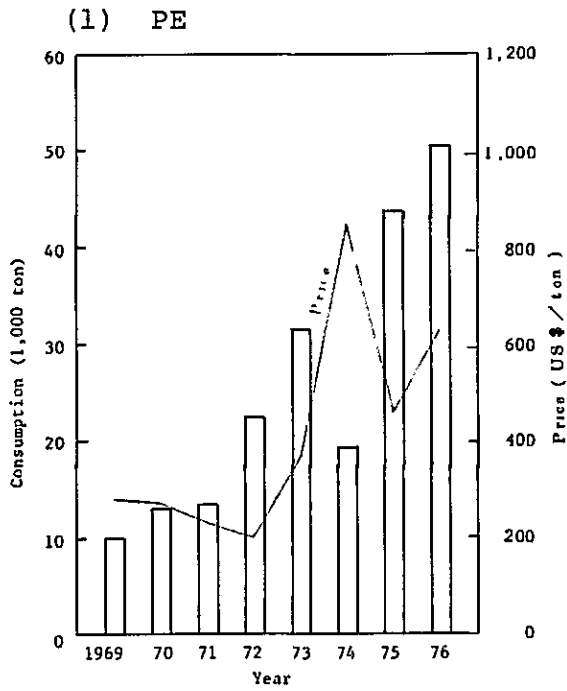


Fig. II-1 Trend of Plastics Material Consumption in Iran (1969-1976)

Table II-1 Demand of Plastics Materials in Iran (1977)

(1) LDPE			(2) HDPE		
Application	Demand (ton)	Composition (%)	Application	Demand (ton)	Composition (%)
Film	32,000	71	Film	2,300	12
Injection	7,200	16	Injection	12,800	63
Blow	2,300	5	Blow	2,600	13
Others	3,500	8	Others	2,300	12
Total	45,000	100	Total	20,000	100

(3) PP			(4) PVC		
Application	Demand (ton)	Composition (%)	Application	Demand (ton)	Composition (%)
Film	1,100	7	Pipe & Joint	24,000	37
Woven Bag	10,000	64	Sheet, Tile	6,500	10
Injection	3,100	20	Leather, Sheet	11,000	17
Others	1,400	9	Shoes	10,700	16
Total	15,600	100	Wire & Cable	7,700	12
			Hose	2,100	3
			Others	3,000	5
			Total	65,000	100

(5) PS (GP, HI & FS)			(6) AS & ABS		
Application	Demand (ton)	Composition (%)	Application	Demand (ton)	Composition (%)
Equipment	6,500	38	Electric Appliance	4,490	100
Household Ware	8,500	50	Total	4,490	100
Packaging	1,700	10			
Others	300	2			
Total	17,000	100			

Source: The Survey Team

Table II-2 Demand Prediction of Plastics
Materials in Iran

(Unit: 1,000 ton)

Material	Method	1980	1985
PE	Cross-section	100 ~ 109	136 ~ 151
	Elasticity	82 ~ 93	113 ~ 149
	Cumulative	87	150
PP	Cross-section	23 ~ 25	32 ~ 36
	Elasticity	23 ~ 27	39 ~ 53
	Cumulative	25	48
PS	Cross-section	27 ~ 29	38 ~ 41
	Elasticity	24 ~ 26	32 ~ 38
	Cumulative	31	57
PVC	Cross-section	80 ~ 88	111 ~ 125
	Elasticity	69 ~ 98	79 ~ 152
	Cumulative	90	146

Source: The Survey Team

Notes: Cross-section: International cross-section analysis
Elasticity: Elasticity analysis with GDP and price as variables
Cumulative: Cumulative prediction by application

Table II-3 Demand Forecast on Plastics Product by Cumulative Method in Iran (1980, 1985)

(Unit: ton)

	1977 (Actuals)	1980	1985
Irrigation and Underdrainage Pipe	9,000	14,400	31,500
Conduit Pipe inside Building	10,000	12,000	15,200
Indoor Drainage Pipe*	0	5,500	12,800
Water Supply Pipe and Outdoor Drainage Pipe	3,000	4,600	9,200
Hot Water Pipe	0	500	900
Cable Conduit Pipe (Corrugated)	0	0	200
Pipe for Natural Gas	0	0	2,000
Floor Tile	1,700	3,400	7,100
Floor Rugs and Carpets (Moquette) (10 ⁶ m ²)	4.0	4.3	5.0
Low-tension Electric Wire	7,700	12,000	20,000
High-tension Cable	0		
Telecommunication Cable*	0		
Packaging Film for General-use	33,000	39,300	52,600
CPP, OPP, Lamination Film	0	5,700	23,400
Woven Bag for Agricultural Products	10,000	12,600	17,800
Woven Bag for Fertilizer and Others	0	14,500	14,500
Bottle Crate	2,230	2,690	8,280
Grate for Agricultural Products	1,400	1,700	2,200
Create for Industrial-use	0	0	500
Agricultural Film	0	500	1,000
Blow Bottle for Shampoo	1,500	1,700	2,200
Blow Bottle for Liquid Detergent	200	300	660
Blow Bottle for Milk	1,000	1,200	1,500
Blow Bottle for Kerosene, Lubricant	600	800	1,300
Pallet*	0	0	20,000
Cold Container*	0	0	800
PVC Corrugated Sheet	200	300	500
Nets*	0	0	0
Parts for Automobiles	0	0	3,400
Parts for Electric Appliances	8,900	16,500	28,600

Note: * It is told that substantial amount of the products was produced in 1977, however, the quantities could not be confirmed by the Survey Team.

