THE STUDY ON A DEVELOPMENT PLAN

FOR

PETROCHEMICAL DOWN-STREAM INDUSTRIES

IN

THE EMPIRE OF IRAN

VOLUME III

CURRENT MARKET STATUS AND FUTURE PROSPECTS OF MAJOR PETROCHEMICAL PRODUCTS

SEPTEMBER, 1978

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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

Platics

ABS	Acrylonitrile-butadiene-styrene Copolymer
AS	Acrylonitrile-styrene Copolymer
DOP	Dioctyl Phthalate
EDC	Ethylene Dichloride
EVA	Ethylene-vinyl-acetate Copolymer
PE	Polyethylene
HDPE	High Density Polyehtylene
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

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1. General Aspects

1-1 Macroscopic demand analysis and forecast

1-1-1 The international cross-section analysis

Fig. I-1-1 (Ref. Table I-1-1) shows the results of the demand forecast made for 1980 and 1985 by means of the international cross-section analysis.

The per capita plastics demand in Iran is on a level lower than in the case of many other countries in relation to the per capita GDP. This seems to be due to the great importance of oil production within the Iranian GDP, and to the consequential insignificance of the effective demand for plastics materials. Along with the progress in the industrialization of Iran in the future, and as agricultural production is increased to reduce the relative importance of oil production in GDP, the per capita plastic consumption level as against per capita GDP will be greatly enhanced to attain the level comparable to the other countries.

The 1980 and 1985 forecast demand shown in Fig. I-1-1 and Table I-1-2 has been calculated on an assumption that the upper limit of the forecast will become comparable to that of the other countries by 1990. The lower limit of the forecast is calculated on an assumption that the level comparable to the other countries will be attained by Iran in the year 2000.

1-1-2 Elasticity analysis

Table I-1-3 gives the GDP and price elasticities estimated on the actual records of consumption of various plastics materials made during 1969 to 1976. The details of the calculations are explained in Appendix I.

As shown in Table I-1-4, the GDP elasticity of Iranian plastics materials is less than 1/2 of the other developing countries where the demand for plastics materials is still on an early stage of development. This has been due to the fact, as has been pointed out earlier, the comparative insignificance of the extent of effective demand for plastics materials in relation to the GDP level.

The value of GDP elasticity varies in accordance with the extent of GDP, and if the change is constant in the demand structure, the GDP elasticity value will be reduced as the GDP grows greater.
Table I-1-5 gives the future GDP elasticity estimated on an assumption that the change will be constant in the demand structure.

Table I-1-1 Per Capita Consumption of Plastics Materials in Major Countries (1975)

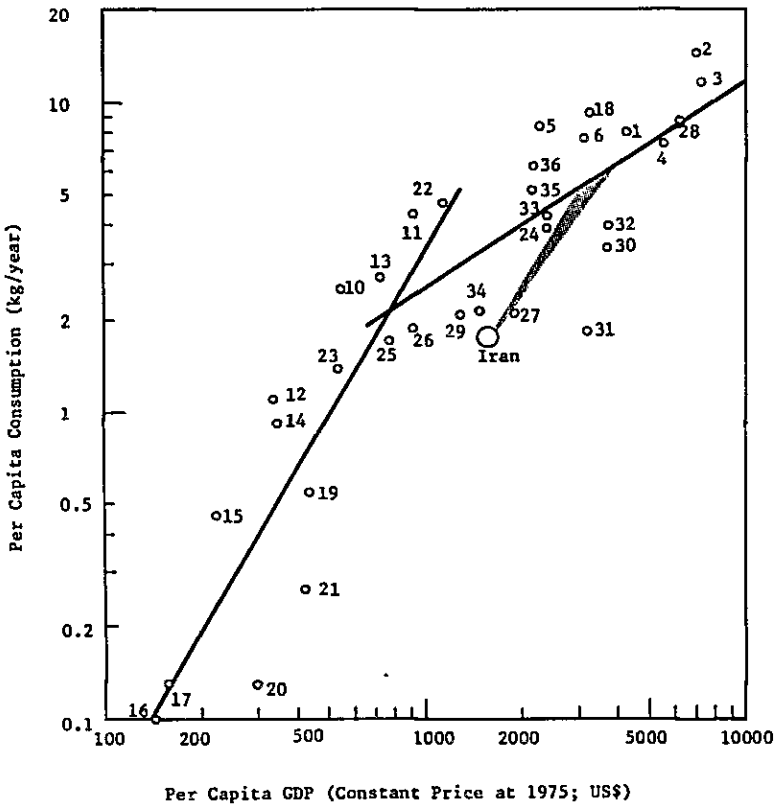
(Unit: kg)

No.	Nation	Per Capita GDP (US$)[1]	PE	PP	PS	PVC
1	Japan	4,316	7.98	3.98	3.70	9.00
2	U.S.A.	7,049	14.49	3.41	6.27	7.30
3	W. Germany	7,157	11.76	2.07	3.64	11.57
4	France	5,485	7.41	1.14	2.73	10.64
5	Italy	2,301	8.33	1.63	5.71	7.97
6	U.K.	3,132	7.61	2.69	2.19	5.28
10	S. Korea	550	2.5	1.8	0.5	2.1
11	Taiwan	917	4.4	2.1	1.3	9.8
12	Thailand	342	1.1	0.42	0.13	0.29
13	Malaysia	730	2.7	0.62	0.13	0.46
14	Philippines	356	0.92	0.57	0.15	0.31
15	Indonesia	225	0.46	0.17	0.04	0.11
16	India	147	0.10	-	0.02	0.07
17	Pakistan	159	0.13	0.02	0.03	0.04
18	Israel	3,166	9.2	-	6.0	7.7
19	Turkey	441	0.53	0.12	0.24	0.14
20	Egypt	310	0.13	-	0.08	0.06
21	Nigeria	431	0.27	0.02	0.02	0.16
22	S. Africa	1,169	4.7	2.0	0.33	2.2
23	Colombia	538	1.41	0.16	0.16	1.0
24	Venezuela	2,415	4.0	-	1.24	1.24
25	Peru	779	1.35	0.27	0.22	0.32
26	Brazil	922	1.95	0.24	0.35	1.31
27	Argentina	1,935	2.14	0.48	1.17	2.06
28	Australia	6,347	8.96	1.93	1.85	6.59
29	Mexico	1,314	2.20	0.43	0.51	0.76
30	New Zealand	1,749	3.46	0.50	0.60	3.61
31	U.S.S.R.	3,093	1.84	-	0.17	1.39
32	Czechoslovakia	3,757	4.05	2.40	3.20	6.19
33	Hungary	2,478	4.23	0.77	0.46	4.16
34	Yugoslavia	1,502	2.24	0.29	0.96	2.18
35	Romania	2,203	5.20	-	0.30	4.07
36	Bulgaria	2,188	6.20	-	2.7	3.58
37	Iran	1,597	1.75	0.38	0.43	1.27

Note: 1) According to Worldcast, Predicasts, Inc.

Source: UNICO

(1) PE (1975)



(2) PP(1975)

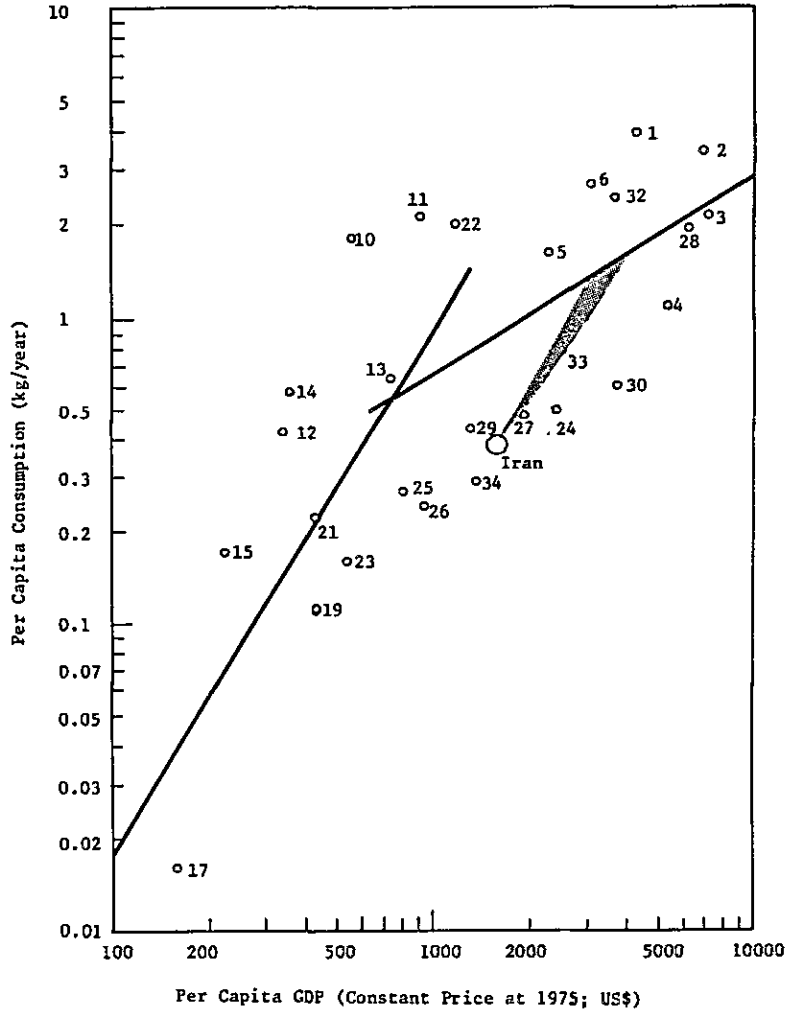
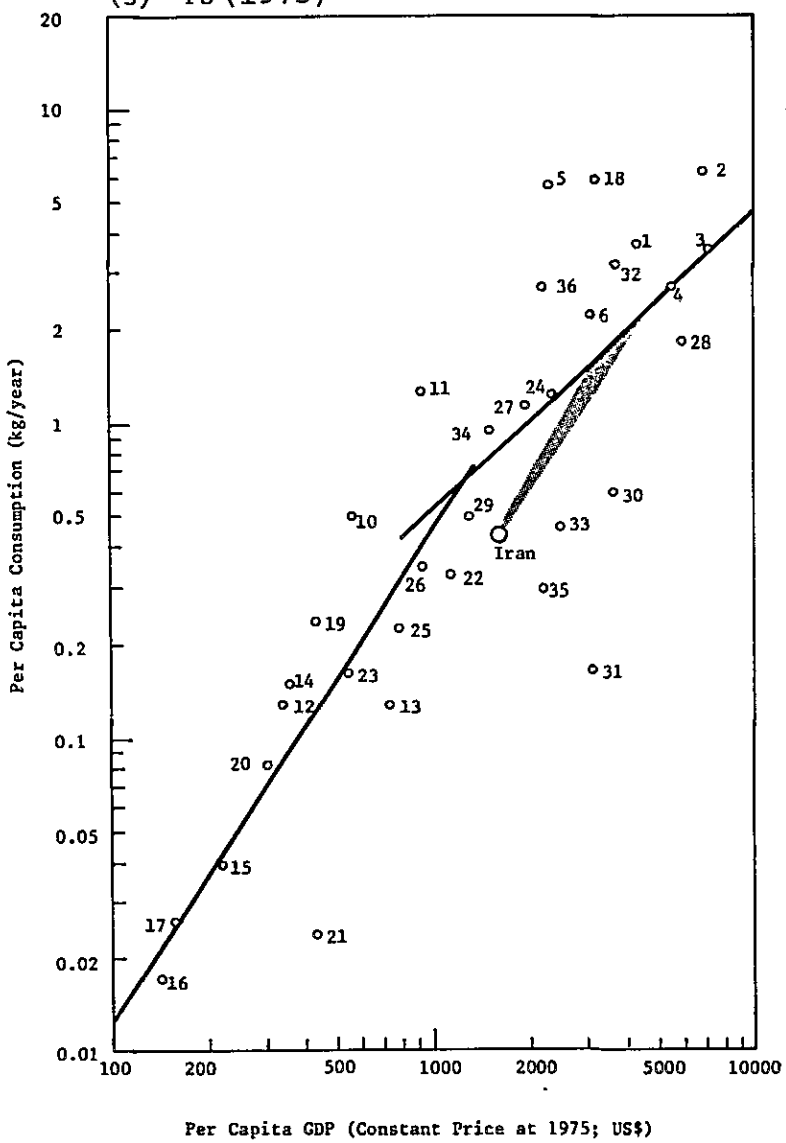


Figure I-1-1 Demand Forecast by the International Cross-section Method

(3) PS (1975)



(4) PVC (1975)

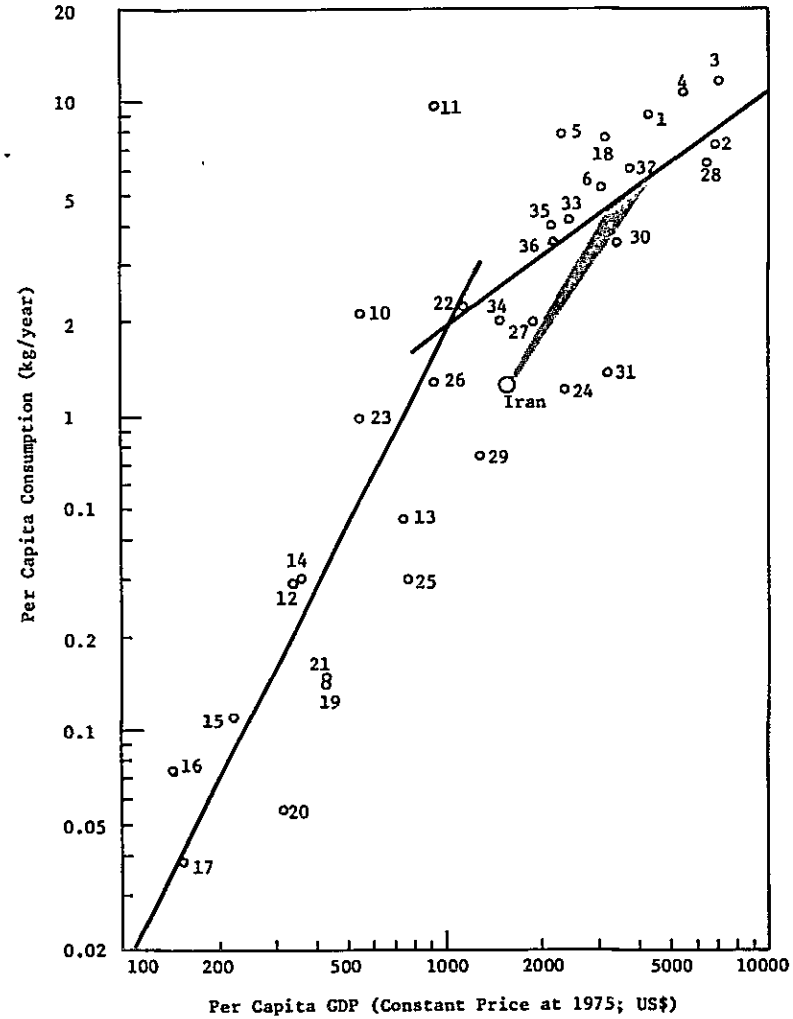


Table I-1-2 Forecast of Major Plastics Consumption by the Cross-section Analysis in Iran (1980, 1985)

	Per Capita Consumption (kg)		Consumption (1,000 ton)		Average Growth Rate (%/year)	
	1980	1985	1980	1985	1980	1985
PE	2.6 ~ 2.9	3.1 ~ 3.4	100 ~ 109	136 ~ 151	12.7	6.5
PP	0.6 ~ 0.7	0.7 ~ 0.8	23 ~ 25	32 ~ 36	13.9	7.2
PS	0.7 ~ 0.8	0.9	27 ~ 29	38 ~ 41	14.5	7.1
PVC	2.1 ~ 2.3	2.5 ~ 2.8	80 ~ 88	111 ~ 125	14.9	7.0

Table I-1-3 GDP and Price Elasticities of Plastics Materials in Iran (1969 - 1976)

	GDP Elasticity	Price Elasticity
PE	1.00	1.05
PP	2.32	1.16
PS[1)]	0.90	0.64
PVC[2)]	0.40	2.91

Notes: 1) Including AS and ABS

2) As PVC resin

Table I-1-4 Comparison of GDP Elasticity between Iran and Other Countries (1969 - 1975)

	GDP Elasticity			
	PE	PP	PS	PVC
Iran	1.00	2.32	0.90	0.40
South Korea	2.44 (LDPE) 1.09 (HDPE)	4.08	2.19	1.84
Taiwan	1.97	3.26	4.38	1.26
Thailand	1.63	4.30	1.79	3.41
Singapore	1.71	2.77	2.87	2.38
Philippines	2.46	3.21	3.38	1.38
Malaysia	4.07	4.82	-	-
Indonesia	2.21	8.26	-	1.44
Mexico	2.66	4.52	1.68	-

Source: UNICO

Table I-1-5 Estimation of Future GDP Elasticity of Plastics Materials in Iran

	1969/1976	1977/1980	1081/1985
PE	1.00	0.88	0.85
pp	2.32	1.51	1.38
PS	0.90	0.78	0.75
PVC	0.40	0.37	0.36

The price elasticity also varies in accordance with the in the price figures. However, because of the difficulty in clearly ascertaining the future status of the price differentiation, it has been assumed that no significant change will take place in the price in the future. Consequently, the price elasticity from 1981 onwards has been assumed on a slightly lower side as shown in Table I-1-6.

The demand forecast has been compiled for two alternative cases, i.e., when the actual price of the plastics materials will not change, and on another case in which the real price will change by 3% per year on average. The obtained results are shown in Table I-1-7.

Table I-1-6 Assumption of Future Price Elasticity of Plastics Materials in Iran

	1969/1976	1977/1980	1981/1985
PE	1.05	1.05	1.00
PP	1.16	1.16	1.00
PS	0.64	0.64	0.50
PVC	2.91	2.91	2.00

1-2 Current status and demand forecast for plastics products by application

1-2-1 Packaging materials

Packaging materials are an extremely important element in the demand for plastics materials in the Iranian market. The importance of packaging materials stems from the following two reasons:

(a) Packaging materials are one of the largest markets not only in Japan, but also in the U.S.A. and European countries, and belong to an important field of demand for polyolefins which are the main products of IJPC.

(b) Since Iran has no abundant forest resources, there is a certain limitation as to the sources of raw material supply for producing paper. Therefore, plastics packaging materials will become more and more necessary than in the case of other countries.

Table I-1-7 Demand Forecast by Elasticity Analysis in Iran

(1) In the case of real price: Constant

	1976	1977 ~ 1980		1981 ~ 1985	
	Actual (1,000 ton)	Quantity (1,000 ton/year)	Growth Rate (%/year)	Quantity (1,000 ton/year)	Growth Rate (%/year)
PE	60.0	82	8.1	113	6.6
PP	13.7	24	14.4	39	10.9
PS	18.5	24	7.2	32	5.8
PVC	60.3	69	3.3	79	2.7

(2) In the case of real price: Decrease by 3%/year

	1976	1980		1985	
	Actual (1,000 ton)	Quantity (1,000 ton/year)	Growth Rate (%/year)	Quantity (1,000 ton/year)	Growth Rate (%/year)
PE	60.0	93	11.7	149	9.9
PP	13.7	27	18.5	53	14.4
PS	18.5	26	9.3	38	7.4
PVC	60.3	98	12.9	152	9.2

The following points were revealed in relation to the features and market potential of the packaging materials in Iran:

(a) At present, quantitatively large application in the packaging field is being made for the manufacturing of general packaging films (centering on LDPE), woven bags (PP), and crates (HDPE)

(b) Bottles made by blow molding (LDPE, HDPE) and light weight containers made by thermoforming of plastic sheets (HIPS, GPPS) are the presently burgeoning fields with a high potential for future growth

(c) Following items are deemed highly prospective in the future in the light of the examples set by developed countries, although almost no utilization is being made at present in Iran:

OPP film, LDPE laminated products with kraft paper, aluminium foil or with cellophane, heat insulation packaging materials made of plastic form, plastic pallets made of HDPE, PP, etc.

(1) General packaging films

(a) Current status

General packaging films are now widely used in Iran for packaging of commercial commodities such as foods, garments, miscellaneous goods, or in the form of shopping bags at supermarkets or general retail shops, further in the form of garbage collection bags which is reported to be rapidly growing quantitatively in recent years.

However, the current status of the popularization of film is rather haphazard. For instance, lundries and cleaning of clothes come in paper wrapping, and the bread "nan" which is the staple food of Iranian people is for the most part wrapped in old newspaper.

As it is difficult to cumulatively estimate the current scale of demand because of the special nature of the application of plastic films as general packaging and wrapping, the results of demand structure survey conducted by NPC in 1975 on the plastics material-wise basis were taken as the basis to which the findings made by the present survey was incorporated in order to estimate the extent of the demand for general packaging film as of 1977.