2. Synthetic Rubber (SBR)

Domestic demand for SBR in Iran is concentrated on the areas of tire and footwears. Industrial items such as conveyor belts are not yet produced domestically.

The amount of demand for tire products in Iran is estimated to be about 90,000 tons in 1976, for which a production of 16,200 tons of SBR is necessary. This amount and the amount of SBR which is used for footwears, plus the imported industrial parts add up to 22,100 tons, the total volume of demand for SBR, which is shown in Table II-4. Of the total amount, the portion of SBR which is actually consumed domestically is estimated to reach 12,500 tons.

Table II-4 Demand of SBR in Iran (1976)

		(Unit: ton)
SBR Consumed in Iran	Tire	8,900
	Footwear and Others	3,600
	Sub-total	12,500
SBR in Imported Products	Tire	8,100
	Industrial Products	1,500
	Sub-total	9,600
Grand Total		22,100
Total		
	Tire	17,000 (77%)
	Others	5,100 (23%)

Source: The Survey Team

The future demand of SBR for tire products, footwears and industrial articles is estimated to be 37,000 tons in 1980 and 62,000 tons in 1985. As tire products take up the largest share, the amount of domestic consumption of SBR depends on the rate of domestic production of tires. On the assumption that the rate of domestic production of tires is 60%, the amount of consumption of SBR is estimated to be 26,000 tons in 1980 and 37,000 tons in 1985. Table II-5 shows demand forecast for SBR.

Table II-5 Demand Forecast of SBR in Iran (1977~1985)

	1977	1978	1979	1980	1981	1982	1983	1984	1985
(1) Weight of necessary tires	103.0	119.0	138.0	160.0	178.0	199.0	224.0	251.0	282.0
(2) Necessary SBR for (1)	18.5	21.4	24.8	28.8	32.0	35.0	40.3	45.2	50.1
		(1) x 18%					(1) x 18%		
(3) Production forecast by the four tire manufacturing companies	48.0	70.0	85.0	95.0	115.0	120.0	140.0	145.0	160.0
(4) SBR demand by the four companies	8.6	12.6	15.3	17.1	18.4	19.2	22.4	23.2	25.6
		(3) x 18%					(3) x 16%		
(5) SBR demand for motor-cycles and others	0.9	1.54	1.7	1.9	2.0	2.3	2.5	2.7	3.0
(6) SBR demand for footwear and footwear industries products	3.6 { ^{3.2} _{0.4}	3.6 { ^{3.2} _{0.4}	6.3 { ^{3.2} _{3.1}	6.6 { ^{3.2} _{3.4}	7.0 { ^{3.2} _{3.4}	7.3 { ^{3.2} _{4.1}	7.7 { ^{3.2} _{4.5}	8.2 { ^{3.2} _{5.0}	8.7 { ^{3.2} _{5.5}
(7) Total SBR demand (2) + (5) + (6)	23.0	26.5	32.8	37.3	41.0	44.6	50.5	56.1	61.8
(8) Domestic consumption of SBR (4) + (5) + (6)	13.1	17.7	23.3	25.6	27.4	28.8	32.6	34.1	37.3

3. Synthetic Fiber Raw Materials

Total amount of consumption of fiber in Iran is estimated to be 240,000 tons in 1976, and per capita consumption of 7 kg/year. Of the total amount, 76,000 tons is synthetic fiber, a percentage share of 32%. Of the total synthetic fiber consumption, the share of nylon is 37%, polyester 26%, and acryl 37% (Table II-6).

It is estimated that in 1985, the total demand for fiber in Iran will be about 490,000 tons and per capita consumption will be 11 kg/year. The share of synthetic fiber will be about 45%, which, in absolute amount, will be 220,000 tons consisting of nylon at 59,000 tons, polyester at 79,000 tons and acryl at 81,000 tons (Table II-7).

Taking the plans for the investments of synthetic fiber producers and the production capacity of domestic synthetic fiber processors into consideration, it is estimated that the amount of production of each synthetic fiber in 1985. According to the estimates, nylon will be 39,000 tons, polyester 60,000 tons, and acryl 57,000 tons (Table II-8). The amounts of raw materials necessary to produce the amount of synthetic fiber stated above, are shown below:

	(Unit: ton/year)
DMT/TPA	56,000
(As TPA)	
Caprolactam	41,000
Acrylonitrile	51,000
Ethylene glycol	22,000
(Ethylene oxide	18,000)

Comparing the amounts of domestic demand for the materials mentioned above and the scale of plants known at the present time, these raw materials are deemed to be produced in a minimum economic scale except for ethylene glycol.

Concerning basic raw materials, xylene, benzene, propylene, and ammonia will become available when the production operation of IJPC is started. (If propylene is used for the plans of DOP and others, it will be in short supply.) Benzene and xylene will be adequately supplied within the capacity of IJPC, and all the products at Abadan Aromatic Project will have to be exported.

Table II-6 Material-wise Textile Consumption in Iran (1976)

	Quantity (ton/year)	Ratio (%)	
Cotton	94,000	39	} 47
Wool, Other Natural Fibers	20,000	8	
Regenerated FY	10,000	4	} 21
Regenerated SF	40,000	17	
Nylon FY	28,000	12	37
Polyester FY	10,000	4	13
Polyester SF	10,000	44	13
Acrylic SF	28,000	12	37
Sub-Total	76,000	32	100
Total	240,000	100	

Source: The Survey Team

Table II-7 Forecast on Textile Consumption in Iran in 1980 and 1985

	Per Capita Textile Consumption (kg/year)	Total Textile Consumption (ton/year)	Average Annual Growth Rate (%) 1980/1976 1985/1976
1976	7.1	240,000	
1980	Minimum 8.6	328,000	8.1
	Medium 9.1	347,000	9.7
	Maximum 9.6	364,000	11.0
1985	Minimum 10.1	444,000	7.1
	Medium 11.1	487,000	8.2
	Maximum 12.1	532,000	9.3

Source: The Survey Team

Table II-8 Forecast on Material-wise Synthetic Fiber Production in Iran

	(Unit: 1,000 ton)		
	1976	1980	1985
Nylon FY	7.5	19.0	39.0
Polyester FY	0	12.0	30.0
Polyester SF	0	15.0	30.0
Acrylic SF	0	20.0	57.0

Source: The Survey Team

III THE PRESENT STATUS AND PROBLEMS OF THE PLASTICS AND SYNTHETIC RUBBER PROCESSING INDUSTRIES

It is believed that there are 300 - 400 plastics and synthetic rubber processing companies in Iran now. However, the majority of these companies are very small, with exception of about twenty enterprises, such as large diversified plastics processing companies, shoe manufacturers, and automobile tire manufacturers, etc.

Plastics and synthetic rubber products by those small-scale processors tend to concentrate to the products manufactured by rather simple and easier technics and of higher profit. Foreign material suppliers and machine makers used to contribute to the development and technology transfer for those products.¹⁾

Due to the lower reliability in quality and delivery, there are several end-users such as makers for electric appliances and soft drinks which are self supplying their necessary plastics products.

Though most of processing facilities were imported from West Europe, generally productivity is not deemed to be high, as rationalization has not become popular.

Plastics industries have a basic tendency to develop in the area where its products are consumed, so that in the past plastics industries in Iran have been developed in the vicinities of large cities which have a high demand, such as Tehran or Isfahan. As a matter of fact, the majority of large scale industries are located in the vicinity of Tehran.

On the other hand, in the area surrounding a big city, a regulation on factory construction has been enforced (the area within 120km of Tehran, 50km of Isfahan). Because of this legal regulation, almost all plastic and synthetic rubber processing industries in these areas are limited in their investment for new facilities.²⁾ Therefore most of their facilities are now very old, so that production efficiency is not very high.

Note 1): Some large-scale enterprises introduce processing technology from the U.S.A. and West European Countries.

2): Replacement of old facilities and equipment is permitted recently on condition that production capacity is not expanded.

At the same time, new industrial areas, such as in Qazvin and Qom have been attracting industries during the past several years. However, in Qazvin, for example, there are already shortages of labor and electricity. Many industries are hesitating to locate their factories in these new industrial areas, because the infrastructure in these areas, such as welfare facilities for laborers, is poor and underdeveloped.

The following points are the problems in the future of the plastics and synthetic rubber processing industries in Iran.

(1) The change of the price of materials

The international prices of plastics materials are now decreasing because of the world-wide economic depression, so that plastic processing industries in Iran are in rather good circumstances. However, as soon as IJPC starts its production, the higher domestic price of plastics and synthetic rubber materials in Iran will cause a new situation.³⁾

(2) It is estimated that a 250 million dollar investment in the plastics and synthetic rubber industries is necessary to expand their production to meet the future increased demand by 1985. In addition, 6,300 laborers to work in these industries will be necessary.

Note 3): The import tax of R17/kg is levied on plastics materials since March 21, 1978, which is equivalent to more than 40% of C&F price value.

IV MARKET DEVELOPMENT

1. Projects for the Demand Development

The expansion of demands for plastics and synthetic rubber can be made by the natural increase of present demands and the development of new demands.

The present demands will increase depending on the increase of consumption which is accompanied with the Iranian economical growth. However, the development of new demands can be achieved only after making all possible efforts to put the potential demands in realization.

Basic obstacles for the Iranian development of new demands for plastics and synthetic rubber are follows:

- (1) The lack of technical reliability in the consumers' feeling on the new products which are manufactured with plastics and synthetic rubber.
- (2) Poor development of the application technology of plastics and synthetic rubber products, such as the method of executing the works using pipes and plastic construction materials, automatic packaging technique using plastic films, application of plastic films for agriculture.

It is a long term project to eliminate all above obstacles. However, for the development of the Iranian petrochemical industry, all kinds of possible efforts must be made on analyzing, finding and eliminating these obstacles which prevent the potential demands in Iran from moving toward realization, as well as expanding the present demands in Iran.

The general prerequisite conditions for demand development are;

- (1) Expansion of consumption by the elevation of people's living standard is first considered. In the forecast of demands in Iran in this survey, it is assumed that the Iranian economy will develop without trouble. Also the development of the industries which consume plastics and synthetic rubber is expected.
- (2) Plastic and synthetic rubber materials should be stably supplied with a low price.

Plastic and synthetic rubber materials have a great competition in price with other materials, so that the special policy on price control must be carefully carried out.

Table IV-1 shows the relation between resin price increase and products price increase. Production cost calculation of plastics products was made based on the cost elements obtained from Iranian processors during the field survey.

General speaking, 25% increase in the material price results into about 20% increase in product price. However, in the case of blow molded bottles, as production cost includes filling cost of contents, the effect is much smaller than other products.

Table IV-2 shows the effect of price hike of products on their demands. Nine years data since 1968 to 1976 in Japan were used for analysis of price effect.