<u>LDPE film:</u>

According to the NPC's survey of 1972, about 24,300 tons or 86% of the total LDPE consumption

was made in the form of film which is considered to be entirely used for packaging. In 1975, 27,400 tons or 76% of the total consumption was made in the form of film. In this year, the amount of film used for agricultural application was extremely small. This fact was supported by the result of visits made the Survey Team to the plastics processing factories.

The rate of growth of demand for LDPE film from 1972 to 1975 is estimated to be about 4% per year. This low level of growth seems to be due to the invasion of HDPE film which rapidly grew in the meantime to take over the LDPE share as will be explained later. The extent of demand for LDPE in the form of general packaging materials as of 1977 is estimated to be on the same low growth rate level, or about 29,600 tons.

HDPE film:

HDPE can be produced into much thinner film than LDPE, thereby ensuring higher price competitiveness. Because of this attractive character for the processors, the ceiling price of HDPE film is higher than LDPE film. According to the NPC survey, it is estimated that the consumption was 480 tons as of 1972, and about 1,000 tons in 1975. The annual growth rate of approximately 30% during this period is now showing a rate as high as almost 50% because of a boom in using shopping bags at supermarkets or general retail stores. It is estimated that the demand as of 1977 was 2,300 tons.

PP film:

Due partly to a rapid growth shown by HDPE, PP is still falling behind in terms of demand growth. NPC 1975 survey revealed a demand amounting to about 1,100 tons which is considered to have remained without showing any significant change ever since. Therefore, it is estimated that the current scale of demand for PP is about 1,100 tons.

PVC film:

During the course of this Survey, there was no instance in which PVC film was used for general wrapping and packaging.

In view of the above-mentioned resin-wise analysis of the current status, it is likely that about 6% per year of growth rate has been constantly registered by general packaging films during the

period from 1972 to 1977, although there is a difference in the degree of growth from resin to resin.

(Unit: ton)

	1972	1975	1977
LDPE	24,300	27,400	29,600
HDPE	480	1,000	2,300
PP	-	1,000	1,100
PVC	-	-	-
Total	24,780	29,400	33,000

(b) Demand forecast

The future demand for packaging film naturally depends on the growth of the commodities to be wrapped or packaged by the films. The major fields of application of packaging-use plastic films are food packaging, and commercial/service industrial packaging. This has been an obvious trend in the developed countries, and the same trend was clearly noted in Iran as a result of this Survey.

This increase in the demand for packaging-use plastic films can be classified into two categories as follows:

- Natural increment made to the already existing demand
- Growth of new demand increase by means of substitution of paper, cellophane, and other conventionally used wrapping materials, as well as through substitution of imported films

Concerning the natural growth of the existing demand, the film consumption will increase along with the growth of the food packaging industry which in turn is to be supported by the progress and development of the agricultural sector. It is safe to assume that the future rate of growth is within a range from 5% to 7% per year which is slightly over the 5% level actually achieved during the period of the Fifth Five-year Plan. For the purpose of this Survey, it has been assumed that the annual growth rate in the future will be 6%.

Concerning the development of new demand area, it

is extremely difficult to quantify the estimation, because the future growth largely depends on the extent and degree of the development efforts to be exerted by the film processing enterprises. However, for the purpose of this writing, an arbitrarily set rate of "5% over the demand level of the previous year" has been assumed. Within the scope of this newly developed demand, included are OPP film and the LDPE laminated products with other materials. Cigarettes and buiscuits are presently wrapped by imported cellophane; however, there seems to be several problems in terms of the strength of cellophane because of generally low relative humidity condition of Iranian climate. In view of the development of automatic packaging processes, further popularization of OPP film is greatly anticipated.

At Vitana Co. which is the second largest buiscuit manufacturer in Iran, it was noted that 400,000 meals a day of school lunch cakes were produced. In order to pack these lunch cakes, imported cellophane/aluminium foil laminated materials were used. Switch-over from cellophane to PP film will involve price problems (cellophane price at present is R70/kg), and also modifications of the packaging facilities will be necessary. However, actual implementation of PP film employment seems to be feasible in the near future. For reference, employment of PP film for packing the school lunch cakes alone will generate 300 ton/year of new demand. In the biscuit manufacturing industry alone, the potential demand for PP film is estimated to be 2,000 ton/year.

At present, there is only one company in Shiraz which is contemplating the employment of LDPE for the lamination at an amount of 15 tons to 20 tons per day. It is likely that the lamination of LDPE and kraft paper or cellophane, aluminium foil, with other materials will have a great growth potential along with future development of cold chain systems.

By 1980, the demand is forecast to be 45,000 tons, while by 1985, the demand will further grow to 76,000 tons as a combination of the expected demand which will grow in the following fields (i) and (ii):

(i) Due to natural growth of the existing demand of estimated 33,000 tons of packaging-use film as of 1977, the consumption will grow to 39,300 tons by 1980 and and 52,600 tons by 1985.

(ii) The development of new demand as a result of market development efforts is expected to attain 5,700 tons by 1980 and 23,400 tons by 1985.

(2) Woven bags

(a) Current status

In Iran, the scope of woven bag utilization is quite wide. They are used for containing barley, wheat, rice, beans (pulses), other grains, potatoes, onions, beets, etc. for transportation. The woven bags are also used for containing sugar, salt, fertilizers, etc.

However, for transportation of agricultural products, jute bags are also extensively used. It is estimated that the amount of new jute bag utilization per year is about 10,000 thousand bags. In the case of containing fertilizers, Shapur Chemical Co., one of the two government-managed fertilizer manufacturing companies, is using PP woven bags imported from Brazil and Korea to contain urea fertilizers, DAP fertilizers, and TSP fertilizers in the amount of about 8,000 thousand bags per year. Shiraz Fertilizer Co., another government-run fertilizer manufacturers is importing about 10,000 thousand LDPE heavy duty bags per year from Portugal, Finland, etc. According to NPC, these heavy duty LDPE bags are scheduled to be replaced with PP woven bags in the near future.

1) Woven bags for agricultural products

One jute bag costs Rl20. Although this price is high, jute bags have inherent characteristics which are suitable for containing agricultural products. For instance, Dr. Omibdwar of Sugar Beet Research Institute maintains that jute bags are indispensable at the time of distributing the beet seeds. According to July, 1977 issue of the "Iran Trade and Industry", Iran committed itself to Bangladesh to import jute in the amount of 13,000 ton/year in order to develop trade relationship between Iran and Bangladesh. Because of these factors, the switch-over from jute bags to PP woven bags will involve some problems. The jute bag importation as of 1975 amounted to 24,361 tons in quantity, and Rl,193 million in value. According to Dr. Omibdwar, the weight of one jute bag is 2kg to 2.5kg. Therefore, it is likely that about 10,000

thousand of jute bags were imported into Iran during 1975. This figure indicates that the jute bag importation amount is almost unchanged since 1971 when jute bag importation registered about 25,000 tons. It is therefore likely that the jute bag importation as of 1977 was also at around this level. In order to estimate the amount of agricultural-use PP woven bags as of 1977, an estimation was made as shown in Table I-1-8 as to the agricultural crop production of 1977 on the basis of production trend from 1971 to 1976 of the major agricultural crops of Iran. On the basis of this estimation, the total quantity of the bags used for shipment of agricultural products was calculated as shown in Table I-1-9.

As the size of the bags varies according to the type of the agricultural products to be contained, an assumption is made here that 30kg bags are used for beets and 60kg bags for other agricultural products. The recycling frequency per year and the service life of the bags were assumed to be ten cycles per year in the case of beets (the cycle frequency is high because the geographic distance between the sugar mills and the surrouding beet cropping lands is short). With one year of service life, and concerning other agricultural products, the frequency is assumed to be one cycle per year with five-year service life.

The amount of PP woven bags used during 1977 is estimated to be 45,200 thousand bags which is obtained by subtracting the jute bag importation amount of 10,000 thousand as mentioned earlier from the total bag amount of 55,200 thousand. If the weight of one PP woven bag on average is 200g and the product yield is estimated to be 90%, it is likely that about 10,000 tons of PP resin was consumed in the form of PP woven bags.

According to the NPC's 1975 survey, the total processing capacity of 11 Iranian woven bag manufacturers (Table I-1-10) is about 20,000 tons per year. Therefore, the average operational rate of these manufacturers must have been on an extremely low level of about 50%.

2) Woven bags for containing fertilizers and plastics materials

Table I-1-8 Estimated Production of Major Farming Corps in Iran (1977)

(Unit: 1,000 ton)

	Actuals						Ratio		Estimate
	1971	1972	1973	1974	1975	1976	1971/1976	1975/1976	1977
Wheat	3,700	4,546	4,600	4,700	5,500	6,040	1.63	1.10	6,640
Barley	900	1,009	923	863	1,400	1,500	1.67	1.07	1,610
Rice (Paddy)	1,050	1,200	1,334	1,313	1,430	1,500	1.43	1.05	1,580
Sugar Beet	3,990	3,918	4,240	4,300	4,670	N.A.	1.27*	1.09*	5,520
Pulses	196	176	200	210	225	230	1.17	1.02	240
Potatoes	400	420	481	533	550 1)	580 1)	1.45	1.05	610
Onions	250	258	307	305	330	340	1.36	1.03	350
Total	10,486	11,527	12,085	12,224	14,105	10,190	1.45	1.08	16,550

Note: * Estimated by UNICO

Source: Ministry of Agriculture and Natural Resources in Iran

1) MIDBI Annual Report

Table I-1-9 Total Woven-bag Demand Estimate for Agricultural use in Iran (1977)

Crops	Production in 1977 (Estimate) (ton)	Unit Weight (kg)	Annual Circulation	Life-span of Bags (years)	Annual Bag Demand (1,000 bags)
Wheat	6,640,000	60	1	5	22,100
Barley	1,610,000	60	1	5	5,400
Rice	1,580,000	60	1	5	5,300
Sugar Beet	5,520,000	30	10	1	18,400
Pulses	240,000	60	1	5	800
Potatoes	610,000	60	1	5	2,000
Onions	350,000	60	1	5	1,200
Total	16,550,000				55,200

Source: UNICO estimate

Table I-1-10 List of PP Woven Bag Manufacturers in Iran

	Resin Consumption in 1975 (ton)	Location
Tolidi Tehran	600	Tehran & Rasht
Jahan Cheet (Armeh)	1,400	Qazvin
Qushid	2,500	Tehran
Iran Gharb	1,400	Qazvin
Synthetic	750	Mashad
Polytex	750	Babol
Kisseh Iran	750	Qazvin
Varzidekar	720	Rasht
Bisotoon	700	Kermanshah
Kisseh Bazr	600	Qom
Iran Faila	400	Shiraz
Total	10,570	

Source: NPC

In the case of fertilizer-use woven bags, the reason for predominantly high employment of imported bags is the fact that the price of domestically produced is 25 to 65% higher than the imported bags (Shapur Chemical). No tabulation of PP woven bags is made in the Iranian import statistics; however, trade statistics of Korea which is the exporting country, shows that the FOB price of PP woven bag is US¢20/bag. It is informed by NPC that the C&F price of the bags is US¢28~30/bag (R20~21/bag). This price disadvantage is causing a great impediment in the growth of demand for domestic woven bags. According to NPC, there is a discrepancy of 25% between the domestic and imported heavy duty bags.

(b) Demand forecast

Agricultural-use woven bags

The future demand for woven bags depends on the growth of the future production of agricultural products. It has been estimated for the purpose of this forecast that the growth rate of the agricultural sector will range from 5% to 7% which is slightly over the 5% record registered during the period of the Fifth Five-year Plan.

The following table shows the production estimate for 1980 and 1985. The figures in the following table have been obtained concerning the major agricultural products which were the subject of the current status analysis made under (b), (1). Of these major agricultural products, annual 7% growth was assumed for those items which showed a growth level of over 40% during the past five years. Those which showed less than 40% of total growth rate were assumed to show 5% per year of growth rate in the future.

On the basis of the above data, the bag requirements for 1980 and 1985 can be calculated to be 66,300 thousand bags and 89,800 thousand bags respectively on an assumption that the bag capacity, bag recycling frequency, and bag service life will remain unchanged from the 1977 data. (Ref. Table I-1-11)

Concerning the future trend of consumption of jute bags, the presently prevailing quantitative trend of growth has been assumed to take place in some years to come. This assumption has been made due to the fact that, as has already been discussed, there are some problems which present difficulties in ready switch-over to woven bags.

The demand for agricultural-use woven bags is estimated to be 56,300 thousand bags in 1980 and 79,800 thousand bags in 1985. In view of the per-bag weight of 200g and the yield, the PP resin consumption for the production of these bags will be 12,600 tons in 1980 and 17,800 tons in 1985.

Fertilizer and plastics materials containing woven bags

The Survey Team could not obtain quantitative information from Shapur Chemical concerning the future extent of woven bag utilization. However, in accordance with the production expansion plans already announced by the company, it is scheduled

Table I-1-11 Production Forecast of Agricultural Products in Iran

(Unit: 1,000 ton)

Crops	Annual Growth Rate (%)	Production Forecast (1980)	Production Forecast (1985)
Wheat	7	8,070	11,320
Barley	7	1,970	2,770
Rice	7	2,010	2,820
Sugar beet	5	6,380	8,140
Pulses	5	280	350
Potatoes	7	750	1,050
Onions	5	410	520

that the fertilizer production capacity will be increased up to 2.5 times the present capacity upon completion of the expansion in 1978. Therefore, the amount of bags to be used by this company should increase from the present level of 8,000 thousand bags to 20,000 thousand bags.

It is also understood that the bag utilization will be increased to 40,000 thousand bags from end-1978 onwards when Shiraz Fertilizer Co. will complete the currently carried out plant expansion. It is likely that the currently used LDPE heavy duty bags will be replaced by PP woven bags.

IJPC which is planning to start operation in 1979 is planning to employ kraft paper bags or imported PP woven bags as the material to pack the plastics materials. The bag requirements commensurate with the scheduled production amount is 9,500 thousand.

APC is currently using kraft paper for wrapping PVC resin. It seems possible for APC to employ PP woven bags instead. The PP bag requirements commensurate with the PVC producing capacity of the company is 1,700 thousand bags.

Iran Carbon Co., manufacturer of carbon black, is using carton to wrap their product.

As has been seen so far, a large and attractive market for PP consumption is now being covered by imported bags. For fertilizer and plastics materials packaging alone, 65,400 tons of bags is required; the potential consumption of PP will amount to 14,500 tons. This market therefore is amply valuable outlet worthy of formulating effective policies as one of the targets for substitution by domestic products. In the case of woven bags, the import substitution signifies the development of new demand.

(3) Crates

(a) Current status

Employment of plastics crates in Iran started with soft drinks and beer bottle transportation operations. The history of plastics crate employment is as long as nearly ten years. Although, plastics crate is almost 100% popularized in this field, is hardly used in other possible areas.

The reason for such an imbalance is that the bottling companies of soft drinks and beer started their own production of the crates. Therefore,

when leading plastics processing enterprises such as Plastiran, Plasco Kar, etc. began to introduce crates as new products, they failed to locate any bulk market. At present, the soft drink and beer bottlers are sometimes giving orders to plastics processing enterprises in order to supplement the shortage of their own in-plant crate making facilities. In these cases, the plastics processing enterprises cannot ensure attractive profits because the bottlers exactly know the raw material resin prices and the crate making process. This being the circumstance, the processing enterprises are not interested in expanding crate manufacturing operations.

During the past two to three years, the above-mentioned leading plastics processing enterprises have been trying to develop new application fields of crates for such operations as vegetable collection, juice and canned fruit transportation, milk, yoghurt distribution, egg, meat transportation, etc. As of 1977, the demand from these new fields has developed to a level approximately 1/2 of the bottle crates. In all the above applications, the palstics material used is HDPE alone. PP is not used at all because of the extremely low temperature during winter time (the lowest temperature during winter is said to be -30° C to -35° C).

The scale of new demand for crates for soft drinks and beer could not be obtained from manufactures and users. Therefore, the crate requirements were calculated on the basis of the production amount of beer and soft drinks. The average life span of crates and annual circulation cycle were incorporated in order to estimate the scale of new demand for crates and the resin consumption for crate production. (Table I-1-12) As a result, the resin consumption for producing crates for soft drinks and beer as of 1977 was estimated to be 2,230 tons. Thus estimated 1977 figure for resin consumption for soft drink crate is supported by the result of the interview held at Sasan Co. which is Coca Cola bottlers as well as crate manufacturers. (Sasan consumed 800 tons of resin. The market share of this company is slightly above 50%).

Estimation was made in exactly the same manner concerning the resin consumption in manufacturing crates for use other than soft drinks and beer. However, the service life span of these crates has not been taken into account because of the fact that the popularization degree of the crates is still low. The elements taken into consideration at the time of calculations are shown in Table I-1-13. The 1976 consumption of resin was

Table I-1-12 Demand Estimation of Crates in Iran (1971 - 1985)

		1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
Production of Non-alcoholic Beverages	(million bottles)	334	447	608	800	977	1,080	1,390	1,690	2,110	2,640	3,300	4,120	5,150	6,440	8,050
								Growth Rate: 25%/year								
Number of Crates Necessary[1]	(million cases)	13.9	18.6	25.3	33.3	40.7	45.0	57.9	70.4	87.9	110.0	137.5	171.7	214.6	268.3	335.4
Number of Crates Necessary for Repeated Usage[2] (A)	(thousand cases)	560	740	1,000	1,330	1,630	1,800	2,320	2,820	3,520	4,400	5,500	6,870	8,580	10,700	13,400
Number of Crates in Circulation[3] (B)	(thousand cases)	280	280	740	1,000	1,330	1,350	1,340	2,060	2,490	3,220	3,950	4,520	6,110	7,550	9,600
Number of Crates (A)-(B) Newly Manufactured	(thousand cases)	280	460	260	330	300	450	980	760	1,030	1,180	1,550	2,350	2,470	3,150	3,800
Resin Consumption[4]	(ton)	420	690	390	495	450	675	1,470	1,140	1,550	1,770	2,330	3,530	3,700	4,700	5,800
Production of Alcoholic Beverages	(million bottles)	180	210	270	410	490	540	650	780	930	1,120	1,340	1,610	1,930	2,320	2,970
								Growth Rate: 20%/year								
Number of Crates Necessary[1]	(million cases)	7.5	8.8	11.3	17.1	20.4	22.5	27.1	32.5	38.8	46.7	55.8	67.1	80.4	96.7	116.3
Number of Crates Necessary for Repeated Usage[2] (A)	(thousand cases)	300	350	450	680	820	900	1,080	1,300	1,550	1,870	2,230	2,680	3,220	3,870	4,650
Number of Crates in Circulation[3] (B)	(thousand cases)	150	150	350	450	680	670	700	980	1,070	1,410	1,640	1,850	2,360	2,740	3,410
Number of Crates (A)-(B) Newly Manufactured	(thousand cases)	150	200	100	230	140	230	380	320	480	460	590	830	860	1,130	1,240
Resin Consumption[5]	(ton)	300	400	200	460	280	460	760	640	960	920	1,180	1,660	1,720	2,260	2,480
Total Resin Consumption	(ton)	720	1,090	590	955	730	1,135	2,230	1,780	2,510	2,690	3,510	5,190	5,420	6,960	8,280

Notes: 1) 1 Case = 24 bottles
2) Repeated usage: 25 times/year
3) Life-span of crates: 5 years
4) Unit weight of crates: 1.5 kg
5) Unit weight of crates: 2.0 kg

Source: Iran Almanac 1977
(Figures from 1971 to 1976)

Table I-1-13 Factors Considered in Estimation of Resin Consumption for Crates other than Cola and Beer

Usage	Estimated Production Figures in 1976 (ton)	Contents of Crates (kg)	Yearly Circulation	Share of Plastic Crates (%)	Unit Weight of Crates (kg)	Estimated Resin Consumption (ton)
Fruits and Vegetables for Canning	76,000[1)]	20[2)]	10	30	1.5	200
Vegetables	680,000[3)]	20	10	10	1.5	510
Eggs	190,000	10[4)]	20	20	1.5	300
Milk	60,000	10[5)]	20	30	1.5	140
Total						1,150
Other Use (10%)						120
Grand Total						1,270

Notes: 1) "Production of canned fruits and vegetables" x 2
2) Contents in volume: 40 liters
3) "Production of onion" x 2
4) Numbers of contents of eggs: 200
5) Volume of milk: 40 packs x @1/4 liter

Source: IMDBI Annual Report

estimated at 1,270 tons, and the 1977 consumption of resin was calculated to be 1,400 tons in view of the recent growth in the production of the commodities to be contained in the crates.