Among the products mentioned in Table IV-2, price change for plastics crate is the most effective to the change of demand. It shows that 37% decrease in demand is caused by 17% increase in product price. On the other hand, the rate of demand decrease for film is only 4% because it is quite popularized and has few competitive products.

In Japan, the U.S.A., and European countries, the petrochemical industries, that is, the suppliers of raw materials, are working on various projects to develop new demands for the products. Meanwhile, the processors' own efforts are made to expand their sales-route for their products. In Iran, in many cases, the foreign petrochemical industries give assistance to the Iranian processors for the market development, which is one of their works to expand their own market-share.

Before IJPC starts its production, the all possible domestic demands should be cultivated and kept to have a stable growth in future. For the achievement of this endeavour, the market-developing campaign must be effectively carried out in a period as short as possible. To promote this, the domestic supplier of the plastic and synthetic rubber materials in Iran is required to fulfill the specific projects shown as follows:

- (1) Projects which should be accomplished by petrochemical enterprise
 - (a) Collection of basic data on plastics products
Examples: Light and weather resistance of films for agriculture
Durability of pipes
Technical method of designing pallets and their durability
Moisture and gas permeability of the packaging films
 - (b) Collection of data on the merits of application of plastics products

Table IV-1

Relation between Resin Price
Increase and Plastics Product
Price in Iran

Mate- rial	Pro- duct	Increase Rate of Resin Price (%)	Increase Rate of Product Price (%)
PVC	Pipe	0	0
		5	4
		10	7
		15	11
		20	15
		25	19
	Film	0	0
		5	4
		10	8
		15	12
		20	16
		25	20
PE	Crate	0	0
		5	3
		10	7
		15	10
		20	14
		25	17
	Blow Bottle	0	0
		5	2
		10	3
		15	5
		20	7
		25	9

Source: Appendix II

Relation between Product Price
Increase and Demand Decrease
in Japan

Table IV-2

Mate- rial	Pro- duct	Increase Rate of Product Price (%)	Decrease Rate of Demand (%)
PVC	Pipe	0	0
		4	3
		7	5
		11	7
		15	10
		19	13
	Film	0	0
		4	1
		8	2
		12	3
		16	3
		20	4
PB	Crate	0	0
		3	10
		7	18
		10	25
		14	32
		17	37
	Blow Bottle	0	0
		2	4
		3	7
		5	11
		7	14
		9	17

Source: Appendix II

Examples: Installation technique of plastic pipes,
and their economic advantage
Improvement of distribution of goods by
using plastic packaging materials

- (c) Promotional campaign for the final consumers of
plastics products.

Examples: Films for agriculture
Pipes for water supply

- (d) Development of plastics products in cooperation
with final consumers

Examples: Containers for automobile lubricant pipes
Pipes for natural gas transportation

- (e) Service for solving the troubles concerning
plastics products

Examples: Solving the troubles on the supply route,
prices, quality and so on of the plastics
products.

- (2) Project which should be accomplished by the government
or its related organizations

- (a) Legal establishment of industrial standards,
organization of inspecting systems, promotion of
indication of standards

Examples: Plastic pipes for irrigation
Plastic pipes for water supply
Plastic pipes for drainage
Plastic pipes for cable protection
Films for agriculture
Electric wire and cables
Polyethylene films for packaging

- (b) Stable supply of plastic products and propagation
of application technique of plastics products

Examples: Plastic pipes and joints for water supply
Films for agriculture

- (c) Positive use of plastic and synthetic rubber
products in public constructions

Examples: SBR for highway pavement
Pipes for irrigation and sewage drainage
Pipes for natural gas transportation

2. The Policies for Development of the Processing Industries

The problems and countermeasures of plastics and synthetic rubber processing industries are shown in Table IV-3. To accomplish the development of processing industries, there are also two projects which should be shared by the petrochemical enterprise and the government or its related organizations.

- (1) The project which the petrochemical enterprise should accomplish
 - (a) Organization of distribution systems for plastics and synthetic rubber materials and establishment of stock points
 - (b) Establishment of technical service laboratory
Guidance to the processing industries on product development, technical development, and market development

Education and training of laborers, engineers, managers
- (2) The policies which the government should be requested to carry out
 - (a) Stimulation of investment by rationalization of the prices of plastics and synthetic rubber products
 - (b) Increase of long term investment fund which is needed for processing industries
 - (c) Improvement of the industrial area

Flexible management of regulations for rationalization of the factories in the vicinity of big cities

Improvement of the conditions for investment in industrial areas
 - (d) Qualification of the policies on the introduction of technical know-how and foreign investment
 - (e) Tax exemption of the imported processing machines
 - (f) Establishment of import regulations and import tax on the products
 - (g) Special tax exemption to protect processing industries
- (3) The project which should be promoted with the cooperation of the petrochemical enterprise

Table IV-3 Problems and Countermeasures in Plastics Processing Industry in Iran

Problems	Present State	Future	Countermeasures
1. Price of Materials	A. Domestic price of PVC, DOP is higher than the international price	Most of the plastics materials for general use is produced in Iran. It is desirable to set the price at the level corresponding to the international price.	The policy of price setting for plastics materials.
	B. Imported plastic materials are cheaper because of the world depression.		
2. Procurement of Materials	A. Necessary grade of materials is not available.	Completion of grade standard for materials is necessary	
	B. Domestic PVC is unstable in weight, many bags are broken		
	C. Satisfactory distribution system of materials is not established		
3. Production Technology and Plant Facilities	A. Manufacturers are inclined to produce the products in which high technology is not required and high profit is expected.	Expansion of demand for industrial materials and enhancement of technology	Introduction of technology and foreign capital.
	B. They depend on service given by manufacturers of materials and machines.		
	C. In-plant production of consuming industry.	Fostering subcontractors is necessary.	
	D. Equipments are made in Europe, but they have low productivity	Enhancement of productivity	Promotion of rationalization of production
	E. Around Tehran, they have old-fashioned equipments		