(b) Demand forecast

The growth of demand for soft drinks and beer in Iran has been truely remarkable. According to the "Iranian Almanac 1977", 1,080 million bottles of Colas were produced and beer and other alcoholic beverages were produced in 540 million bottles during 1976. The Cola manufacturers and bottlers are highly confident about the future growth of the market. Their target is 320 bottles per person per year which is the actual annual consumption figure registered in Mexico which has climate conditions similar to Iran. Forecasts here have been formulated on the basis of an annual average growth rate of 25% which is an average figure over past five years. Concerning beer, an annual growth rate of 20% is assumed. The process of calculation for forecast formulation is as shown in Table I-1-12. According to this table, the estimated resin demand is 2,690 tons in 1980 and 8,280 tons in 1985.

It is also assumed that the growth of the crates for use other than Coca Cola and beer will grow along with the increase in the agricultural sector production. On this assumption, it is assuemd that the resin requirements will be 1,700 tons in 1980 and 2,200 tons in 1985.

The tool boxes currently used at the assembly lines in automobile factories or electrical appliance manufacturing factories are also assumed to be replaced by plastics boxes in the near future, so that 500 tons is additionally forecast for the year 1985.

(4) Other applications

Bottles and containers made by blow molding:

The growth of demand for plastics containers in Iran has just started. In the major application field of plastics bottles, i.e., liquid detergents, shampoo, cosmetics, etc. in Iran is still largely occupied by non-plastics containers. Plastics bottles are used to contain shampoo and only a small portion of liquid detergents.

Production of shampoo is amounting to 18,000 to 20,000 ton/year in Iran, and the total amount of this production is contained in LDPE bottles to be placed on market.

Including shampoo, cosmetic products are mostly manufactured by foreign companies and marketed in foreign-made containers. There is a great difference even in terms of external appearance and design of the bottles. The LDPE consumption estimated on the basis of shampoo production amount is 1,500 tons. It is possible that about 5% per year of growth will be materialized through import substitution.

Concerning the liquid detergent container bottles, it should be noted that the rate occupied by liquid detergents in the total detergent production in Iran is only about 2% (about 2,300 tons out of total detergent production of about 90,000 tons). Therefore, the HDPE consumption in this application is as small as 200 ton/year. The growth of demand for liquid detergent will be 16% or more which is higher than the growth rate of the overall detergents. The HDPE consumption growth is expected along with this demand increase.

Iran dairy industries is using 250cc milk container by manufacturing the container through their own in-plant HDPE blow molding facilities. The weight per bottle is 20g, and the company is consuming about 1,000 tons of HDPE every year. Milk is not delivered to each house in Iran. It is amply possible that HDPE milk containers can effectively compete with glass bottles; however, competition with PE laminated paper container ("Tetrapak", "Purepak", etc.) which is the major form of milk containers is quite disadvantageous for HDPE bottles. This being the circumstance, the best expected future growth rate will be 5% per year.

In addition to the above, blow molded containers are manufactured in the form of 20-liter kerosene containers, 4-liter anti-freeze containers, and other liquid for household use. Including these productions, it has been estimated that the resin consumption for blow molding process as of 1977 is at approximately 3,300 tons. At present, edible oil is entirely contained in metallic containers (0.5kg to 1kg capacity). In view of the worldwide trend, the containers of the following items will be gradually changed in the plastics bottles, thereby creating new demand:

> Mayonnaise, ketchup, juices, sauces, edible oil, vinegar, cleanser, bleach, anti-freeze, motor oil, industrial chemicals, etc.

The future growth rate of these new demand fields has been assumed as 10% per year. The employment of plastics to make Cola bottles which is consumed in a great quantity, the attitude was quite negative at Mina Glass because of the problems pertaining to the danger of cancer.

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In addition to the above, blow molded containers are manufactured in the form of 20-liter kerosene containers, 4-liter anti-freeze containers, and other liquid for household use. Including these productions, it has been estimated that the resin consumption for blow molding process as of 1977 is at approximately 3,300 tons. At present, edible oil is entirely contained in metallic containers (0.5kg to 1kg capacity). In view of the worldwide trend, the containers of the following items will be gradually changed in the plastics bottles, thereby creating new demand:

Mayonnaise, ketchup, juices, sauces, edible oil, vinegar, cleanser, bleach, anti-freeze, motor oil, industrial chemicals, etc.

The future growth rate of these new demand fields has been assumed as 10% per year. The employment of plastics to make Cola bottles which is consumed in a great quantity, the attitude was quite negative at Mina Glass because of the problems pertaining to the danger of cancer.

The forecast amount of consumption of resin for making blow mold containers is 4,050 tons in 1980 and 5,900 tons in 1985.

Light duty containers made by thermoforming of sheets:

In Iran, this type of containers are used in only small portion of ice cream and yoghurt packaging. The consumption is about 300 ton/year. As egg containers, waste paper pulp is used as the raw material.

This product forms a small market at present in Iran. According to an analysis made in the U.S.A. ("Modern Plastics International" 6,(1)), the ratio between blow molded container and thermoformed container in the packaging field is about 5:2. In Iran, the size of market will be about 2,400 tons by 1985 in such applications as egg containers, butter containers, etc.

Plastic pallets

The Sixth Five Year Plan has the "rationalization of commodity distribution" as one of the major objectives. As part of this effort, the introduction of the "palletization" will be inevitably made soon or later. The materials to form pallets may be wood, plywood, steel, aluminium, paper, etc., plastics being one of the most suitable materials. Iran is particularly suffering from the limitation in the forestry resources, so that the importance of plastic pallets will rapidly grow. Concerning the quantity of the subject cargoes of palletization, the following estimation can be made. According to the "Foreign Trade Statistics of Iran, 1975", the foreign trade cargo amounts to about 12,000 thousand tons. On the other hand, the domestic cargo quantity is estimated at about 50,000 thousand tons, thereby making a total of 62,000 thousand tons. It is assumed here that 50% of these cargoes will be palletized. The capacity per pallet is assumed to be 1 ton, and annual cycle of utilization of one pallet is assumed to be 25. Therefore, the pallet requirements (one pallet measuring 1,100 x 1,100 x 150mm) will be 1.24 million. The weight of one pallet made of HDPE structural foam is assumed to be 23kg. Therefore, a new demand generated in this field will be about 29,000 tons.

Heat insulation materials for small-sized containers used in cold-chain systems

According to Issue No. 153 of the "Iran Economic

Service", the Ministry of Commerce is planning to implement the construction of refrigerated warehouses having a total capacity of 1,200 thousand tons within the period of the Sixth Five Year Plan in order to house fruit, vegetables, milk products, and meat products. It is likely that insulated containers will be employed for the transportation of these products between the points of production and consumption. Plastic foam materials may therefore be employed for the purpose of effecting insulation to these containers (polyurethane or PS foam).

Although the dimensions of the insulated containers vary greatly, it is assumed here for the simplicity of calculation that the containers are totally standardized to be 70kg capacity. This container will require 70mm thickness of insulation. The annual recycling frequency of container is set at 25. Thus, the container requirements will amount to 560 thousand. On an assumption that the employed plastics foam has 0.03 apparent specific gravity, the plastic foam requirements therefore will be about 1,400 tons. Further, the newly constructed warehouses themselves will need insulation materials. Therefore, as a whole, a new demand of approximately 2,500 tons of plastic foam materials is expected.

Plastic corrugated board

Iran Paper Mfg., Co. which was visited during the course of this Survey conducted a market survey on plastic corrugated board several years ago. The survey concluded that no significant domestic demand could be expected in such application fields as fish boxes, fruit boxes, vegetable shipment containers, etc. which are undoubtedly successful fields in developed countries.

There was an enterprise in Iran which started to manufacture and market plastic corrugated boards two or three years ago. Iran Paper Mfg., Co. informed the Survey Team that no product of this plastic corrugated board manufacturing company seemed to be marketed at present. It is therefore likely that this particular item does not hold much future prospect in Iran.

Plastic nets

Another company visited by the Survey Team, Varzide-kar Co. was producing 0.6 ton/day of plastic nets on an experimental basis by using production

facilities imported from Chisso Engineering K.K. of Japan. The products are for wrapping fruit, vegetables, etc. This product seems to have a potential market in Iran.

1-2-2 Agricultural-use materials

As an important market outlet for plastics products in Iran, the agricultural sector of the country must be placed under careful attention. The expected demand for plastics products generated from the agricultural sector seems to include the following points some of which fall under governmental administrative matters for overall decision as to the implementation:

(a) Irrigation work is now positively progressed for an ultimate goal of establishing self sufficiency in the supply of food in Iran. The dam-based irrigation work has now taken shape as a result of the implementation of projects envisaged within the framework of the Fifth Plan. At present, the work to be done is to reinforce the branch lines and terminal facilities of the irrigation systems. A great amount of plastic pipes will be needed for the substantialization of the irrigation terminal water ways and water drainage systems for agricultural land improvement.

(b) The conventional irrigation network largely based on open gutters is not capable of freely adjusting the water flow amount. Therefore, the effective utilization of water is estimated to be as low as 40% or less. In the case of an installation calling for an enormous amount of construction and facility cost such as a dam-based irrigation system, the utilization burden of water becomes very high. Therefore, it becomes absolutely necessary to enhance the effective utilization rate of water to a maximum extent. By installing a system of piped irrigation, the water utilization can be enhanced up to 60% to even 80%. Of course, this problem is one of the agro-economic issues of the country. This problem is important because the advantage gained by increasing the irrigable land by using the same amount of water will be significant in view both of the agro-economical improvement and overall conservation of the natural resources.

(c) A great amount of agricultural products are presently discarded wastefully because of insufficiency in the distribution system. This is particularly true in the case of unprocessed fresh food products for daily consumption. Approximately 30% of the yield is thus lost during distribution. It is therefore extremely necessary to improve the quality of packaging at the time of shipment. Full utilization of plastics materials is strongly desired in this respect.

(d) In Iran, capital intensive agriculture is still to be developed. The income of agricultural workers in the water-abundant area along the coast of Caspian Sea will be improved to a level comparable to that of future industrial workers, when the grade and quality of the crops will be improved, and arrangement will be made in such a way that a year-round stable profit will be made on the basis of steady and abundant harvest.

There is a certain limitation in the availability of agricultural land along the coast of the Caspian Sea. This limitation calls for the development of intensive agricultural operations in this respect, it seems necessary to introduce modern cultivation agriculture based on tunnel houses by utilizing plastics materials.

(1) Pipes for irrigation and under drainage systems

(a) Current status

In the Fifth Five Year Plan, it was planned that the following will be completed by the end of the plan period as shown in Table I-1-14.

- The area under irrigated crops shall be increased by 380,000 ha.
- The coverage of main irrigation networks shall be increased by 843,000 ha.
- The coverage of branch irrigation networks shall be increased by 595,000 ha.

The plastics pipes will be used for the branch irrigation networks, thereby showing a potential demand for pipes to cover 595,000 ha of irrigation. If all the requirements are covered by PVC pipes, the demand extent will be as follows (Ref. Table I-1-15):

595,000 x 0.375 ton/ha ÷ 5 years
≒ 44,600 ton/year

595,000 x 0.2 ton/ha ÷ 5 years x 1/4
≒ 5,900 ton/year

Total: 50,500 ton/year

On the other hand, it has been estimated that the demand for PVC during 1977 was approximately 65,000 tons, of which 34% or 22,000 ton/year was consumed in the form of PVC pipes. In this case, the PVC pipes were mainly used in the form of conduit pipes and as agricultural materials. As will be mentioned later, the demand for conduit

Table I-1-14 Estimate of Available Water by Source and Type of Use based on the Fifth Plan

Source and Type of Use	Unit	End of Fourth Plan	During Fifth Plan	End of Fifth Plan
Water supply for cities and industry				
Total urban population	million persons	13.2	3.8	17
Total water used by cities and industry	million m^3	690.0	268.0	958
Supplied by the private sector	million m^3	768.0	487.0	1,255
City population using water supplied by public sector	million persons	8.9	8.1	17
Agriculture				
Area under irrigated crops[1)]	1,000 ha	3,500	380.0	3,880
Water needed for irrigated crops, in a year	million m^3	34,000	4,800.0	38,800
Water supplied from irrigation projects of public sector	million m^3	10,790	3,970.0	14,760
Area under cultivation within the coverage of irrigation projects of public sector	1,000 ha	688	296.0	984
Coverage of main irrigation networks, 1 and 2	1,000 ha	263	843.0	1,105
Coverage of branch irrigation networks, 3 and 4	1,000 ha	90	595.0	685
Coverage of improved traditional networks	1,000 ha	-	100.0	100
Surface-water control and supervision over water resources				
Annual average of total water controlled through construction of cistern dams	million m^3	16,360	9,920.0	26,280
Installed capacity of water power plants	1,000 kw	792	1,020.0	1,812
Ratio of installed capacity of hydro-power plants to thermal power plants	%	38	-	30
Annual average of nationalized water	million m^3	-	6,000.0	6,000

Source: Report on the Fifth Plan Program
Iran Almanac 1977 p. 212

Note: 1) Total area under cultivation at the end of the Fourth Plan was approximately 75,000 hectares. An increase to 150,000 hectares is planned by the end of the Fifth Plan.

Table I-1-15 Estimation of Plastics Pipe Consumption for Agricultural-use

	Piping Method	Pipe Requirement		
			per ha	ton/ha
Irrigation	Semi-stationary Method Applied for extensive area	Main Branch	ø75mm x 100m	0.48
		Tributary Line	ø200mm x 25m	
		Main Branch	ø50mm x 100m	0.27
		Tributary Line	ø150mm x 25m	
		Average		0.375
Under Drainage	Stationary Method For the purpose of soil improvement by desalting	Lateral Drain	ø50mm x 100m x 3	0.20
		Collecting Drain	ø75mm x 100m	

Source: Yachiyo Engineering

Note: Unit Weight of PVC Pipe

Nominal Diameter (mm)	Irrigation (kg/m)	Under Drainage (kg/m)
50	1.1	0.41
75	2.2	0.82
150	6.7	
200	10.1	

pipes is estimated to be about 10,000 tons, for agricultural purposes, 9,000 tons was consumed and 3,000 tons for other applications.

If it is assumed that the branch irrigation network installation did progress as planned, the utilization rate of plastics pipes for agricultural purpose must have been only about 18% (9,000/50,500) of the potencial demand, because the plastic pipes of other than PVC material was produced in an extremely small amount.

(b) Demand forecast

The irrigation plan to be envisaged in the Sixth Five Year Plan is expected to be 119,000 hectare per year as the lower limit which was the average annual irrigation area in the Fifth Plan.
On the other hand, the upper limit is set hypothetically on the basis of the estimation made through the present local survey that the Sixth Plan will implement the substantialization of branch irrigation network covering 809,000 hectare which corresponds to the total irrigation area to be covered by the dams which completed by the end of the Fifth Plan.

It is further planned by the Sixth Plan that the agricultural items which showed a 5% per year growth rate during the Fifth Plan and which showed about 3% per year of growth rate on average over the past decade shall be increased up to 5% to 7% during the period of the Sixth Plan. Therefore, the irrigation area which is vitally connected to such an improvement plan cannot be smaller than that covered by the Fifth Plan.

Therefore, it is assumed that the coverage of the branch irrigation networks planned by the Sixth Plan should be within a range from 595,000 hectare. In other words, it is assumed that 119,000-162,000 hecatre per year on average shall be the target area figure for 1980.

If we take the increasing rate of irrigation area to be 5%, which is the smallest figure assumed in the Sixth Plan (5-7%/year), we obtain the figure of 152,000-206,800 ha/year for 1985.
On the basis of the above-mentioned increase of irrigation area, we estimated the potential and the actual amount of demand for plastic pipe, which is indicated in Table I-1-16.
We used figures of Table I-1-15 as unit consumption of pipe per hectare.

Underdrainage pipe is used for the purpose of

Table I-1-16 Demand Forecast for Pipes for Agricultural Use in Iran (1980, 1985)

		Irrigation Area (ha/year)	Potential Demand (ton/year)[1]			Demand which should be materialized	
			Irrigation Pipe	Under-drainage Pipe[2]	Total	(ton/year)	Rate of Materialization (%)
1977		119,000	44,600	5,900	50,500	9,000	18
1980	Minimum	119,000	44,600	5,900	50,500	11,000	22
	Maximum	162,000	60,700	8,100	68,800	15,100	
	Average				59,700	13,100	
1985	Minimum	152,000	56,000	7,600	63,600	19,100	30
	Maximum	206,800	77,500	10,300	87,800	26,300	
	Average				75,700	22,700	

Notes: 1) Applied by using unit material consumption figures in Table I-1-15

2) On the basis that pipe is used one fourth of the total area under irrigation.

soil-improvement by removing salt from newly cultivated land.

The potential demand for pipes is estimated on an assumption that the cultivated area is 1/4 of total area.

It is assumed that the ratio of actual demand against potential demand for agricultural-use pipe increases gradually, and the following figures are obtained.

	(%)
1977	18
1980	22
1985	30

Table I-1-16 shows, the amount of demand for plastic pipes by taking the average figure between the upper limit and the lower limit as follows:

	(ton/year)
1980	13,100
1985	22,700

(2) Materials for intensive agriculture

At present in Iran, the augumentation of agricultural operation is implemented by newly developing agricultural lands and also integrating small-holdings of the lands. Another approach to increase the agricultural productivity is to introduce the intensive agricultural operation.

The agricultural operations now conducted along the coast of the Caspian Sea has an ample conditions to induce the intensive agricultural techniques in order to increase the productivity per unit land area.

The important fields of potential demand in this respect are as follows:

- Green-house cultivation operation by employing tunnel green houses using plastic sheets
- Wrapping of fruit while growing
- Cultivation of high-grade cash crop vegetables, introduction of water-fed cultivation technique, etc.

It should also be noted here that the production of high unit-cost agricultural products by this intensive agricultural operation will at the same time facilitate the introduction of modern container system, packaging system, etc. into the transportation system of the products.

However, the trend of the demand for plastics materials for use in the intensive agricultural operation is entirely unknown at the present stage.

1-2-3 · Civil engineering and construction materials

The prevailing structure of buildings in Iran consists of steel columns and beams and brick or hollow brocks to form the floors, walls, and cealings. This type of structure takes up the majority of the buildings in this country. The outer wall is for the most part constructed by flagstones, tiles, or mortar. Many houses are simply constructed with brick outer walls. This Iranian method of construction consisting of steel skeleton fitted with bricks is peculiar to this country and is very different from the traditional construction methods employed in the neighbouring Mideast countries. However, this method was largely introduced after World War II. It is most likely that this method was developed from the traditional structure which consisted of wooden skeleton fitted with bricks. It is true, however, that there is no part in such a construction structure for plastics materials to be widely applied. This is also true with other types of building structures in the rest of the world as far as the major parts of the buildings are concerned.

a) Concerning the interior finish materials, internationalization is a conspicuous trend all over the world. Iranian buildings are not exceptions. Particularly in the case of flooring materials, a rapid change is taking place from traditional marble, terrazzo, and other stones to synthetic fiber tickets or plastic tiles. Application of vinyl sheets onto walls and ceilings is becoming popular.

b) Plastic pipes are extensively used in construction in developed countries; however, in Iran, the only pipes used seem to be the PVC pipes employed as indoor conduit pipes. For water feeding and drainage, no PVC pipes seem to be used. However, this field is highly potential as a future market outlet for plastics materials.

c) No plastics material is currently employed in civil engineering field. Concerning the water buffle board, the current demand extent is out of question because number of projects for dam construction, elevated rail-

way construction, elevated motorway construction, etc. is still small. The development of demand generated from industries such as construction machinery manufacturing including conveyor belts for industrial plants is important problem to be solved in the future. However, at the present stage, the development of these fields of demand is still inconspicuous. No water prevention sheets for aqueduct are currently employed. It is therefore deemed that no significant demand will come out from these fields.

(1) Indoor conduit pipes

(a) Current status

Conduit pipes are one of the positively consumed construction materials in Iran at present.

Housing construction planned by the Fifth Plan amounts to 1,050,000 houses with an annual average construction target of about 200,000 houses. Of this amount, it was expected that private industries in the urban areas will construct 550,000 houses (average 110,000 houses per year); however, the actual result during 1974 was 72,000 houses, and in 1975 about 85,000 houses. This means that the actual achievement has been falling behind the planned target. On the basis of the actual growth rate, it is estimated that the housing construction completion during 1977 should have been 118,000 houses.

Concerning the public housing projects, the construction is largely pre-fabrication based, supported by positively introduced overseas technology. Therefore, the public housing projects are excluded from the market for Iranian domestic plastics materials. Also, in rural areas, the housing construction will be made in accordance with the traditional method of building technique, thereby calling for no plastics construction materials. On these assumptions, it is safe to assume that the potential demand for conduit pipes during 1977 was about 15,000 ton/year (118,000 houses x 130kg/house*).

Since the popularization rate of indoor conduit pipes is considerably high, it is assumed that the actual installation rate is somewhere slightly below 70%. Therefore, the actual demand during 1977 may be estimated as 10,000 ton/year approximately (15,000 ton x 0.7).

Note: *: Refer to Table I-1-17.

Table I-1-17 Estimation of Unit Consumption of Pipe for Construction Equipment (Iran, Japan)

	Japan	Iran	Remarks
Construction Specification			
Total Construction Area (m^2)	50 ~ 70	179 ~ 218	
Number of Storey (F)	3 ~ 10		
Number of Bathrooms and Washrooms	-	2 ~ 3	
Consumption Amount of PVC Pipe			
For Water Supply (kg/unit)	15.5 ~ 17.1	32	Depend upon the number of bathrooms
For Drainage (kg/unit)	39.6 ~ 70.6	110	
For Hot Water Supply (kg/unit)	8.1	8	
For Electric Wire Conduit Pipe[1] (kg/unit)	70.4	130	

Source: Yachiyo Engineering

Note: 1) It is Assumed that the amount of conduit tube to be used is proportional to construction area.

As they use 200V-system in Iran (100V-system in Japan), Iranian wire-section is estimated as much as 2/3 of that in Japan.

(b) Demand forecast

As shown in Table I-1-18, the housing construction projects involved annual average of 200 thousand houses in the Fifth Plan, followed by annual average of 700 thousand houses up to 1992.

If it is assumed that the scope of plastics-based construction materials is limited to the houses which are built by private sector in the urban areas, the following calculation becomes valid, because the Sixth Five Year Plan (1978 - 1982) envisages construction of 850,000 houses (170,000 houses/year) in this field.

1980: 22,000 ton/year

In the same manner, the Seventh Five Year (1983 - 1987) envisages 1,320,000 houses (264,000 houses/year) for new construction.

1985: 34,300 ton/year

However, a great extent of pre-fabricated houses are included in this Plan, and overseas housing construction technology is intended to be largely introduced. Therefore, this pre-fabricated house portion is assumed to be 75% of the potential demand
as follows:

Potential demand for 1980: 16,600 ton/year

Potential demand for 1985: 25,700 ton/year

Since the public sector housing construction projects largely involve pre-fabricated houses as main design, and also in view of the fact that the scale of the projects is small, this Sector has been excluded from the scope of estimation.

As it is estimated that the actual demand during 1977 was 70% of the potential demand, it is further estimated that the actual demand rate over the potential demand in 1980 and 1985 are estimated to be 73% and 80% respectively. Therefore, the following calculations may be conducted:

Prospective demand in 1980: 12,100 ton/year

1985: 20,600 ton/year

Table I-1-18 The Number of Construction of Houses during 1973/74 - 1992/93 in Iran by Type

(Unit: 1,000 houses)

			Total	Prefab-ricated	Precast Steel Frame	Steel Frame, Brick	Steel Rein-forced Brick	Stone Worked	Wooden	Wooden, Brick	Others
Urban District	Public Sector	1973/74 - 77/78	260	52	130	65	13	-	-	-	-
		78/79 - 82/83	400	200	133	67	20	-	-	-	-
		83/84 - 87/88	620	465	62	46	16	-	31	-	-
		88/89 - 92/93	970	727	97	48	25	-	73	-	-
	Private Sector	1973/74 - 77/78	550	55	137	247	55	28	-	28	-
		78/79 - 82/83	850	212	278	212	85	21	21	21	-
		83/84 - 87/88	1,320	590	400	150	68	10	68	34	-
		88/89 - 92/93	2,030	1,218	509	150	51	-	102	-	-
Rural District	Public Sector	1973/74 - 77/78	40	-	-	-	28	8	-	4	-
		78/79 - 82/83	88	9	-	-	53	9	13	4	-
		83/84 - 87/88	193	39	-	-	96	20	28	10	-
		88/89 - 92/93	425	127	-	-	214	21	42	21	-
	Private Sector	1973/74 - 77/78	200	-	-	-	40	20	20	20	100
		78/79 - 82/83	440	22	-	-	110	44	44	44	176
		83/84 - 87/88	970	97	-	-	388	48	97	48	292
		88/89 - 92/93	2,144	536	-	-	856	108	215	108	321

Source: Ministry of Economic Affairs of Iran

(2) Indoor water supply and drainage pipes

(a) Current status

PVC pipes are hardly employed for these applications in Iran at present. There are several reasons for the low rate of popularization of PVC pipes. The first reason is the distrust in PVC pipes. The plumbing enterprises replied to the questions asked by the Survey that the actual employment rate of PVC pipes in their work is less than 2% or almost none. The actually confirmed example was the plumbing used for the sinks installed at the chemical laboratory of NIOC. At present, almost no plumbers in Iran have sound knowledge concerning the standards of PVC pipes, especially in terms of the difference between the water feeding pipes and conduit pipes or specifications of various fittings.

There were a number of plumbers who stated that they could not employ PVC pipes because no stipulation is made as to the employment of PVC pipes in specification documents issued by construction design offices. The potential demand for PVC pipes generated from the estimated 177,000 houses in 1977 concerning the urban area housing construction (private housing construction: public housing construction = 2 :1) is as follows:

Water supply:	5,700 ton/year
Hot water supply:	1,400 ton/year
Drainage:	19,400 ton/year
Total:	26,500 ton/year

This potential demand has not been materialized into actual demand. In addition, unless some action be taken, it will remain as a potential demand forever.

(b) Potential demand forecast

(i) Indoor water supply pipes

It is possible to expect potential demand covering all the housing constructions made in the urban areas:

1980:(850,000 + 400,000) ÷ 5 + 250,000 houses/yea

250,000 x 0.032 = 8,000 ton/year

1985: (1,320,000 + 620,000) ÷ 5 = 388,000 houses/year

388,000 x 0.032 = 12,400 ton/year

The above figures cover only the indoor portion of the application. Actually, the potential demand for application also as the city water intake pipes to be installed outdoors will constitute a great extent of potential demand. However, estimation on this point is extremely difficult.

It should be noted here that a considerable extent of technical and skill training is required and substantialization of parts supply is indispensable if this potential demand is to be turned into actual demand. First of all, the standards and inspection systems must be completed, and the training of skilled workers must be undertaken. In Japan at present, the cost of PVC pipes is approximately 1/2 of steel pipes, and the installation cost is slightly lower than that of comparable steel pipes. Therefore, if reliable materials and trustworthy installation workers are lined up, the users will most likely welcome the employment of PVC pipes.

Concerning the materials, coloring identification should be made in order to distinguish water pipes from conduit pipes. The markings of the manufacturers must be indicated in all the products in order to facilitate. It is also desired that the users be informed thoroughly as to the simple method of inspecting the quality of the pipes. It is recommended, however, that the actual implementation of such provisions be conducted after 1985, and in the meantime, the experimental installation of the pipes be carried out.

(ii) Hot water feeding pipes

1980	1,300 ton/year
1985	2,100 ton/year

It is necessary to use heat-resistance PVC pipes to produce hot water feeding pipes. It is important that clear color differentiation be made to all the pipes in accordance with the application, i.e., city water feeding, drainage, hot water feeding, etc. in order to avoid misapplication. Although the demand for hot water pipes may be small,

these should be prepared for ready availability as one of the construction materials.

It is also recommended that heat resistance PVC pipes for hot water feeding in package with heat insulation be developed in order to propagandize correct heat maintenance methods in order to contribute to an overall energy saving of the country. This provision, however, will not bring about much advantages in the cost and profit. The actual implementation of this system should also be considered after 1985.

(iii) Indoor water drainage

As it is possible to expect the demand for this item will be generated throughout the urban area as in the case of water feeding pipes, the subject houses for 1980 potential demand estimation is as follows:

(850,000 + 400,000) x 1/5
= 250,000 houses/year

Therefore, the potential demand figures will be as follows:

1980: 250,000 x 0.11 = 27,500 ton/year

1985: 388,000 x 0.11 = 42,700 ton/year

The indoor water drainage pipe application involves the highest extent of potential demand for plastics pipes. In addition, the requirements for fittings are comparatively small in the case of this product, so that the production can rather easily cope with the demand. Further, the presently employed pipes are high-cost cast iron pipes, etc., and the users are experiencing perpetual problems of plugging of the drainage pipes caused mainly by poor connecting technique employing lead caulking. Therefore, if proper PVC-based drainage system is popularized, the effects on demand generation would be great.

Here again, it is necessary to gain the trust from the users as to the function of the plastics drainage pipes in the same manner as the case of water feeding pipes. Because drainage pipes involve much more simple technique than water feeding pipes, it is strongly desired that positive action be taken for further popularization of the

system.

Although no employment is made at present, the actual demand rate by 1980 is estimated at 20%, and 30% by 1985. If the demand is developed on these targets, the actual demand will be as follows:

Actual demand, 1980: 27,500 ton x 0.2
= 5,500 ton

Actual demand, 1985: 42,700 ton x 0.3
= Approx. 12,800 ton

(3) Flooring plastic tiles, floor rugs (moguette), and carpets

(a) Current status

(i) Conventionally, the flooring materials for Iranian houses mainly consisted of stones such as marble, terrazzo, ceramic tiles, etc. However, substitution with various rugs (moquette) made of machine-woven synthetic fibers became popular. It is assumed that about 28% of all the rooms except for utility rooms of the urban housing constructed during 1976 was covered by the synthetic fiber rug (moquette) as follows:

1976: Housing completion by private sectors in urban areas (estimated)

Potential demand:

Room area ($218m^2$/house x 0.65) x 100,000 houses = Approx. 14.2 million m^2

Actual consumption:

Actual demand for flooring rug (moquette):
4 million m^2

Therefore, the following will ensue:

Rug convered area/room area = Approx. 28%

(ii) Plastic tiles are also used for floors of kitchen, bathroom, or office floors. The potential demand for 1976 may be estimated as follows on an assumption that the consumption rate per house is $218m^2$/house x 0.2:

$218m^2$ x 0.2 x 100,000 houses = Approx 4.4 million m^2

The actual demand for plastic tiles is estimated as follows:

If the popularization rate is the same as that of synthetic fiber rug, i.e., 28%, and the tiles are used only for kitchen floors, the per house utilization rate should be reduced by 2/3. Thus, the following will ensue:

4.4 million m^2 x 2/3 x 0.28 = 0.82 million m^2

Further on an assumption that the specific gravity of plastic tile is 1.8, thickness is 2mm, and plastic blending ratio is 20%, the actual demand will be calculated as follows:

0. 82 million x 1.8 x 0.002 x 0.2
= Approx. 600 ton

(b) Demand forecast

(i) Plastic tiles

If it is assumed that the estimated 1977 actual demand, i.e., 600 tons, will grow in proportion to the increase of the number of the housing construction every year, the following estimate can be made:

1980: 600 ton x 127,600/118,000 = Approx. 650 ton

1985: 600 ton x 146,000/118,000 = Approx. 750 ton

(ii) Flooring rug (moquette) and carpets

If it is assumed that the 1977 actual demand, i.e., 4 million m^2, will grow in proportion to the number of housing construction every year, the following estimate can be made:

1980: 4 million m^2 x 127,600/118,000
= Approx. 4.3 million m^2

1985: 4 million m^2 x 146,000/118,000
= Approx. 5.0 million m^2

2. Polyolefins

2-1 Supply situation

2-1-1 Imports of olefinic polymers into Iran

Table I-2-1 gives the material-wise importation amount from 1973 to 1976 according to the Foreign Trade Statistics of Iran. Table I-2-2 also shows the figures of exportation to Iran made from Japan, the U.S.A., and European countries from 1969 up to 1976 based on the trade statistics of these exporting countries.

Table I-2-1 Imports of Polyolefins into Iran (1973 - 1976)

(Unit: ton)

	PE	PP
1973/74[1)]	21,404	4,625
1974/75	16,381	6,518
1975/76	32,571	11,011
1976/77	66,561	13,724

Source: Trade Statistics of Iran

Note: 1) Calendar year of Iran from March 21 to March 20

Table I-2-2 Trend of Polyolefins Imports from Major Exporting Countries into Iran (1969 - 1976)

(Unit: ton)

	PE	PP
1969	9,937	124
1970	13,062	997
1971	13,454	1,674
1972	22,471	1,720
1973	31,549	3,733
1974	19,324	3,044
1975	43,851	7,647
1976	50,506	8,296

Source: Trade Statistics of Japan, U.S.A., W. Germany, France, Italy, U.K., Netherlands, Hong Kong, and Singapore

2-1-2 Supply source of olefinic polymers

Besides the exporting countries shown in Table I-2-2, some other countries like East European countries, Israel, Turkey etc., also export olefinic polymers to Iran, of which amount shares 20 to 30% of total import in Iran. Table I-2-3 shows the supply source of olefinic polymers in 1975 and 1976 according to Iranian Foreign Trade Statistics. Table I-2-4 gives the trend of export market share in olefinic polymers of major exporting countries based on the trade statistics of these countries.

Table I-2-3 Supply Source of Polyolefins

(Unit: %)

	PE		PP	
	1975/76	1976/77	1975/76	1976/77
Japan	56	43	39	38
U.S.A.	4	11	3	8
U.K.	-	-	4	2
W. Germany	13	15	19	16
France	10	2	-	4
Italy	3	8	6	7
Netherlands	2	5	1	2
Austria	-	-	14	13
Finland	3	9	-	-
Israel	-	-	9	-
Others	9	7	5	10
Total	100	100	100	100

Source: Trade Statistics of Iran

Table I-2-4 Trend of Market Share in Polyolefins imports into Iran from Major Exporting Countries

(1) PE

(Unit: %)

	Japan	U.S.A.	W. Germany	France	Italy	U.K.	Nether-lands	Hong Kong	Singa-pore	Total
1969	17.4	12.8	66.6	2.0	1.3	-	-	-	-	100
1970	30.9	11.1	41.4	2.8	2.5	1.5	9.8	-	-	100
1971	64.3	4.1	26.3	4.4	0.9	-	-	-	-	100
1972	67.1	1.9	19.5	2.0	0.3	9.2	-	-	-	100
1973	33.4	16.3	26.4	21.5	-	0.8	1.5	-	-	100
1974	52.4	7.7	27.7	4.3	-	0.4	2.4	-	5.0	100
1975	73.5	0.7	18.1	7.2	-	0.1	0.5	-	-	100
1976	55.3	4.6	28.9	5.1	-	0.6	5.4	-	-	100

Source: Trade Statistics of Japan, U.S.A., W. Germany, France, Italy, U.K., Netherlands, Hong Kong, Singapore

(2) PP

(Unit: %)

	Japan	U.S.A.	W. Germany	France	Italy	U.K.	Nether-lands	Hong Kong	Singa-pore	Total
1969	64.7	31.2	-	-	4.0	-	-	-	-	100
1970	41.0	15.9	15.1	-	5.9	22.1	-	-	-	100
1971	34.8	17.9	14.2	-	30.2	3.0	-	-	-	100
1972	47.8	10.2	9.3	-	13.4	19.3	-	-	-	100
1973	44.2	52.5	1.2	-	-	0.1	0.6	1.3	-	100
1974	85.8	14.1	-	-	-	0.1	-	-	-	100
1975	75.5	-	23.7	-	-	0.8	-	-	-	100
1976	64.9	5.6	25.2	2.8	-	1.4	-	-	-	100

Source: Trade Statistics of Japan, U.S.A., W. Germany, France, Italy, U.K., Netherlands, Hong Kong, Singapore

2-1-3 Price trend

Table I-2-5 shows the average figures of C&F prices and FOB prices quoted by the exporting countries on olefinic plastics materials from 1969 to 1976. No material-wise stipulation is made in the Iranian official trade statistics up to 1972, the prices from 1973 onwards alone stipulated in this table.

The import prices kept falling until 1972 which is likely to be one of the reasons for the increase shown in the demand during the same period. The prices picked up slightly during 1973 as a result of the price protective measures taken by exporting countries in the form of export cartel formation, etc. During 1974, the prices of plastics materials actually increased along with the hike of oil price. However, this sudden skyrocketing of the plastics materials prices should be deemed as a temporary phenomenon. In 1975, the prices began to fall again. With a slight uptrend in 1976, the trend began to show another fall in 1977 because of the effects of the global oversupply.

Table I-2-5 Trend of Import Price of Polyolefins into Iran (1969 - 1976)

(Unit: US$/ton)

	PE		PP	
	(A)[1]	(B)[2]	(A)	(B)
1969	283	-	392	-
1970	271	-	351	-
1971	235	-	325	-
1972	203	-	293	-
1973	371	559	528	605
1974	859	1,050	932	1,022
1975	465	677	459	707
1976	637	712	669	772

Note: Exchange rate: 1973, 1974 R67.63/US$
1975 R69.28/US$
1976 R70.62/US$

1) (A): Average FOB price of Japan, U.S.A., W. Germany, France Italy, U.K., Netherlands, Hong Kong, and Singapore

2) (B): C&F price of Trade Statistics of Iran

2-1-4 Future supply situation

Production of polyolefins by IJPC is scheduled to be started toward the end of 1979, but commercial production will begin at the begining of 1980.

Production capacities for polyolefins are as follows:

	(1,000 ton/year)
LDPE	100
HDPE	60
PP	50

2-2 Demand situation

2-2-1 Current demand situation

Table I-2-6 shows amount of polyolefins consumption by application in Iran in 1977 in terms of comparison with European countries, the U.S.A., and Japan.

As in Table I-2-6 shows, a comparative study among Japan, the U.S.A., and European countries indicates a particular point that the item "others" occupies a large portion in the demand structure in all these countries.

Applications which are included in the item "others" are indicated below:

LDPE	Liminate
	Electric wire and cable
	Pipe
HDPE	Stretched tape
	Monofilament
	Pipe
PP	Monofilament
	Fiber
	Blow-molded container

(1) LDPE

In the consumption of LDPE, the blown film consumption is overwhelmingly high. The film consumption takes up 71% of the total LDPE consumption, followed by 16% occupied by injection molded products, and 15% occupied

Table I-2-6 Demand Structure of Polyolefins in Iran (1977) and its Comparison with Other Countries

(1) LDPE

(Unit: ton, %)

	Iran (1977)		Japan (1976)		U.S.A. (1976)		West Germany (1974)		France (1975)	
	Quantity	Share	Quantity	Share	Quantity	Share	Quantity	Share	Quantity	Share
Film	32,000	71	335,830	55	1,472,000	62	520,000	74	260,000[1)]	65
Injection Molded Products	7,200	16	39,005	6	259,000	11	60,000	9	60,000	15
Blow Molded Products	2,300	5	21,047	3	23,000	1	24,000	3	10,000	3
Others	3,500	8	217,932	36	635,000	26	102,000	14	67,000	17
Total	45,000	100	613,814	100	2,389,000	100	706,000	100	397,000	100

Source: Iran: Estimate by Survey Team
Other Countries: World Plastics Industry 1977/78 (Plastics Age)

Note: 1) Including coating

(2) HDPE

(Unit: ton, %)

	Iran (1977)		Japan (1976)		U.S.A. (1976)		West Germany (1975)		France (1975)	
	Quantity	Share	Quantity	Share	Quantity	Share	Quantity	Share	Quantity	Share
Film	2,300	12	33,291	11	43,000	3	-	-	-	-
Injection Molded Products	12,800	64	96,946	32	291,000	23	94,000	34	58,000	43
Blow Molded Products	2,600	13	67,905	22	473,000	38	131,000	48	65,000	48
Others	2,300	11	106,776	35	444,000	36	51,000	18	12,000	9
Total	20,000	100	304,918	100	1,251,000	100	276,000	100	135,000	100

(3) PP

(Unit: ton, %)

	Iran (1977)		Japan (1976)		U.S.A. (1976)		West Germany (1975)		France (1975)	
	Quantity	Share	Quantity	Share	Quantity	Share	Quantity	Share	Quantity	Share
Film	1,100	7	136,201	25	82,000	8	14,500	12	5,000	7
Woven Bag	10,000	64	54,458	10	320,000[1)]	32	25,000[2)]	21	9,000	13
Injection Molded Products	3,100	20	228,251	43	425,000	42	42,400	36	40,000	57
Others	1,400	9	117,859	22	181,000	18	36,700	31	16,000	23
Total	15,600	100	536,769	100	1,008,000	100	118,600	100	70,000	100

Notes: 1) Including fiber

2) Including tape, twisted yarn

by blow molded products as of 1977. LDPE covered electric wires and cables, as well as laminated products are presently totally imported in the form of finished products due to lack of domestic production.

(a) Film

Film is most commonly used for general light weight packaging of garments, textile products, foods, miscellaneous goods, etc. Although a film of large lay-flat width of 6m to 10m is being produced, this product seems to be not yet used for agricultural application.
It has been reported that experiments have been going on since four to five years ago concerning the application of plastic films for agricultural use. Concerning heavy duty bags, the finished products are being imported because of the inferior quality and inadequate prices of domestic products. In Iran, the most popular capacity of heavy duty bags is 50Kg, thereby creating the strength problems. Therefore, the Iranian market for LDPE heavy duty bags is virtually small.