Problems	Present State	Future	Countermeasures
4. Labour	A. In general, labour force is lacking	Necessary labour is estimated to be 6,000 hereafter	Strengthening of technical training
	B. Especially skilled labour is lacking		
5. Infra-structure	A. Electricity is lacking.		Planning of model industrial area
	B. Industrial area is not arranged satisfactorily		
6. Management	A. Industrial capital is not developed sufficiently	Necessary capital investment in the future is estimated to be US\$250 million	Promotion of capital participation of foreign companies Promotion of capital participation of consuming industrialists
	B. There is no cooperative connection between plastic processors and plastic consumers		
	C. No joint ventures with foreign companies among companies specialized in plastics processing		
	D. Permission to introduce capital and technology is hard to obtain		
	E. Maximum share of foreign capital is 25%.		
	F. Administration is not effective enough		
7. Supporting Industry	A. Coloring pellet, master batch, are dependent on importation	Demand is to be expanded rapidly	Improvement of investment-conditions for foreigners Intensive fostering of management Founding coloring agent manufacturer Founding mold manufacturer
	B. Molds are dependent on importation		
	C. Sub-materials (except for DOP) are dependent on import		

Source: Table III-2-1, Vol. IV

- (a) Development of supporting industries
 Example: Coloring industry of plastics materials
 Mold manufacturing industry
- (b) Consideration of joint-investment with the consumer industries
 Example: Woven bags for fertilizer
 In-plant bottle manufacturing and filling

3. Actual Schedule and Project of Investment

Table IV-4 shows the future projects of the development which are considered from the results of the forecast of demands depending on the plastic and synthetic rubber products in Iran.

The above-mentioned projects for the developments shown in the table are as follows:

- (1) Replacement of imported materials
 - (a) Floor moquette
 - (b) Cables for high-voltage electricity and communications
 - (c) Woven bags for fertilizers
 - (d) Industrial parts (automobile parts)
 - (e) Industrial belts
- (2) Development of new field of products which are already manufactured in Iran
 - (a) Pipes for irrigation and underdrainage
 - (b) Pipes for house drainage
 - (c) Crates for agriculture
 - (d) Films for agriculture
 - (e) Blow bottles (in-plant line of bottle manufacturing and filling)
- (3) Materialization of potential demand

This is mainly the replacement of the traditional materials which have been used.

Table IV-4 Current Status and Countermeasures for Development Project

A. Plastics	Products	Current Status	Effect of Development	Countermeasures
(1)	Pipes for Irrigation and Underdrainage	To be used gradually	Improvement in utilization rate of irrigation water	Technical instruction of users, establishment of standards, and demand development by propaganda
(2)	Indoor Drainage Pipe	Not used	Rationalization of construction work	Introduction of technology (including process and piping technology)
(3)	Water Supply Pipe	Not produced at present	Rust proofing, prevention of clogging	Investment in new plant equipment is necessary. Establishment of standards, execution of inspection
(4)	Warm Water Supply Pipe	Not produced at present	Rust proofing, prevention of clogging	Introduction of technology is necessary. Investment in new plant equipment, establishment of standards
(5)	Cable Conduit Pipe	Large potential demand	Rust proofing, prevention of clogging	Introduction of technology including piping technology, investment in new plant equipment
(6)	Pipe for Natural Gas	Large potential demand	Rust proofing, prevention of clogging	Introduction of technology
(7)	Moquette and Carpets	Depends on imports	Import substitution	Establishment of joint venture or introduction of technology
(8)	High-tension Wire, Communication Cable	Depends on imports	Import substitution	Propaganda to consumers, introduction of technology, introduction of automatic packaging
(9)	CPP, DPP, Laminating Film	Lamination has started	Stream-lining of distribution, import substitution	Decision on intention of investment for the use of domestically produced products.
(10)	Woven Bag for Fertilizer	Depends on imports	Import substitution	Demand development is necessary
(11)	Crates for Agricultural Products and Tools	Production has been started, but not popular yet	Stream-lining of distribution	Propaganda for construction technology of houses and tunnels
(12)	Agricultural Film	Experimental use has been started	Promotion of intensive agriculture	Propaganda for construction technology of houses and tunnels

A. Plastics		Countermeasures	
Products	Current Status	Effect of Development	Countermeasures
(13) Blow Bottle	Manufacturers already exist, expected demand increase along with the development in consuming industries	Stream-lining of distribution	Introduction of in-lining of bottles and fillings
(14) Pallet	Not used	Stream-lining of distribution	Demand development through product importation, introduction of large injection molding machine
(15) Cold Container	Demand increase is expected along with the development of cold chain	Stream-lining of distribution	Demand development through product importation, introduction of technology
(16) Nets	Experimental use has been started	Stream-lining of distribution	Introduction of technology
(17) Industrial-use Parts	In-plant production by consuming industries	Import substitution, Improvement in rate of domestic production	Development of and investment in specialized manufacturers
B. Synthetic Rubber Products (SBR)		Countermeasures	
Products	Current Status	Effect of Development	Countermeasures
(1) Industrial-use Belt	Dependent on imports	Import substitution	Introduction of foreign capital or introduction of technology
(2) Mixing Agents for Road Pavement	Not used	Decrease in expenditures for road maintenance	Test use and propaganda