(b) Injection molded products

The major markets for this type of products are small household goods and toys. In this field, many products are competing with HDPE.

(c) Plastic containers

The major outlets for this type of products are household food containers, small bottles for pharmaceutical and medical application, detergent bottles, vinegar containers, and other types of small bottles.

(d) Other fields

Another major market outlet for LDPE is thin-walled small-diameter pipes for use as gardening hoses during winter.

(2) HDPE

As far as HDPE is concerned, the rate of injection molded products is extremely high. Almost 64% of the total demand for HDPE consists of this type of products. The second highest rate (13%) is occupied by containers, followed by blown films (12%). These three categories of products constitute the major market outlets for HDPE products. The reason for the extremely high rate of injection molded products in comparison to industrially developed countries is the fact that no PP is used at all for producing outdoor-use crates due to severe

climate conditions. The reasons for the low rate of blow molding in comparison to the developed countries is chiefly that the small bottles for detergents, shampoos, bleach, etc. are not as yet popularized. This is due not only to the smaller amount of consumption of liquid detergents than in the case of developed countries, but also because of the fact that for the most part the detergents, shampoos, bleach, etc. are being imported from Europe and the U.S.A. in the form of completely finished products.

Consumption of HDPE film bags is now increasing rapidly by substituting paper bags and LDPE film bags to some extent in such uses as garbage bags, shopping bags, etc. The use of HDPE film bags in these areas is now becoming highly fashionable. It is estimated that HDPE bags occupy 7% of the total.

(a) Injection molded products

It is estimated that the present market consists of 70% for household goods and 30% for soft drinks and beer crates. This area, however, is going to be one of the most prospective market outlets in view of the fact that containers for vegetables, eggs, milk, and bread are conspicuosly growing in recent years.

(b) Blow molded products

The present market consists mainly of household preserve containers and liquid containers to stock up jam, jelly, suger, salt, dried fruit, etc. altogether occupying probably more than 80% of all the consumption of bottle products. Other market outlets are kerosene containers and toys. Although there is a potential demand for HDPE bottles to contain chemicals, anti-freeze solutions, oil, etc. the demand in these is still under developed. Large tanks of more than 100 liter capacity is not used at all in Iran.

(c) Film

Because of high tensile strength, impact strength, and rigidity, high molecular weight HDPE film is being employed as garbage bags and shopping bags, thereby replacing paper bags and some LDPE film bags. The use of HDPE film bags in these areas is becoming highly popular in recent years. In view of the fact that paper resource is not abundant in Iran, HDPE film bags is expected to show a steady growth in the future.

(d) Other products

Irrigation pipes made of HDPE are now beginning to be used in construction. This field is highly prospective. As far as flat yarn products are concerned, these are totally occupied by PP.

(3) PP

In this field, woven bags is overwhelmingly higher in market share than other types of products. About 64% of the market is taken up by woven bags, followed by injection molded products (20%), and films (7%). An abnormally high rate of woven bags presents a considerably inbalanced demand structure. The reason for this is the two-fold. The first reason is that, in comparison to developed countries, the rate of PP utilization in the total polyolefine blow molded product area is low, and the second reason is that no CPP or OPP film is domestically produced in Iran because of still extremely small size of the market.

(a) Woven bags

Although woven bags are used for packaging agricultural products (rice, wheat, potatoes, etc.), sugar, salt, carpets, etc., the potential demand in this field is still extremely high due to the fact that the utilization rate of linen bags is still high. As fertilizer bags, imported woven bags are currently employed entirely because of quality and price problems presented by the Iranian domestic products.

(b) Injection molded products

Because of severe climate conditions, all the crates for containing soft drinks and beer bottles are made of HDPE. PP is only partly used in producing household goods in such cases where rigidity or heat-resistance characteristics are particularly required.

(c) Film

Blown films are beginning to be used for packaging textile products and beans, however, the absolute demand is still low. No domestic production is carried out for CPP film or OPP film, and the importation of film products in original roles is still insignificant. This is due to the fact that the food industry and the textile industry are still under developed in Iran, so that no demand is generated by the market where no requirements for diversification of packaging materials is existent. The quality improvement in packaging is still under developed.

(d) Other products

Although straws constitute the largest market, the absolute level of demand is still extremely low.

2-2-2 Demand forecast

Table I-2-7 shows the application-wise demand forecast for polyolefins based on the information obtained through interviews with processors and end users.

(1) LDPE

The demand growth rate of films is estimated to be about 10% per year on an assumption that some laminated products will be placed on the market from 1980 onwards in addition to the already existing films for packaging. It is also likely that the domestic production of high-voltage and communication-use cables will be started after 1980, together with the utilization of plastic pipes as water feeding purposes. These items are duly included in the relative tables and discussions.

Regarding the blow-molded products, squeeze bottles will be made by LDPE alone or in the form of blending with HDPE. This consumption amount is also added to the total estimation.

(2) HDPE

It is likely that the consumption of HDPE will grow at a considerably high rate in the form of packaging films in such fields of application as for manufacturing shopping bags, garbage bags, etc. Concerning the injection-molded products for agricultural use and crates for containing soft drink and beer bottles, it has been estimated that HDPE will be more extensively consumed than PP. It is also assumed that plastic pallets will be used in the market around 1985, so that of the potential demand in this respect estimated at 57,000 ton, about 10%, or 6,000 ton will be materialized as actual demand by 1985.

Regarding the blow-molded products, the growth in the field of containers for detergents, shampoo, bleach, etc. is expected to show almost no progress. Therefore, it is assumed here that the consumption ratio of the blow-molded products in the total HDPE products will not show any significant change from the present level of 13%. Therefore, the demand growth rate here is estimated at 14% to 15% per year.

In addition, it is expected that the indoor water drainage pipes will be popularized by 1980, and water feeding and

Table I-2-7 Demand Forecast of Plastics Materials in Iran by Material and Application (1980, 1985)

(1) LDPE

	1977		1980			1985		
	Quantity (ton)	Share (%)	Quantity (ton)	Share (%)	Growth Rate (%/year)	Quantity (ton)	Share (%)	Growth Rate (%/year)
Packaging Film	29,600	66	34,200	60	5	41,900	46	4
Other Film	2,400	5	7,100[1)]	13	44	23,700[2)]	27	28
Film Total	32,000	71	41,300	73	9	65,600	73	10
Injection Molding	7,200	16	8,300	15	5	11,800	13	7
Blow Molding	2,300	5	3,000	5	9	4,200	5	7
Others	3,500	8	4,700[3)]	8	10	8,400[4)]	9	12
Grand Total	45,000	100	57,200	100	8	90,000	100	9

Notes: 1) Including 4,000 tons of laminate

2) Including 19,800 tons of laminate

3) Including 2,400 tons of wire coating and 900 tons of pipe

4) Including 5,000 tons of wire coating and 1,800 tons of pipe

(2) HDPE

	1977		1980			1985		
	Quantity (ton)	Share (%)	Quantity (ton)	Share (%)	Growth Rate (%/year)	Quantity (ton)	Share (%)	Growth Rate (%/year)
Packaging Film	2,300	12	3,600	12	16	8,900	15	20
Injection Molding	12,800	63	19,400	64	14	38,000[1)]	64	14
Blow Molding	2,600	13	4,000	13	15	7,700	13	14
Others	2,300	12	3,100	10	10	5,000[2)]	8	10
Total	20,000	100	30,100	100	15	59,600	100	15

Notes: 1) Including 6,000 tons of pallet

2) Including 2,200 tons of pipes for natural gas and cable guard pipes

(3) PP

	1977		1980			1985		
	Quantity (ton)	Share (%)	Quantity (ton)	Share (%)	Growth Rate (%/year)	Quantity (ton)	Share (%)	Growth Rate (%/year)
Packaging Film	1,100	7	3,200[1)]	9	42	5,400[1)]	11	18
Woven-bag	10,000	64	18,000[2)]	66	22	32,300[3)]	67	12
Injection Molding	3,100	20	4,600	18	14	9,000	19	14
Others	1,400	9	1,500	6	2	1,600	3	6
Total	15,600	100	25,300	100	17	48,300	100	14

Notes: 1) Including OPP and CPP films

2) Including 5,400 tons for fertilizer

3) Including 14,500 tons for fertilizer and other uses

cable protection conduit pipes will start to be marketed in 1985. Also, utilization of plastic pipes for natural gas transportation is expected to begin around 1985. With these forecasts altogether, the demand for plastics pipes in 1985 is estimated to be 2,000 tons.

(3) PP

Regarding the film for packaging, it is assumed that CPP will be marketed in 1980 and OPP in 1985, so that a considerably high rate of demand growth is incorporated in this forecast. Concerning woven bags, it is assumed that woven bags for fertilizer use will be produced domestically from 1980 onwards. As has been discussed earlier, HDPE is extensively used at present in injection molding operation. This situation is assumed to persist in the future, and further it is expected that the growth rate of PP in injection molding operations will be on the same level as that of HDPE, i.e., approximately 14% per year.

3. Styrene Polymers

3-1 Supply situation

3-1-1 Imports of styrene polymers into Iran

According to the Iranian Trade Statistics, importation of polyestyrene into Iran is shown as follows:

(Unit: ton)

1973/74[1)]	5,819
1974/75	6,090
1975/76	6,220
1976/77	12,841

Source: Trade Statistics of Iran

Note: 1) Calendar year of Iran from March 21 to March 20

However, according to the trade statistics of major exporting countries, imported amount of styrene polymers, namely, GPPS, HIPS, FS, AS and ABS into Iran is totaled as follows:

(Unit: ton)

1969	4,094
1970	8,039
1971	5,199
1972	7,334
1973	10,192
1974	8,386
1975	13,003
1976	16,229

Source: Trade statistics of Japan, U.S.A., West Germany, France, Italy, U.K., Netherlands, Hong Kong and Singapore.

3-1-2 Supply source of styrene polymers

Table I-3-1 shows the supply source of polystyrene in 1975 and 1976 according to the Iranian Foreign Trade Statistics. Table I-3-2 gives the trend of export market share in styrene polymers of major exporting countries based on the trade statistics of these countries.

3-1-3 Price trend

Table I-3-3 shows the average figures of FOB prices quoted by the exporting countries on styrene polymers from 1969 to 1976. In Table I-3-3 C&F prices of polystyrene are also stipulated up to 1976 from 1973 according to the Iranian Trade Statistics.

3-1-4 Future supply situation

Production of styrene polymers in Iran is said to be planned by private sector, however, it is not fixed.

Although production of styrene monomer was once planned by private sector, however, it is not fixed.

3-2 Demand situation

3-2-1 Current demand situation

Table I-3-4 shows amount of styrene polymers consumption by application in Iran in 1977 in terms of comparison with European countries, the U.S.A., and Japan.

Table I-3-1 Supply Source of Styrene Polymers

(Unit: %)

	1975/76	1976/77
Japan	30	19
U.S.A.	4	7
U.K.	3	5
W. Germany	36	28
France	5	5
Italy	3	9
Netherlands	10	15
Belgium	9	6
Finland	-	-
Israel	-	-
Others	0	6
	100	100

Source: Trade Statistics of Iran

Table I-3-2 Trend of Market Share in Styrene Polymers Imports into Iran from Major Exporting Countries.

PS (Including AS and ABS resins)

(Unit: %)

	Japan	U.S.A.	W. Germany	France	Italy	U.K.	Nether-lands	Hong Kong	Singa-pore	Total
1969	0.1	20.7	67.7	9.0	2.5	-	-	-	-	100
1970	3.3	6.4	51.0	6.6	3.9	1.6	27.3	-	-	100
1971	5.7	8.0	33.6	3.6	4.6	2.2	42.3	-	-	100
1972	19.5	4.1	32.6	-	0.9	5.0	37.9	-	-	100
1973	3.2	12.1	37.5	5.4	-	0.7	41.2	-	-	100
1974	10.0	16.8	36.1	-	-	3.6	31.4	1.2	0.9	100
1975	21.8	-	34.7	9.7	-	2.4	28.7	-	2.7	100
1976	19.2	12.5	23.8	11.2	-	6.0	27.4	-	-	100

Source: Trade Statistics of Japan, U.S.A., W. Germany, France, Italy, U.K., Netherlands, Hong Kong, Singapore

Table I-3-3 Trend of Import Price of Styrene Polymers into Iran (1969 - 1976)

(Unit: US$/ton)

	PS	
	(A)	(B)
1969	363	-
1970	356	-
1971	350	-
1972	306	-
1973	528	727
1974	1,205	1,341
1975	687	971
1976	790	915

Note: Exchange rate: 1974, 1975 R67.63/US$
1975 R69.28/US$
1976 R70.62/US$

1) (A): Average FOB price of Japan, U.S.A., W. Germany, France, Italy, U.K., Netherlands, Hong Kong and Singapore
2) (B): C&F price of Trade Statistics of Iran

(1) PS

The demand for PS in 1977 is estimated to have been 17,000 ton/year.

In Iran, the rate occupied by the daily-use goods made of PS is high. The domestic production of household electrical appliances is being progressed over the past years, so that the growth of PS for use as industrial parts and components is conspicuously high. The field in Iran in which a comparatively low consumption of PS is made in comparison to industrialized countries is the packaging materials application field.

(2) AS resin

The use of AS resin in Iran has just started. The demand amounts to approximately 300 tons/year. This

Table I-3-4 Demand Structure of Polyolefins in Iran (1977) and its Comparison with Other Countries

(1) PS (GP, HI, FS)

(Unit: ton, %)

	Iran (1977)		Japan (1976)		U.S.A. (1976)		West Germany (1975)		France (1975)	
	Quantity	Share	Quantity	Share	Quantity	Share	Quantity	Share	Quantity	Share
Machine Parts	6,500	38	130,103	26	70,000	5	160,000	14	14,500	9
Sundries, Stationery	8,500	50	218,368	43	372,000[2]	26	280,000	25	42,000	27
Packaging Material	1,700	10	143,800[1]	29	591,000[3]	42	515,000	47	71,500	48
Others	300	2	11,111	2	383,000	27	160,000	14	25,000	16
Total	17,000	100	503,382	100	1,416,000	100	1,115,000	100	153,000	100

Notes: 1) FS

2) Furniture, Household articles, Toys

3) 193,000 tons is FS.

(2) AS Resin

(Unit: ton, %)

	Iran (1977)		Japan (1976)		U.S.A. (1976)	
	Quantity	Share	Quantity	Share	Quantity	Share
Machine Parts	330	100	17,400	45	-	-
Parts for Automobile	0	0	5,800	15		
Sundries, Stationery and Others	0	0	15,500	40	-	-
Total	330	100	38,800	100	42,000	100

(3) ABS Resin

(Unit: ton, %)

	Iran (1977)		Japan (1976)		U.S.A. (1976)		Western Europe(1975)		France (1975)	
	Quantity	Share	Quantity	Share	Quantity	Share	Quantity	Share	Quantity	Share
Electric Parts	4,160	100	63,300	34	74,000[1]	18	21,000	13	9,850	33
Parts for Automobile	0	0	46,900	26	77,000	19	33,000	21	8,500	28
Sundry Goods, Stationery, Others	0	0	74,000	40	261,000	63	106,000[2]	68	11,650	39
Total	4,160	100	184,200	100	412,000	100	160,000	100	30,000	100

Notes: 1) Including office machine, telephone, and general machinery
2) Including 48,000 tons of machine parts

amount is 6/1,000 to 8/1,000 of the demand scale now achieved in Japan and the U.S.A. respectively.

The potential demand for AS resin is estimated as approximately 1,100 tons. The discrepancy between the potential and actual demands is accounted for by daily-use miscellaneous goods. Almost no AS resin is used in automobile and other machinery industries because of the following apparent reasons:

1) AS resin has an inherent character of high transparency and pleasant appearance rather than mechanical performances. Therefore, this resin is usually used as lamp covers, instrumentation cover plates, electric fan blades, etc. in developed countries.

2) AS resin has smaller impact strength than ABS resin, so that an AS-made machine part or component must be within a certain size limitation.

3) The price of AS resin is comparatively high, and therefore not competitive price with other commodity plastics materials.

AS resin was originally developed by improving the brittleness of PS together with improved heat resistance and solvent-resistance characteristics. However, AS resin still lacks virtual characteristics of engineering resins possessed by ABS resin particularly in terms of impact strength. Therefore, the application of AS resin is rather limited such as where PS resin cannot be employed in view of mechanical and chemical performance, and at the same time where transparency, surface luster, hue, etc. are particularly required.

In view of these inherent characteristics of AS resin, it is rather natural that the consumption level in Iran is extremely low at present with only limited application. Even so, a potential problem is the lack of processors in Iran who are capable of manufacturing small industrial parts of high quality and precise measurements. For instance, Iranian automobile manufacturers cannot economically produce AS resin parts because of the smallness of the size and the insignificance of the quantitative requirements.

(3) ABS resin

The ABS resin consumption as of 1977 in Iran was about 4,200 tons which roughly corresponds with the NPC's forecast figures of 4,700 tons (surveyed in 1974).

The scale of the demand in Iran is 1/100 to 2/100 of the demand in Japan, the U.S.A., and West European countries as shown in Table I-3-4(3).

The extent of potential demand has been estimated on the basis of the past history of the Japanese market (Appendix I); however, it still shows that the consumption amounted to about 7,300 tons in 1977 which is about twice as high as the actual demand now materialized. The difference between the potential demand and the actual demand is mainly due to the following two reasons:

(i) No ABS resin is presently used to produce daily-use miscellaneous goods and automobile parts and other machinery parts.

(ii) In the case of automobile manufacturing, ABS resins are greatly imported in the form of already finished parts and components.

However, in the field where ABS resin is already employed in Iran, for instance in the case of refrigerators, the actual demand exceeds the potential demand. This is due to the fact that the leading refrigerator manufacturers Azumayesh Ind. and ARJ Co. are using ABS to make the refrigerator door backs and other parts, while other manufacturers turning out much smaller amount of products are using HIPS. Further, the present level of Iranian technology cannot achieve surface gloss and smoothness comparable to ABS resin when HIPS is employed.

On the other hand, ABS is used in Iran by utilizing the inherent and virtual properties of this resin, i.e., by making use of the engineering-plastics-oriented performances. As the features of the Iranian ABS resin demand structure, the following may be pointed out:

(a) ABS consumption is limited to industrial parts and components production, and no application is made in producing daily-use miscellaneous good products.

(b) For the most part, the industrial application of ABS is found in refrigerator manufacturing, and few other machines employ ABS resin as components or parts.

(c) In the automobile industry, the use of plastic in general in Iran is still much lower when compared to Japan, the U.S.A., or West European countries. The ABS resin components and parts for automobiles are presently imported from these countries in the form of finished parts.

3-2-2 Demand forecast

Table I-3-5 shows the application-wise demand forecast for styrene polymers based on the information obtained through interviews with processors and end users.

Table I-3-5 Forecast of Styrene Polymers Demand in Iran (1980, 1985)

(1) PS (GP, HI, FS)

	1977		1980			1985		
	Quantity (ton)	Share (%)	Quantity (ton)	Share (%)	Growth Rate (%/year)	Quantity (ton)	Share (%)	Growth Rate (%/year)
Machine Parts	6,500	38	9,200	41	12	14,000	43	9
Sundry Goods, Stationery	8,500	50	9,900	44	5	12,500	38	5
Packaging Material	1,700	10	2,700	12	17	4,300	13	10
Others	300	2	700	3	33	2,000	6	23
Total	17,000	100	22,500	100	10	32,800	100	8

(2) AS

	1977	1980				1985			
	Apparent	Apparent			Potential	Apparent			Potential
	(ton)	(ton)	Growth Rate (%/year)	Share (%)	(ton)	(ton)	Growth Rate (%/year)	Share (%)	(ton)
(1) Industrial Uses for:									
(a) Electric, Electronic Appliances									
Electric Fan	110	120			130	230			230
Juicer	80	140			140	280			280
Refrigerator	130	190			300	400			400
TV	10	50			50	70			70
Radio	0	10			10	10			10
Cooler	0	50			50	80			80
Sub-Total	330	560	19.2	66.7	680	1,070	13.9	31.6	1,070
(b) Motor Vehicles	0	0			130	250		8.4	250
(2) Sundry Goods and Others	0	240		33.3	480	1,780	47.8	59.9	2,220
Total	330	800	34.4	100	1,290	3,100	31.1	100	3,540

(3) ABS

	1977 Apparent (ton)	1980 Apparent (ton)	1980 Growth Rate (%/year)	1980 Share (%)	1980 Potential (ton)	1985 Apparent (ton)	1985 Growth Rate (%/year)	1985 Share (%)	1985 Potential (ton)
(1) Industrial Uses for:									
(a) Electric, Electronic Appliances									
Refrigerator	3,300	3,920	5.9	51.2	1,330	4,900	4.6	23.3	1,800
Electric Fan	480	510		6.7	390	910		4.3	700
TV	150	190		2.5	170	250		1.2	230
Radio	70	90		1.2	80	110		0.5	100
Telephone	160	190		2.5	210	300		1.4	340
Cooler	0	-		-	330	-		-	580
Washing Machine	0	-		-	20	-		-	30
(b) Other Electric, Electronic Appliances and Machinery	0	2,750		35.9	2,750	9,100		43.3	9,100
Sub-Total	4,160	7,650	22.6	100	5,280	15,570	15.2	74.0	12,880
(c) Rolling Stocks									
Motor Vehicles	0	0		-	1,530	2,900		13.8	2,900
Other Rolling Stocks	0	0		-	140	270		1.3	270
(2) Sundry Goods and Others	0	0		-	5,300	2,300		10.9	11,500
Total	4,160	7,650	22.6	(100)	12,250	21,040	22.5	100	27,550

(1) PS (GP, HI and FS)

(a) Parts and components for household electric appliances and other machines

A forecast has been formulated concerning various types of household electrical appliances on the basis of the correlation between the past production records and the GDP.

Of the appliances, refrigerator consumes a high rate of resin materials. As far as refrigerators are concerned, the most extensively used resin is ABS; however, the utilization rate of PS is estimated to grow gradually so that a PS rate comparable to Japanese rate will be attained by 1980. (The Japanese rate is as follows: Average plastics utilization per refrigerator is 13.6 kg, in which PS utilization amount occupies 54.2% or 7.4 kg/refrigerator.) By taking into account this shift in the material employment, the demand growth rate of PS up till 1980 has been estimated on a higher side. Concerning those items which are already produced in Iran but for which no statistical data are available (e.g., juicers, lighting devices, etc.) as well as concerning the imported electrical appliances (e.g., taperecorders, stereo equipment, vacuum cleaners, etc.), forecasts have been made by assuming hypothetical figures.

(b) Daily-use miscellaneous goods

The estimated growth rate of this category of items ranges from 12% to 15% which is on a slightly higher level than estimated future growth rate (9.3%) of GDP.

(c) Packaging materials

An area in which the consumption is comparatively low in Iran is the packaging material field. However, it is forecast that demand for ice-cream cups formed by thermal molding of HIPS sheets will grow. It is also assumed that introduction of one-pack distribution system using low-foaming polystyrene trays will be extensively made along with the rationalization of commodity distribution. Further, it is assumed that the employment of high-foaming polystyrene as shock absorbing materials will grow along with the production increase in household electrical appliances. With these factors altogether, it has been assumed that the demand growth rate will be 15% to 25%.

(d) Others (synthetic wood)

It is forecast that the demand for PS-based synthetic wood will grow in view of the scarcity of the forest products in Iran. The synthetic timber will be

used extensively for producing furniture, picture frames, school chairs, etc.

(2) AS resin

AS resin is used in those fields in which PS resin cannot be used because of its insufficiency in mechanical and chemical performance, and at the same time where PS resin cannot be accepted because of the insufficiency in transparence, surface gloss, color effects, and other external appearance factors. On the other hand, ABS resin is used chiefly in the fields where it can fully display its mechanical properties which make ABS resin as a superb engineering resin. In other words, AS resin is more popularly used in daily-use-goods-oriented area of industrial parts. Therefore, in the case of AS resin, it is not necessary to clearly draw a line between the industrial-use-parts-oriented application fields and daily-use-miscellaneous-goods-oriented application fields.

The potential demand in the field of daily miscellaneous goods is estimated to be about 500 tons in 1980 and 2,200 tons in 1985. This potential demand was calculated by first obtaining the demand extent on the basis of the relationship with the per capita GDP. Then, estimated imports of AS resin in the form of products such as clocks, toys, etc. are subtracted from the potential demand thereby bringing the potential demand for AS resin in the form of resin. Of this potential demand, it is estimated that 50% will be materialized as actual demand in 1980, and 80% in 1985.

The results of the demand forecast for AS resin in 1980 is about 800 tons, while it will be about 3,100 tons in 1985. Because of the low level of the current demand, the annual growth rate is estimated as over 30% from a period from 1977 up to 1985.

(3) ABS resin

The following points were taken as the bases for formulating a forecast on the demand for ABS resin. It should be noted here that the term "demand" signifies such a nature of demand which is likely to be materialized in the future, and therefore should not include the "potential demand".

(a) It has been assumed that the demand for ABS resin will grow in such fields that the properties of ABS resin as an engineering resin are required, and that the application of ABS resin for manufacturing daily-use miscellaneous goods will not grow for some time to come. This assumption is made because of the fact that the use of ABS resin for producing the daily-use miscellaneous

goods becomes possible only after the commencement of the Iranian domestic production of ABS resin, and further if the domestic ABS resin can be supplied to the market on a price level on a politically reduced level below the price is of other resin.

(b) It is highly difficult to assume that all the potential demand for ABS resin will entirely be materialized into actual demand by 1980. Even in the industrial-use application field of ABS resin, the assumed time of materialization of potential demand into actual demand is 1985.

Demand forecasts have been formulated on the basis of the above basic points, and results as shown in Table I-3-5 have been obtained. The demand forecasts were made for the following five groups:

(a) Refrigerators, electric fans, TV sets, radios:

The forecast figures were obtained by multiplying the number of production unit of the items as obtained through the potential demand estimation shown in Appendix I, Fig. AI-2-1, Table AI-2-1 by the average ABS resin unit consumption of Iran (Table AI-2-4).

(b) Electrical appliances, electronic products, and general machines other than the above:

It has been assumed here that the potential demand will be turned into the actual demand by 1980 concerning these types of products including air conditioners and washing machines. The estimation was made on the basis of the consumption of ABS resin used for manufacturing electric machines, electronic machines, and other general machines in the case of Japan and the per capita GDP of also Japan.

(c) Automobile:

It has been assumed that the materialization of actual demand will not be made in 1980. The basis for this assumption is that the automobile manufacturers in Iran are at present entirely preoccupied by the assembly of the main bodies of the automobiles, thereby having no allowance for the self-production of small parts which are entirely imported at present.

(d) Vehicles other than automobiles:

It has been assumed here that the Japanese ratio between the automobile-destined demand and other-

vehicle-destined demand for ABS will also be applicable to the Iranian situation. (Chapter 2, Appendix I) However, it is also estimated that the potential demand will not be turned into actual demand as of 1980.

(e) Daily-use miscellaneous goods:

The potential demand for ABS resin in this field has been obtained on the basis of the relationship between the daily-use miscellaneous goods-destined ABS consumption and per capita GDP in Japan and the U.S.A. (Chapter 2, Appendix I) into which the Iranian per capita GDP factor is incorporated. The domestic production rate of the products was multiplied to thus obtained correlation.

As shown in Table I-3-5, the ABS consumption in 1980 is estimated to be 7,700 tons and in 1985 about 21,000 tons. The annual growth rate from 1980 to 1985 therefore will be about 23% which is a considerably high rate.

The demand structure in 1980 will mostly consist of electric machinery, electronic machines, and general-use machines, while little ABS resin being used in the fields of automobile manufacturing and daily-use miscellaneous goods production. In 1985, about 15% will be taken up by the automobile industry, and about 11% is likely to be occupied by the production of daily-use miscellaneous goods.

4. PVC

4-1 Supply situation

4-1-1 Domestic production

Abadan Petrochemical Co., a 74-26 joint-venture company between NPC and B.F. Goodrich of the U.S.A. started its production in 1969. The production capacity during the early stage of operation was 20,000 tons per year in terms of PVC resin. The capacity was increased to 60,000 ton/year in 1976. The original capacity of 20,000 ton/year was based on raw material ethylene which was made available from off-gas of an oil refinery; however, the increment 40,000 ton/year employs imported EDC as the raw material.

Table I-4-1 gives the production figures of Abadan Petrochemical Co. (APC). Although the operational rate was on a low level during the initial stage of production, APC gradually increased the output thereafter. Since 1973, the company attained a 100% operational rate to meet worldwide supply shortage of PVC.

Table I-4-1 PVC Production of Abadan Petrochemical Company (1969 - 1976)

(Unit: ton)

	Production Capacity	Production Amount
1969	20,000	3,789
1970	20,000	10,809
1971	20,000	13,112
1972	20,000	15,568
1973	20,000	20,218
1974	20,000	17,781
1975	20,000	17,226
1976	60,000	34,000[1)]

Source: NPC

Notes: 1. Production target in 1977 is 45,000 tons. (APC)

1) Estimate

After the expansion of the plant, an output record of 34,000 tons was registered in 1976. The production target for the year 1977 was reported to be 45,000 tons.

On the other hand, PVC compounds are being turned out by Polika Factory which is a 100%-owned subsidiary of APC. The PVC compound production capacity is 3,000 ton/year. The PVC compounds produced by this company is mainly used for manufacturing pipes and electric wires. Polika Factory also produces PVC pipes, joints, and water-buffle board.

As far as PVC compounds for shoe manufacturing is concerned, shoe manufacturers are producing compounds by themselves. They are selling their excess production to the market for general use.

4-1-2 Importation

The domestic production of PVC in Iran has always been falling behind the level domestic demand, so that about 1/3 of the domestic demand on average has been met by imports every year. Due to recent increase in the production capacity of APC, the importation of suspension type PVC materials fell accordingly; however, the emulsion type (paste-resin) and copolymerization type PVC, both of which are not produced by APC, are still totally imported.

Table I-4-2 gives the importation amount from 1973 to 1976 according to the Foreign Trade Statistics of Iran.

Table I-4-3 shows the figures of exportation to Iran made from Japan, the U.S.A., and the European countries from 1969 up to 1976 based on the trade statistics of these exporting countries.

Table I-4-4 shows the supply source of PVC from other countries according to the Iranian Trade Statistics in 1975 and 1976. In Table I-4-5 export market share in PVC of major exporting countries is shown based on the trade statistics of each country.

4-1-3 Price trend

Table I-4-6 gives the ex-factory price trend of PVC at APC. Influenced by the imported PVC price, it seems likely that the APC's PVC price up to 1973 must have been considerably lower than the production cost level. In other words, the ex-factory price stagnated around a R30/Kg level from 1969 to 1972 with an improvement up to R36/Kg in 1973. This price was still lower than the total sum of 1973 annual average price of imported PVC powder (R29.8/Kg) plus US$160 per ton import duty (about R11/Kg). Due to a price increase of imported PVC in 1974, the domestic PVC price also increased to R48/Kg when the domestic price exceeded the production cost for the first time. The currently prevailing ex-factory PVC price of APC is R55/Kg.

Table I-4-2 Imports of PVC into Iran (1973 - 1976)

(Unit: ton)

	PVC[2]
1973/74[1]	15,766
1974/75	6,604
1975/76	19,158
1976/77	12,208

Source: Trade Statistics of Iran

Note: 1) Calendar year of Iran from March 21 to March 20
2) Total of powder, granules, liquid, and paste

Table I-4-3 Trend of PVC Imports form Major Exporting Countries (1969 - 1976)

(Unit: ton)

	PVC	
	Resin	Compound
1969	5,586	1,332
1970	2,522	1,888
1971	8,110	1,104
1972	6,479	1,569
1973	9,831	3,513
1974	3,439	1,548
1975	17,607	1,666
1976	17,152	9,656

Source: Trade Statistics of Japan U.S.A., W. Germany, France, Italy, U.K., Netherlands, Hong Kong, and Singapore

Table I-4-4 Supply Source of Imported PVC

(Unit: %)

	Powder		Granule		Other Shape	
	1975/76	1976/77	1975/76	1976/77	1975/76	1976/77
Japan	37	34	47	45	52	29
U.S.A.	11	40	17	-	24	42
U.K.	2	-	1	6	-	1
W. Germany	16	9	13	6	7	12
France	-	-	-	17	1	1
Italy	17	-	9	2	4	8
Israel	4	7	6	14	11	-
Others	13	10	7	10	2	8
Total	100	100	100	100	100	100

Source: Trade Statistics of Iran

Table I-4-5 Trend of Market Share in PVC Imports into Iran from Major Exporting Countries

(1) PVC resin

(Unit: %)

	Japan	U.S.A.	W. Germany	France	Italy	U.K.	Nether-lands	Hong Kong	Singa-pore	Total
1969	0.2	43.4	37.7	-	18.8	-	-	-	-	100
1970	18.2	5.8	53.5	-	22.4	-	-	-	-	100
1971	28.8	0.4	36.7	-	19.1	15.0	-	-	-	100
1972	13.9	-	52.9	-	29.8	3.4	-	-	-	100
1973	6.1	4.0	61.3	-	-	26.1	-	-	2.5	100
1974	-	2.8	87.1	-	-	4.0	-	-	6.1	100
1975	73.7	-	23.4	-	-	1.7	-	-	1.1	100
1976	68.2	-	22.1	8.8	-	0.2	-	-	0.6	100

Source: Trade Statistics of Japan, U.S.A., W. Germany. France, Italy, U.K., Netherlands, Hong Kong, Singapore

(2) PVC compound

(Unit: %)

	Japan	U.S.A.	W. Germany	France	Italy	U.K.	Nether-lands	Hong Kong	Singa-pore	Total
1969	12.1	21.4	34.3	3.2	29.1	-	-	-	-	100
1970	1.6	16.9	69.1	-	9.3	1.8	1.3	-	-	100
1971	47.3	25.8	-	-	25.1	1.9	-	-	-	100
1972	24.6	20.8	14.1	-	38.8	1.7	-	-	-	100
1973	9.2	4.4	16.4	68.3	-	1.3	0.4	-	-	100
1974	59.1	11.2	21.9	-	-	6.5	1.3	-	-	100
1975	84.1	-	5.8	-	-	9.3	0.7	-	-	100
1976	26.1	61.3	4.4	7.4	-	0.6	0.2	-	-	100

Source: Trade Statistics of Japan, U.S.A., W. Germany. France, Italy, U.K., Netherlands, Hong Kong, Singapore

Table I-4-7 shows the average figures of C&F prices and FOB prices quoted by the exporting countries on PVC from 1969 to 1976.

Table I-4-6 Ex-factory PVC Price of Abadan Petrochemical Company (1969 ~ 1977)

	rial/kg	US$/ton[1)]
1969	30.13	394
1970	31.30	410
1971	31.20	408
1972	29.91	392
1973	35.93	531
1974	48.37	715
1975	44.06	636
1976	49	694
1977	55	779

Source: NPC

Note: 1) Exchange rate is taken from Monthly Bulletin of Statistics, United Nations, Vol. XXXI (12), (Dec. 1977).

Table I-4-7 Trend of Import Price of PVC into Iran (1969 - 1976)

(Unit: US$/ton)

	PVC[3)]	
	(A)[1)]	(B)[2)]
1969	319	-
1970	346	-
1971	284	-
1972	307	-
1973	394	441
1974	954	1,005
1975	575	785
1976	547	813

Note: Exchange rate: 1973, 1974 R67.63/US$
1975 R69.28/US$
1976 R70.62/US$

1) (A): Average FOB price of Japan, U.S.A., W. Germany, France, Italy, U.K., Netherlands, Hong Kong, and Singapore
2) (B): C&F price of Trade Statistics of Iran
3) PVC powder

4-1-4 Future supply situation

Neither expansion nor new establishment of PVC plant is announced at present.

IJPC will produce 170 thousand tons per year of ethylene dichloride and 150 thousand tons per year of vinyl chloride monomer from the end of 1979.

4-2 Demand situation

4-2-1 Current demand situation

Table I-4-8 shows amount of PVC consumption by application in Iran in 1977 in terms of comparison with European countries, the U.S.A., and Japan.

PVC has various functional advantages, and has a high flexibility of displaying a wide range of performances. PVC can be made into soft materials up to hard materials. By taking advantages of these characters, PVC is made into various and versatile products as a basic material almost comparable to steel or aluminium.

In Iran, APC began to produce PVC in 1966, and has so far succeeded in establishing stable demand in several market outlet fields. However, a number of under developed fields still exist in view of the high versatility and flexibility of the physical properties of PVC.

The PVC demand structure in Iran is characterized by a stagnation in shoe-making-related fields, while a great demand growth is beginning to manifest itself in rigid pipe products. Demand from electric wire and construction materials field is beginning to grow in recent years.

In the shoe industry, the production is now falling due to PVC resin price increase and labour shortage. The export competitiveness of Iranian shoes is also deteriorating. Because of the fact that the ups and downs in the fashion trend of shoes is highly conspicuous, thereby causing rapid changes in the material requirements. For instance, the material requirements

shift from rubber to PVC, and then to EVA to PU. This being the circumstance, it is likely that the growth rate of PVC consumption in the shoe industry is insignificant.

As far as rigid PVC pipes are concerned, a recognition is now gained for their effectiveness as agricultural irrigation pipes. The demand in this area is growing centering on 100mmø pipes. In this Sixth Five-year Plan, the substantialization of agricultural foundation of the country is set as one of the national targets

Table I-4-8 Demand Structure of PVC in Iran (1977) and its Comparison with Other Countries

(Unit: ton, %)

	Iran (1977)		Japan (1976)		U.S.A. (1976)[1]		West Germany (1975)		France (1975)	
	Quantity	Share	Quantity	Share	Quantity	Share	Quantity	Share	Quantity	Share
Pipe & Fitting	24,000	37	309,111	33	658,000	32	560,000	22	150,000	28
Hard Sheet, Profile & Tile	6,500	10	231,328	24	198,000[2]	10	240,000	9	40,000	8
Leather, Sheet	11,000	17	292,099	31	230,000[3]	11	440,000	17	51,000	10
Shoes	10,700	16			-	-	-	-	16,000	3
Wire Coating	7,700	12	113,936	12	160,000	8	305,000	12	43,000	8
Hose	2,100	3			-	-	140,000[4]	6	-	-
Others	3,000	5			783,000	39	845,000	34	230,000	43
Total	65,000	100	946,474	100	2,029,000	100	2,530,000	100	530,000	100

Notes: 1) Including copolymer
2) Floor tile, extruding film, sheet
3) Coating
4) Including soft PVC profile

with an ultimate objective of self sufficiency in the supply of food. Therefore, it is highly likely that the demand for rigid PVC pipes will steadily grow over a long period.

Because of rapid recent development of industry in Iran together with the improvement in living standard of people, electric power shortage in Iran is becoming one of the serious problems. The power consumption grew along with the growth of GNP thereby creating growth of demand for electric wires. In line with the popularization of telephones, the demand for communication cables is also anticipated.

Iran shows a stable market for flexible hoses used in plant watering. This field is also expected to show a stable growth in the future.

In the construction materials field, the use of PVC tiles for flooring is still insignificant in Iran. However, the use of PVC tiles seem to be starting as a general flooring material. The demand in this field is also expected to be active in the future.

4-2-2 Demand forecast

Table I-4-9 gives the application-wise demand forecast for PVC based on the information obtained through interviews with processors and end-users.

A detailed description about PVC has been made in relation to the application-wise demand forecast.
Concerning the future demand of PVC for application other than covered in that chapter, estimation were made in Table I-4-10.

(1) PVC for manufacturing artificial leather and soft sheets

The PVC-processed products used for automobiles including artificial PVC leather is estimated to amount to 15kg/automobile, and this amount has been added to this category. The automobile production is estimated to grow to 290 thousand in 1980 and 550 thousand in 1985.

(2) Shoes

In the shoe manufacturing industry, there is a great change in the type of materials to be used because of the changes in the trend of the fashion.
Therefore, the growth of demand for PVC is estimated to be 6% from 1978 to 1980, and 4% from 1980 to 1985.

Table I-4-9 Demand Forecast of PVC in Iran by Application (1980, 1985)

	1977		1980			1985		
	Quantity (ton)	Share (%)	Quantity (ton)	Share (%)	Growth Rate (%/year)	Quantity (ton)	Share (%)	Growth Rate (%/year)
Pipe and Fittings	24,000	37	37,900	42	16	69,300	47	13
Rigid Sheet, Profile and Tiles	6,500	10	9,300	10	13	17,000	12	13
Leather and Flexible Sheet	11,000	17	15,400	17	12	22,500	15	8
Shoes	10,700	16	12,800	14	6	15,600	11	4
Wire Coating	7,700	12	9,600	11	8	15,000	10	9
Hose	2,100	3	2,400	3	5	3,000	2	5
Others	3,000	5	3,300	4	3	3,800	3	3
Total	65,000	100	90,700	100	12	146,200	100	10

(3) Soft PVC hoses

There is already a stable demand for gardening (watering) hose and steady growth of consumption is likely. However, in view of the possible competition with hoses made of other materials, the demand for soft PVC hose is estimated here as 5% per year.