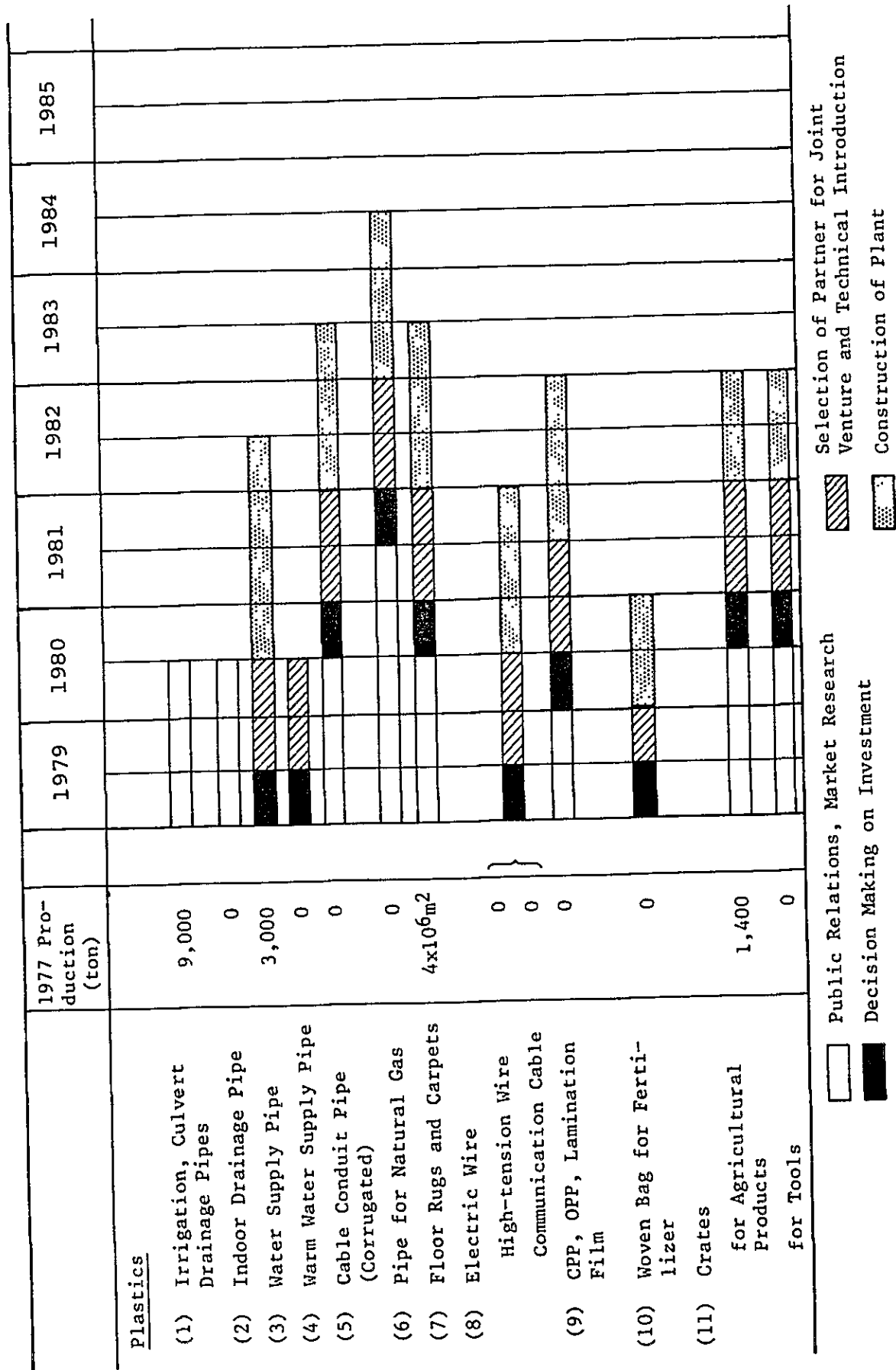
- (a) Pipes for water supply
- (b) Pipes for hot water
- (c) Natural gas pipes
- (d) CPP/OPP films, laminate films
- (e) Pallets

Highly technical processes are necessary to produce following products. Therefore, introduction of foreign capital or technology is recommended to promote their production in Iran, as well as to promote their application and marketing the products.

- (a) Pipes for water supply
- (b) Pipes for hot water
- (c) Pipes for cable protection
- (d) Natural gas pipes
- (e) Moquette and carpets
- (f) Cables for high-voltage electricity and communication
- (g) CCP/OPP, laminate film
- (h) Pallets
- (i) Cold containers
- (j) Nets
- (k) Industrial parts (automobile parts, electric appliance parts)
- (l) Industrial belts
- (m) Mixing agents for road pavement