Table I-4-10 Application-wise PVC Leather and Sheet Demand Forecast (1980, 1985)

(Unit: ton)

	1977 (Actual)	1980	1985
Leather			
Automobile	3,000	4,400	8,200
Furniture	1,500	2,200	2,900
Buildings	2,000	2,900	3,500
Suitcase and Bags	1,500	2,000	2,700
Footwear	2,000	2,500	3,000
PVC Sheet	1,000	1,400	2,200
Total	11,000	15,400	22,500

II SYNTHETIC RUBBER

1. Analysis of Demand and Demand Structure Concerning SBR

1-1 Demand and demand structure

Table II-1-1 gives the actual consumption and forecast consumption of SBR in Iran compiled on the basis of NPC's data (1974).

Table II-1-2 shows results of a survey concerning the tire weight figures of production made by Iran's top three tire manufacturers (Kian Tire Co., General Tire and Rubber Co., and Bridgestone-Iran Co.). The industry is by far the largest consumer of SBR. The SBR content figure of 17% - 18% is estimated against the weight of all the tires encompassing both passenger cars (PC) and truck and buses (TB) tires in Iran. (Source: Bridgestone Iran)
The SBR consumption in Table II-1-2 is calculated on an assumption that SBR weight is 18% of the tire weight.

Table II-1-1 Actual Consumption and Estimation of SBR in Iran (1975 - 1980)

	Consumption (ton)	Increase Rate Against Previous Year (%)
1970	6,000	-
1971	6,800	13
1972	7,800	15
1973	9,100	17
1974*	10,900	20
1975	11,800	8
1976	14,800	25
1977	17,000	15
1978	20,100	18
1979	22,000	9
1980	24,000	9

Source: NPC (1974)

Note: *30,000 tons of tires, 4,500 tons of tubes, and 7,600 tons of other rubber products were imported in 1974.

Table II-1-2 Tire Production Trend of Three Tire Companies in Iran (1972 ~ 1977)

(Unit: 1,000 ton)

Year / Company	1972	1973	1974	1975	1976	1977	1977[3]
Kian Tire Co.	8.7	11.7	11.9	14.0	15.0	15.0	SBR: 2.4
General Tire and Rubber Co.	11.3	12.6	16.7	18.5	18.0	14.0	SBR: 2.4
Bridgestone-Iran Co.	-	-	-	-	12.0	19.0	SBR: 3.84
Sub-total	20.0	24.3	28.6	32.5	45.0	48.0	SBR: 8.64
SBR Content[1]	3.6	4.4	5.2	5.9	8.1	8.6	-
Iran[2] Yasa Co.	0.36	0.44	0.48*)	0.59	0.81	0.86	-
Grand Total	4.0	4.8	5.7	6.5	8.9	9.5	8.64

Notes: 1) Based on the assumption as in 1-1 of this chapter that the SBR content of tires is equal to: Weight of tire x 0.18

2) SBR for motorcycle tires and bicycle tires

*) Data from NPC

3) Reference data in 1977 aggregated and estimated by Marubeni

Concerning the SBR used in motorcycle and bicycle tires shown in this Table, calculations were made by employing rate figure of about 10% of tire weight to represent the SBR amount. This rate has been obtained from the actual SBR consumption records for 1974 by Iran Yasa Co. (Source: NPC data).

Table II-1-3 shows the actual SBR consumption data obtained from footwear manufacturing companies visited by the Survey Team. However, the data of the two leading manufacturers, Melli Shoe Co. and Bella Shoe Co. were not clarified. Therefore, it has been assumed that these two companies together consumed 1,000 tons of footwear-use SBR by excluding the plastics footwear. Although the SBR consumption figure assumed to be 1,000 ton/year for these two leading companies may seem to be too conservative, this figure is considered here to be more realistic in view of the fact that the consumption of plastics (PVC, PU, and EVA) has been increasing over the past year or two in the manufacture of footwear (Table II-1-3). Therefore, the actual consumption of SBR in footwear production has been on a level lower than that of recent years.

SBR consumption in footwear manufacturing during 1976 is estimated as apploximately 3,200 tons when adding total consumption 2,120 tons of six companies visited.

In addition to footwear, some small amount of industrial-use rubber products are being turned out. The SBR consumption for these items is estimated to be between 400 tons to 500 tons per year. However, at present in Iran, nearly all the conveyor belts, hoses, etc. are being imported as will be explained later. Therefore, the Iranian rubber industry consists almost entirely of the tire industry and the footwear industry.

Table II-1-4 shows a summary of SBR consumption by the two major rubber industries.

It therefore seems likely that the SBR consumption in 1976 in the Iranian rubber industry was about 12,500 tons. This figure is smaller than the above-mentioned NPC forecast in which estimated consumption was 14,800 tons. This seems to be due to the decline in the consumption of SBR for footwear manufacturing.

According to the Foreign Trade Statistics of Iran (1976/1977), the major imports of rubber products are as shown in Table II-1-5.

As the table shows, the amount of imported tires is 75,700 tons in 1976. The achieved output of tires in Iran is 45 thousand tons (Table II-1-2). By adding both figures we obtain apparent demand amount about 120 thousand tons. However, as the imported amount of tire was excessive in 1976, they restricted import in 1977, in fact import was almost forbidden.

Table II-1-3 Consumption of SBR and Other Pertinent Products Collected through Visits to Footwear Manufacturing Companies (1976)

(Unit: ton)

Material / Company	SBR	H-SBR	SBR-MB[1] (SBR)	NR	PVC	DOP
Wien Shoe	300	-	300 (100)	-	2,400	2,400
Jam Shoe	400	250	2,000 (700)	1,200	-	-
Setareh	250	-	-	-	2,000	2,000
T.S.T. Co.	100	20	-	200	-	-
Shadanpour	-	-	-	-	1,300	1,300
Otafuku Iran	-	-	-	-	2,500[2]	2,000
Sub-total	1,050	270	800	1,400	8,200	7,700
Total SBR Consumption		2,120				

Notes: 1) Calculated on the basis that SBR in the SBR-Master Batch is 30%.

2) The Melli Group Enterprises are consuming additionally about 2,500 tons of PVC in other factories.

Table II-1-4 SBR Consumption in Iran (1976)

(Unit: ton)

Tire, Tube		Footwear and Others	Total
Passenger Car, Truck, and Buses	Motorcycle and Others		
8,100	800	3,600	12,500
8,900			

Table II-1-5 Importation of Rubber Products into Iran (1976/1977)

	Quantity (ton)	Amount (million rials)
Tires		
Lorry tires	57,000	8,900
Motorcar tires	11,000	1,400
Bus tires	1,400	200
Tractor tires	5,800	900
Motorcycle tires	500	80
Total	75,700	11,480
Industrial Articles		
Pipes, tubings	2,200	500
Conveyers	2,600	1,600
Others	2,700	1,100
Total	7,500	3,200

Source: Trade Statistics of Iran (1976/1977)

Note: Other imports are;

Tire and tube 10,000 tons, 1,350 million rials

Scrapped rubber 7,800 tons, 820 million rials

Demand for tires in 1976 is 85 - 90 thousand tons according to Bridgestone and 90 - 95 thousand tons according to JETRO.

With figures of output of cars and owned cars (registered cars) in Iran, demand for tires for new cars and spares is estimated to be 90 thousand tons (Table II-1-6).

Therefore, the necessary amount of demand for SBR in Iran is 16,200 tons, of which 8,100 tons is for domestic consumption and 8,100 ton is contained SBR in imported tires.

Table II-1-7 is a summary of the data described above. SBR total demand in 1976 was about 22,100 tons. It is noted that in this figure, 1,500 tons of SBR contents in imported industrial rubber products (SBR contents is assumed as 20%) is included.

1-2 Features of the demand structure

The demand structure of rubber products consists of an overwhelmingly large portion of tires in Iran. The remaining portion is occupied by the footwear industry and the industrial-use product manufacturing industry; however, the latter is almost completely met by imports.

As clearly shown by Table II-1-3, the current status of demand for SBR in the footwear industry has greatly progressed the switch-over to the employment of full plastics footwear production based on soft PVC materials. The consumption of PU and EVA in this field has also progressed considerably, thereby reducing the consumption of SBR as the footwear raw material.

There has been a great change in the selection of footwear raw materials. Introduction of the thermoplastic elastomers which are gaining a great popularity in developed countries will be embodied soon or later in Iran. A great problem here is the extent of endurance and competitiveness of rubber-based footwear which involves complicated processing steps as against the newly gaining plastics materials. In short, it is likely that the future growth of footwear-use SBR consumption is insignificant because of the influx of various plastics materials into this industry. In spite of these recent circumstances, the rate of SBR consumption between footwear industry and industrial-use product industry will stay at 2:1.

For reference, the product-wise demand structure of rubber products in Japan is as follows:

Tires:	6
Industrial-use products:	2
Footwear and others:	1
Non-industrial-use products:	1

Table II-1-6 Estimation of Tire Demand in Iran (1976)

For New Cars

	Car Production[1] (units)	Unit Weight of Tires[4] (kg)	Unit Consumption of Tires[4] (units)	Demand for Tires (ton)
Passenger Cars	110,000	6	5	3,300
Buses	4,000	50	9	1,800
Mini-buses	2,200	10	5	110
Trucks and Tankers	14,000	50	9	6,300
Vans	41,000	10	5	2,050
Total				13,560

For Repairing

	No. of Registered Cars[2] (units)	Unit Weight of Tires[4] (kg)	Unit Consumption of Tires[3] (unit/year)	Demand for Tires (ton)
Passenger Cars	970,000	6	2.0	11,620
Trucks and Buses	190,000	50	5.6	53,200
Total				66,760
Others (Heavy-duty tires)				10,000
Grand Total				90,320

Sources: 1) IES Economic Survey No. 151
2) Iran Almanac 1977 p. 199
3) BS-Iran Co.
4) UNICO Estimates

Table II-1-7 Demand of SBR in Iran (1976)

(Unit: ton)

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

Source: The Survey Team

It should be noted here that the rate occupied by the footwear industry in the case of Japan is only about 5%.

However, one of the features of the footwear industry of Iran is the emergence of overall footwear manufacturers such as Melli Co. which produce nearly all the necessary materials within their factory (adhesives, paints, leather, shoelaces, etc.) and have grown to be exporters.

1-3 Problems in the demand for SBR

The following points may be enumerated as the problems concerning the demand for SBR in Iran:

(a) Introduction of technology for manufacturing industrial-use products

As has been discussed earlier, nearly all the indutrial-use rubber products are being met by import at present.

Concerning the industrial-use rubber products, special rubber may have to be handled depend-

ing on the purpose of application. The blending technology and the general manufacturing techniques require highly sophisticated knowledge and high technical level. Therefore, there is no short cut for the establishment of this technology. Nevertheless, it seems important to immediately plan for the future domestic production of industrial-use rubber products by positively promoting the necessary policies for technology transfer from developed countries in view of the importance of this field in the framework of industry.

(b) Production increase for truck/bus (TB) tires, especially the tires for light trucks (LT)

Although production increase of truck/bus tires will not significantly contribute to the promotion of SBR consumption, the production increase of light trucks is strongly desired at present in view of the handiness of this type of vehicles employed in commodity distribution system. The commodity transportation in Iran is almost entirely dependent on trucking. The production increase of light trucks will greatly contribute to the transportation aspect of the national industrialization. Therefore, establishment of systems for further increase in the production of light truck tires is highly necessary.

(c) Renewal of licenses for tire manufacturing factories in Iran

With the permitted tire-output of the existing three tire-manufacturing companies Iran will suffer from a great lack of supply, when we consider the increasing number of owned cars, trucks, and buses. Even if General Tire and Kian Tire both renewed their license to add 20 thousand tons each in addition to the current capacity, and Bridgestone added 10 thousand tons to their existing capacity, plus 40 thousand tons Pars Tire, thereby making their individual production capacity in 1985 up to 40 thousand tons, the total output of these four companies (each having 40 thousand tons capacity) will cover only 60% of the total tire demand forecast for the year 1985. This clearly indicates that the license renewal for production is urgent necessary action for these tire manufacturers.

(d) Control of tire prices and regulation on the shareholding by foreign-based tire manufacturers

Although the current situation of these three tire manufacturers vary from company to company they are all suffering from deficit in their operation due mainly to the governmental control of the ceiling price for tires.

But because of the foreign investment law they can remit money to home country within 25% of profit, even if they gain profit. If no adequate governmental policy is taken to solve this problem in order to protect the Iranian tire manufacturing industry, the production of domestic tires will stagnate so that the dependency upon import tire may become much heavier.

2. Forecast on the Demand and Demand Structure

Table II-2-1 and Fig. II-2-1 show the actual reocrds of registration of passenger car and truck and bus as well as the future forecast thereof. According to the forecast made in this table, passenger car is expected to grow by 15% per year up to 1980 and by 10% per year up to 1985. Concerning truck and bus, the production increase is seriously considered at present including light truck. Therefore, the growth rate per year is assumed to be 20% per year up to 1985. As a result, the registration number of passenger car will amount to 1.68 million ton in 1980 and 2.67 million in 1985. Truck and bus will amount to 388 thousand by 1980 and 967 thousand by 1985.

As against thus forecast increase in the demand for tires, two alternative cases are established here. The first case presupposes 100% domestic production of tires, and the other case assumes 60% as the domestic production rate of the tires as a target. In the second alternative, the production of tires is assumed to be as shown in Table II-2-2.

In Table II-2-3, the tire requirements in terms of weight in 1976 is stated as 90 thousand tons. By taking this figure as a basis, the SBR consumption has been calculated. At the same time, similar calculations of SBR consumption were conducted concerning bicycle tires, footwear, and industrial-use products.

In Table II-2-1, the increase rate of passenger cars after 1981 was reduced from 15% of earlier time to 10%, while the growth rate of truck and bus was kept constant on a 20% level. Therefore, the SBR contents for a period from 1981 to 1985 was reduced to 16% at the time of calculation.

Concerning the SBR contained in tires for motorcycles and bicycles, an assumption was made at 10% annual growth for the purpose of the calculation.

Concerning the SBR demand generated from footwear and other industries, assumptions made are that the SBR demand in the field of footwear raw materials will show no change because of the increase in the utilization of plastics materials, and also that the demand for industrial-use products will grow by 10% per year through substitution of imported products.

As shown in this table, it is forecast that SBR demand will amount to 37,300 tons in 1980. However, when the target is set at 60% domestic production rate, the forecast on the domestic demand is only 25,600 tons. Therefore, if IJPC starts producing SBR at a rate of 40,000 tons as scheduled, the difference amounting to 14,400 tons will have to be exported.

The future demand structure of SBR used for non-tire products is assumed to be as follows:

Table II-2-1 Number of Registered Passenger Cars (PC), Trucks and Buses (TB), and Weight of Necessary Tires

(Unit: 1,000 vehicles)

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
Passenger Cars	400	500	600	780	970	1,100	1,270	1,460	1,680	1,830	2,010	2,210	2,430	2,670[3]
(Ratio over previous year)	-	(125)	(120)	(130)	(124)	← Growth Rate 15%/year →				← Growth Rate 10%/year →				
Tracks and Buses	80	100	110	150	190	228	274	323	388	466	560	672	806	967[3]
(Ratio over previous year)	-	(125)	(110)	(136)	(126)	← Growth Rate 20% year →								
Total	480	600	710	930	1,160	1,328	1,544	1,783	2,058	2,296	2,570	2,882	3,236	3,637
(Ratio over previous year)		(125)	(118)	(131)	(125)	(115)	(116)	(115)	(115)	(112)	(112)	(112)	(112)	(112)
Weight of necessary tires (1,000 ton)	-	-	-	-	90[2]	103	119	138	160	178	199	224	251	282

Notes: 1) Based on the data of the Iran Almanac 1977 (p. 199, and BS-Iran Co.
2) Based on Tsusho Koho (JETRO Report), June, 1977
3) On the basis of 40 million population, the ownership of passenger car will be 1 unit/15 persons, while truck and buses will be 1 unit/500 persons.

Table II-2-2 Production Forecast of Four Major Tire Manufacturing Companies

(Unit: 1,000 ton)

	1977	1978	1979	1980	1981	1982	1983	1984	1985
Kian Tire Co. (K.T.)	15	20	25	25	30	30	35	35	40
General Tire & Rubber (G.T.)	14	20	25	25	30	30	35	35	40
BS-Iran Co. (B.S.)	19	30	30	30	35	35	40	40	40
Pars Tire Co. (P.T.)	-	-	5	15	20	25	30	35	40
Total	48	70	85	95	115	120	140	145	160

Notes: 1. License owned by the above companies: K.T.: 20,000 ton, G.T.: 20,000 ton, B.S.: 30,000 ton, P.T.: 40,000 ton.
2. Above figures presuppose renewal of licenses except for the case of P.T.

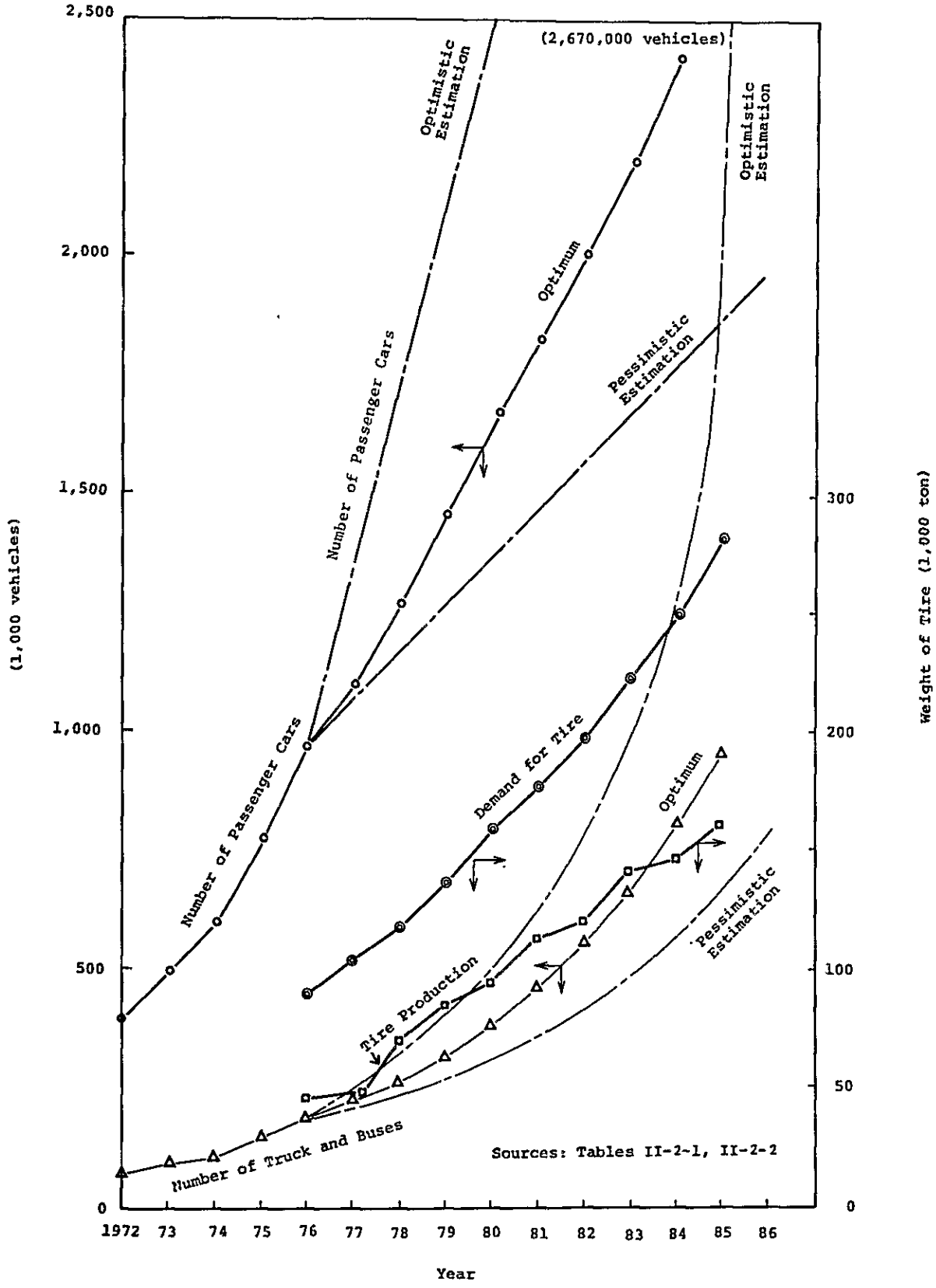

Figure II-2-1 Production and Demand Forecast of Tire in Iran

Table II-2-3 Demand Forecast of SBR in Iran (1977 - 1985)

(Unit: 1,000 ton)

		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 (1) x 18%	24.8	28.8	32.0	35.0	40.3 (1) x 18%	45.2	50.1
(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 (3) x 18%	15.3	17.1	18.4	19.2	22.4 (3) x 16%	23.2	25.6
(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$\{^{3.2}_{3.8}$	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

		1980	1985
Rate of domestic production of tire (%)	60	26	24
	100	18	14

In the field of manufacturing footwear and other rubber products, it is likely that the ratio between footwear and industrial products will be 1 to 1 by 1980 as shown in Table II-2-3 due to the growth of domestic production of the industrial-use products.