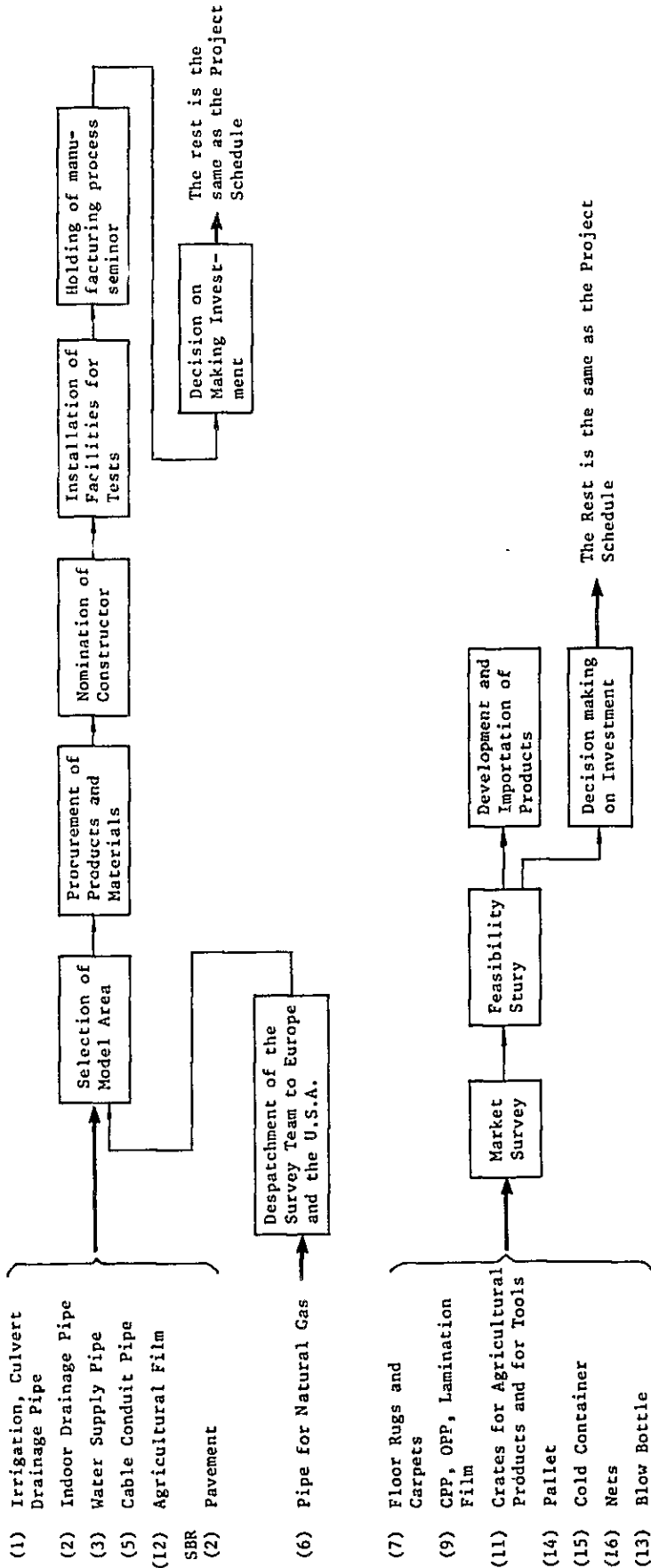
Fig. IV-1 shows the suggested time schedule of these projects. This figure shows a rough measure; therefore, should not be considered very strictly.

Fig. IV-1 Project Execution Schedule



	1977 Pro- duction (ton)	1979	1980	1981	1982	1983	1984	1985
(12) Agricultural Film	0							
(13) Blow Bottle for Shampoo	1,500							
for Liquid Detergent	200							
for Milk	1,000							
for Kerosene	600							
(14) Pallet	0							
(15) Cold Container	0							
(16) Nets	0							
(17) Industrial-use Parts for Automobiles	0							
for Electric Appliances	8,900							
Synthetic Rubber (SBR)								
(1) Industrial-use for Belt, Hose	400							
(2) Pavement	0							

(Attached) Contents of Project Execution



Followings are the products and industries in which a prompt decision making on investment is indispensable:
 (3) Water Supply Pipe, (4) Warm Water Pipe, (8) Cable, (10) Woven-bag for Agricultural Use, (17) Industrial Parts,
 and (1) SBR Belt.

V SUGGESTED POLYMER SALES ORGANIZATION

Petrochemical enterprise should play an important role in the development of downstream industries.

Fig. V-1 and Fig. V-2 indicate the kind of organization and functions concerning the polymers sales of petrochemical enterprises.

The organizations consist of the Sales Department and Sales Promotion Department. The former, Sales Department, should be charged for the actual sales business, as well as supervising the local offices and the stock points. The latter, the Sales Promotion Department, should be charged for technical service to the processing industries and expansion of demands and technical developments. The Technical Service Laboratory (Fig. V-2) belongs to the Promotion Department.

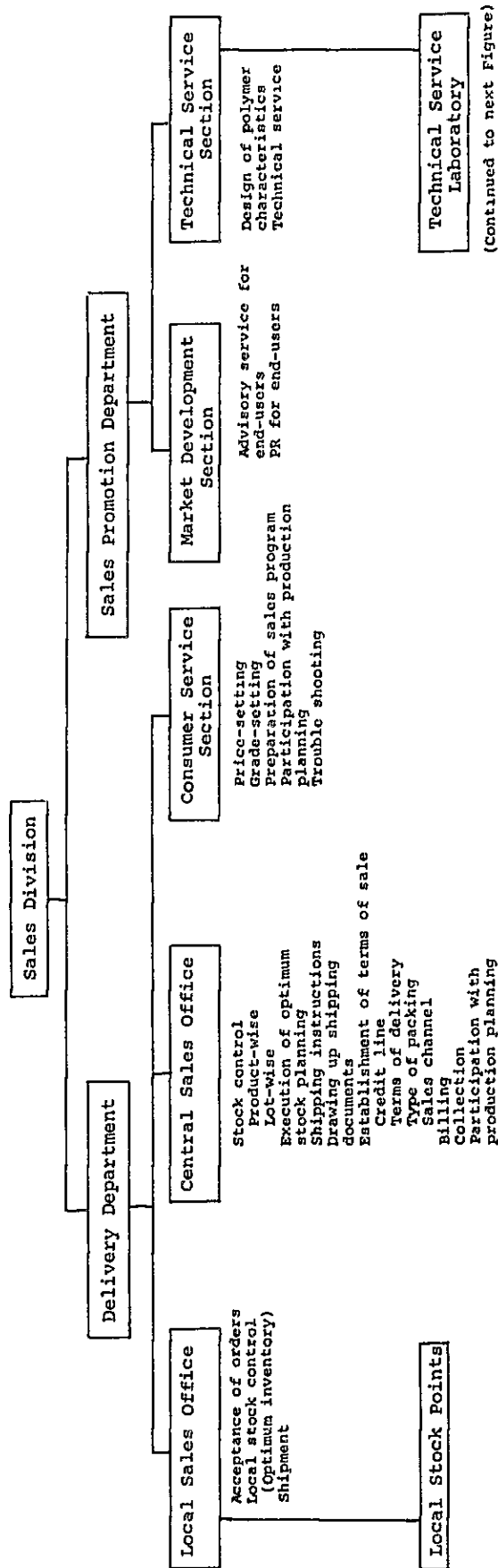


Fig. V-1 Suggested Polymer Sales Organization for the Domestic Market

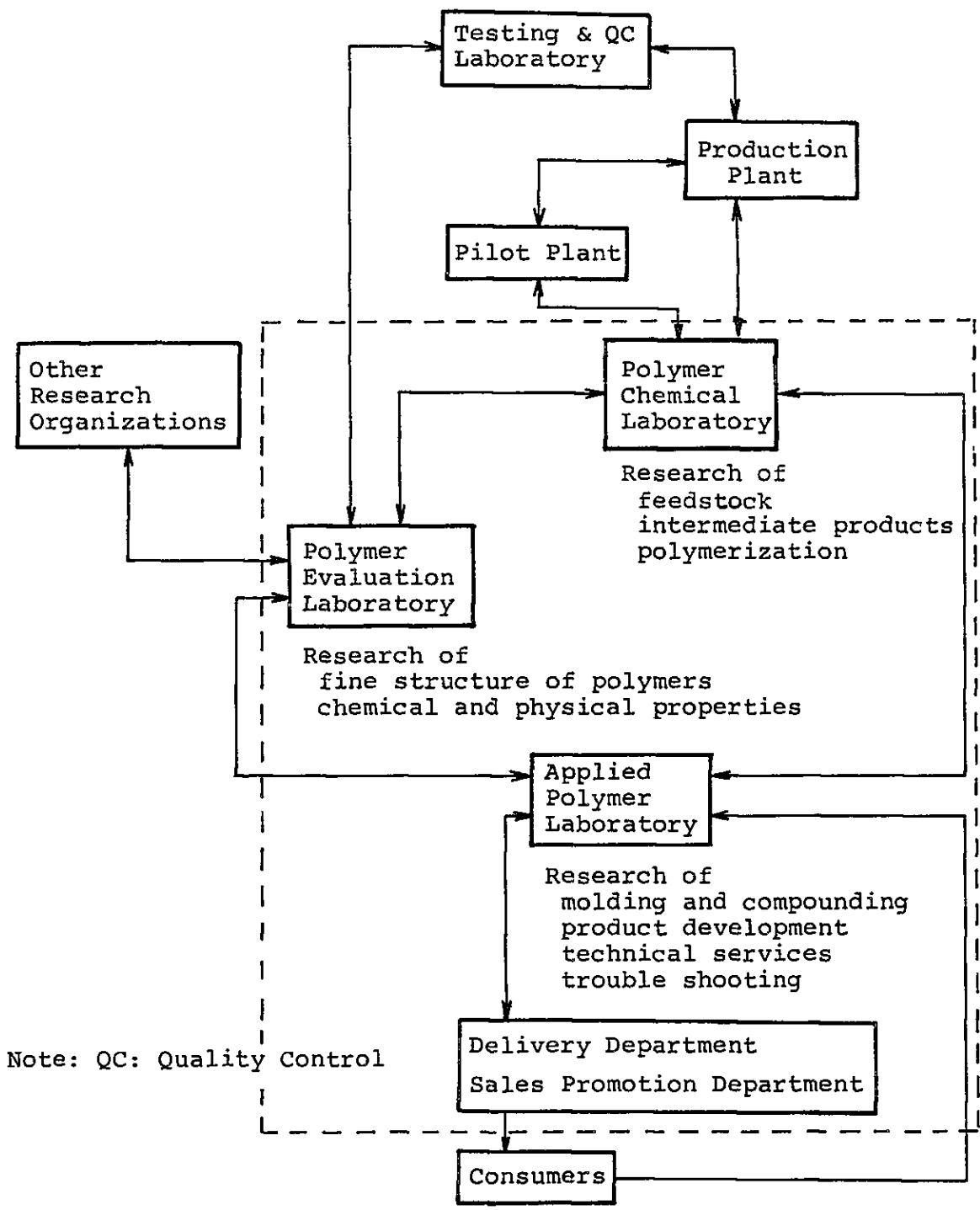


Fig. V-2 Outline of Research Organization of Technical Service Laboratory and Inter-relationship of Each Laboratory

JICA