Table II-2-4 gives the utilization rate of SBR categorized on the basis of the grade-wise consumption in 1976. In the non-tire industry, high styrene SBR is most extensively utilized. As the rubber industry as a whole, 1500 and 1502 are fairly evenly employed at present. It is noted here that 700 tons to 800 tons of SBR latex is being imported.

Table II-2-4 Grade Number of SBR Used in Iran and its Utilization

(Unit: %)

Grade No.	1500	1502	1507	1707	1712	1778	1808	High Styrene SBR	SBR Consumption (ton)
Tire	24	13	-	-	50	12	-	-	8,600 (70%)
Footwear	2	19	10	-	-	14	7	48	3,600 (30%)
Others	29	18	-	6	-	-	33	13	

3. Promising Products and the Expected Size of their Market

It has already been pointed out that rubber product manufacturing industry in Iran largely consists of the tire manufacturing industry and the footwear manufacturing industry. The particular point about the production structure of rubber products in Iran is the almost complete lack of industrial-use product manufacturing. With such a special structure in mind, the following two market fields may be pointed out as a promising product market outlets:

(1) Industrial-use products market centering on belt conveyor and hoses

(2) SBR latex market as road pavement improving agent

The following paragraphs will further elaborate the background and the future prospect concerning the above two promising commodity market outlets.

3-1 Market for industrial-use products

Nearly all the demand for industrial-use rubber products in Iran is presently met by imports. However, the demand for the industrial-use products is obviously growing along with the progress of the industrialization of the country. In the year 1976, Iran imported 2,600 tons of conveyor belts, or Rl.6 billion in value from overseas. In addition, 5,000 tons or Rl.7 billion - 1.8 billion of other industrial-use rubber products were imported into Iran during the same period. In other words, the already existing market for the industrial-use rubber products is as large as R3 billion - R4 billion.

As has been discussed earlier, it seems absolutely necessary to embark upon early production of these items in Iran by means of technology transfer agreements, foreign investment induction, etc.

3-2 Market of SBR latex for the improvement of paved road

In Iran, the means of transportation for commodity distribution is almost entirely dependent upon land transportation. It is estimated that 80% to 90% of the total transportation facilities consists of truck transportation. The efficiency of transportation by trucks depends largely on the performance of the roads. SBR is an effective improving agents of the asphalt pavement of the roads. In Japan, 6,000 tons of SBR latex (3,000 tons in terms of conversion into solid SBR) was consumed in 1976 in this field. The consumption of SBR in Japan in this application is definitely growing.

The oil producing districts of Iran mostly belong to high-temperature zones where asphalt-paved roads often become

too soft to hold the load. By blending SBR latex in the asphalt, the waving and melting of the road will be prevented, thereby considerably increasing the endurance. From this viewpoint, 25% increase in the paving cost is by no means expensive. In view of the improvements brought about in the transportation efficiency, the additional cost will amply pay for itself.

Within the framework of the Sixth Plan which starts in 1978, it is likely that road-construction-related projects amounting to 3,800 Km have been newly formulated in addition to the delayed portion of the projects envisaged during the Fifth Plan.

If it is assumed that SBR latex at a rate of 10 weight % is used for 1,000 km of the planned new roads, about 35,000 tons of SBR latex, or 17,500 tons of solid SBR will have to be consumed. (Assumption is made here that the road will be of two lanes, 7-meter width, requiring 5 kg/m^2 of SBR latex.)

For this work, the paving cost will be increased by approximately 25%. The necessary facility cost will be for the cost of pumps (about ¥300,000 per pumps) in the case of the Hot Mixture Process in which the pumps are used on the spot. If SBR latex is to be directly fed into an asphalt plant, the cost of such a plant will be from ¥100 million to ¥300 million (requiring two operators).

Concerning the SBR latex product for road improvement application, the JSR-Roadex manufactured by Nippon Gosei Gomu K.K. is the best proven product so far.

III SYNTHETIC FIBER RAW MATERIALS

1. Outline

1-1 Relationship between petrochemical industry and synthetic fiber manufacturing industry

The synthetic fiber manufacturing industry developed along with the petrochemical industry from which nearly all the raw materials are supplied. At present, the synthetic fiber raw material industry is considered to be part of the petrochemical industry in the broader sense of the term. Fig. III-1-1 shows the relationship between the raw materials and products of the synthetic fiber industry together with the related industries.

Iran has a conspicuously well developed textile industry together with Turkey and Egypt. With the history of the carpet manufacturing industry and cotton spinning/weaving industry in the background, Iran embarked upon the operation of the synthetic fiber processing during the decade of 1960. In 1969, the production of nylon fiber was started. During the 1970s, polyester and acrylic processing facilities were installed, and at the same time the importation of these types of synthetic fiber began to increase. At present, production facilities for polyester and acrylic fibers are being installed, while projects for expanding the nylon fiber producing plants are being formulated. Although Iran does not have the synthetic fiber raw material producing industry, the construction of a BTX plant is already started within the framework of IJPC's project. Further, a study is made on aromatics plant project to be constructed in Abadan. Together with NPC, a joint study has been started concerning the construction of plants to produce caprolactam and DMT/TPA.

1-2 Relationship between synthetic fiber raw material industry and synthetic fiber manufacturing industry

Almost 98% of the total production of synthetic fibers in the world consists of nylon, polyester, and acrylic fibers, namely the three major synthetic fibers. It is likely that this structure will not change in the future. As shown in Fig. III-1-2, the supply of the raw materials for the three major synthetic fibers is entirely made from the petrochemical industry. The features of the relationship between the synthetic fiber raw material industry and the synthetic fiber producing industry are as follows:

(1) The items constituting the so-called synthetic fiber raw materials are used almost entirely for the production of synthetic fibers. Caprolactam, cyclohexane,

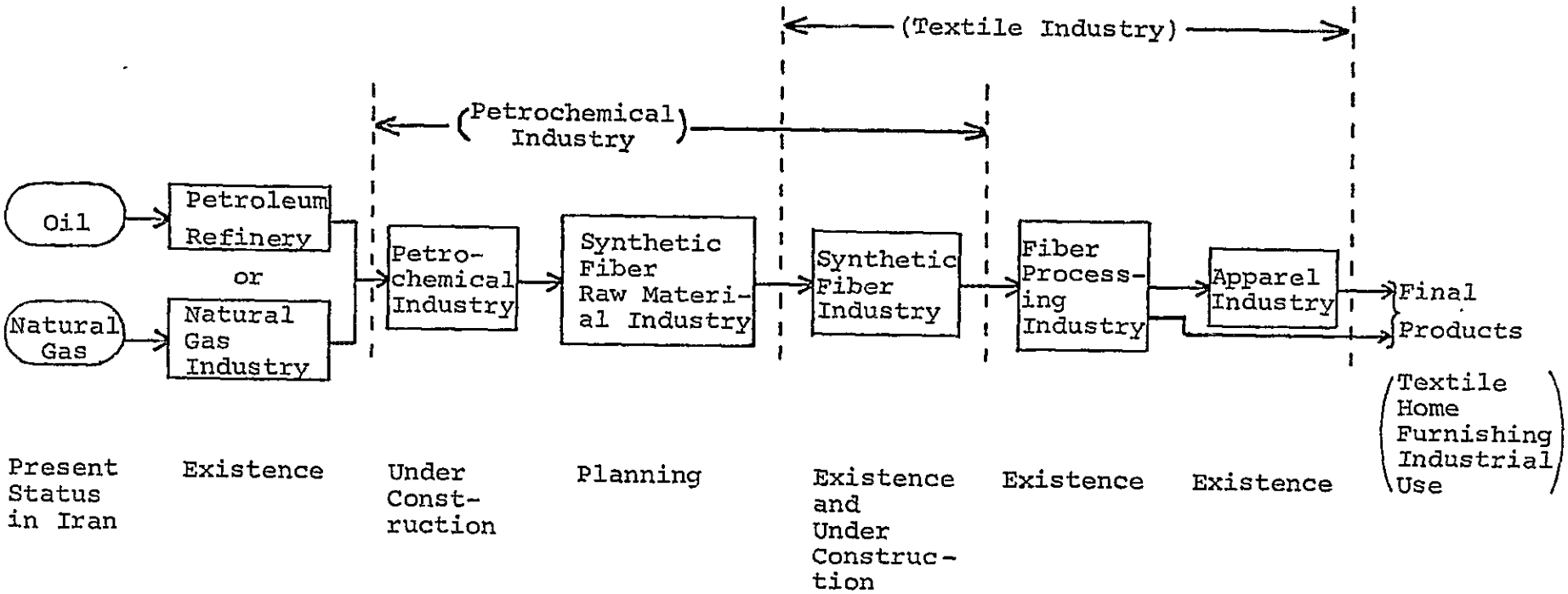

Fig. III-1-1 Relationship between Synthetic Fiber Manufacturing Industry and its Related Industries

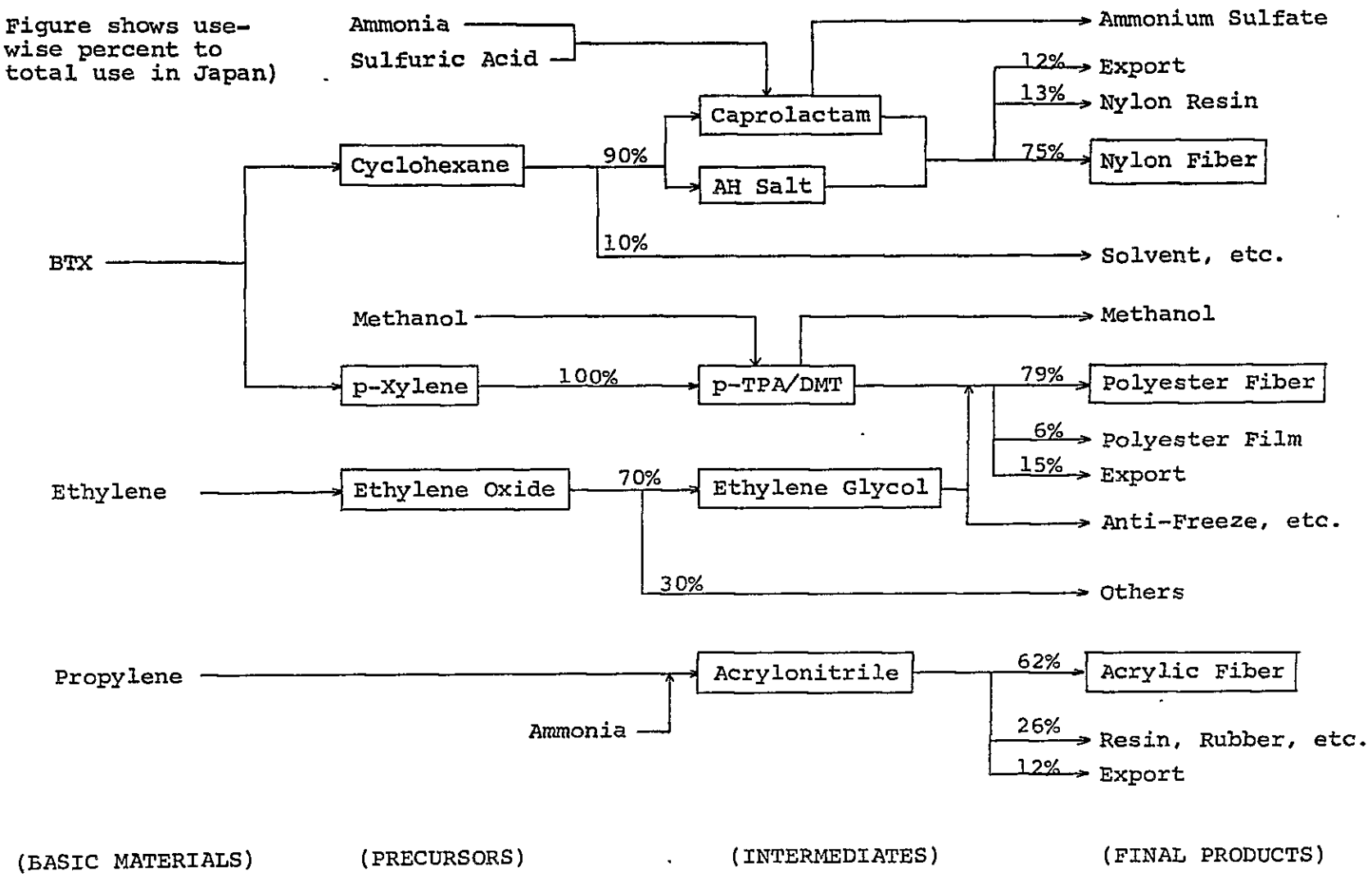

Fig. III-1-2 Relationship between Synthetic Fiber and Synthetic Fiber Raw Materials

DMT/TPA, and p-xylene, which are the major raw materials of nylon and polyester have almost no application field other than for the production of synthetic fibers. Acrylonitrile is the major raw material of acrylic fibers, and ethylene glycol/ethylene oxide is another important raw material of polyester. These raw materials are most extensively used in manufacturing synthetic fibers.

Therefore, the relationship between the manufacturers of the synthetic fiber raw materials and the synthetic fiber manufacturers who are the consumers is extremely close.

(2) The aromatics petrochemical industry largely depends on the synthetic fiber manufacturing industry.

The crude raw material of caprolactam and cyclohexane is benzene, while that of DMT/TPA is xylene. Both benzene and xylene are major aromatics products. From this viewpoint, the existence of the aromatics petrochemical industry is possible only when the crude raw material supply to the synthetic fiber raw material industry is ensured. Therefore, the operational rate of the aromatics petrochemical industry is largely affected by the production trend of polyester and nylon.

(3) The minimum economic scale of the synthetic fiber raw material industry is much larger than that of the synthetic fiber manufacturing industry.

The minimum economic scale of the synthetic fiber manufacturing plant is about 20 ton/day (7,000 ton/year) in the case of polyester SF manufacturing plant.

Generally, the production scale of a synthetic fiber manufacturing plant is over 40 ton/day (14,000 ton/year). In the case of FY producing facilities, the most common scale is 20 ton/day to 30 ton/day (7,000 ton/year to 10,000 ton/year) or higher. However, the direct manufacturing facility which forms a unit of the operation is very small, so that there are several FY manufacturing plants each having a capacity of less than 20 ton/day.

On the other hand, the minimum economic scale of a synthetic fiber raw material plant is roughly 50,000 ton/year which depends on the type of the product. The normal scale of operation in this industry is over 100,000 ton/year. Therefore, the minimum economic scale of the synthetic fiber raw material industry is almost ten times as large as that of the synthetic fiber manufacturing plant. Therefore, except for the case of mainly export-oriented plants, the construction of synthetic fiber raw material plant is usually studied only after ascertaining that the

domestic synthetic fiber manufacturing industry will attain a certain scale of operation.

1-3 World production trend of synthetic fiber

Fig. III-1-3 shows the material-wise trend of fiber production in the world. As is evident from this illustration, an overwhelmingly large part of the total textile production increase has been achieved by the growth of synthetic fibers. As it is not possible to expect any significant growth in the natural fibers and regenerated fibers in the future, it is obvious that the textile consumption growth from now onwards will be almost entirely covered by the increase in the production of synthetic fibers.

Table III-1-1 gives the past production records and future outlook of the three major synthetic fibers. The world synthetic fiber production stagnated in 1974 and 1975; however, the production attained a record high of 860,000 ton/year in 1976. It is now forecast that the growth rate from now onwards will be lower than the past rate. However, it is still expected that the average annual growth of production until 1982 will be 6.1%.

In terms of material-wise comparison, polyester showed the highest rate of growth because of its cost advantage and the paramount applicability in garment field. In 1980, it is expected that polyester share will be 50% of the total synthetic fibers. Although nylon is expected to grow in the carpet manufacturing and industrial-use fields, the growth is not highly expected in the garment field except for special applications. In Europe and the U.S.A., some leading synthetic fiber manufacturers are giving up the nylon production. Acrylic fibers have been showing a considerably high growth in the field where wool has traditionally been used, such as knitted products, carpets, curtains, blankets. However, the demand scale of the wool-application field is not as large as that of cotton, so that the acrylic fiber share in the total synthetic fiber production has been stagnated. The demand of acrylic fiber shows a conspicuous difference from region to region of the world. The share in the West European countries is higher than other regions because of the traditional propensity towards wool.

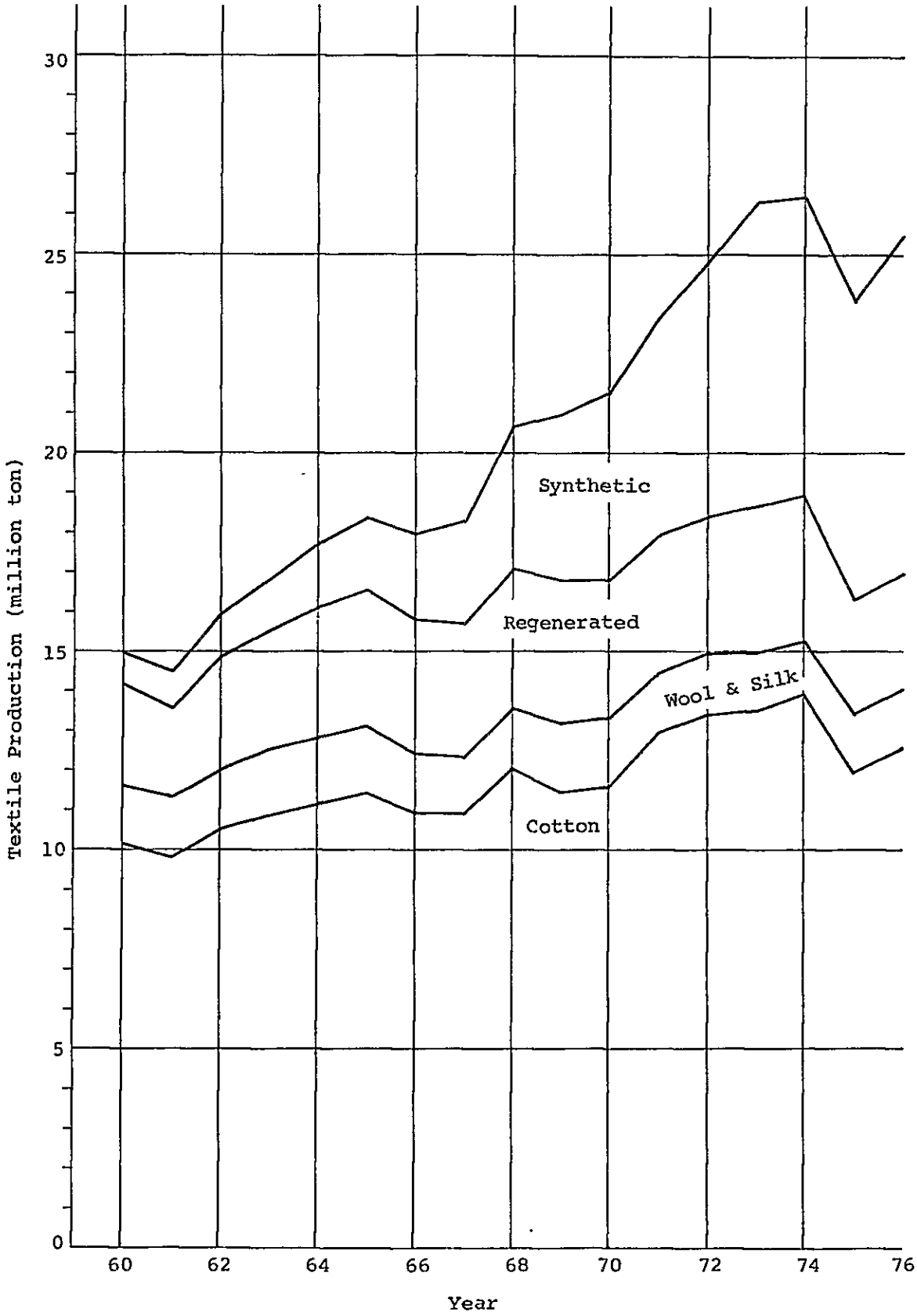

Fig. III-1-3 Trend of Textile Fiber Production in the World

Table III-1-1 Trend of Synthetic Fiber Production in the World

	Production Amount (1,000 ton)						Growth Rate (%)	
	1970	1974	1975	1976	1980 1)	1982 1)	1970/76	1976/1982
Nylon	190	260	247	283	320	335	6.9	2.9
Polyester	165	328	337	391	570	665	15.5	9.3
Acrylic	100	145	140	173	215	220	9.6	4.1
Total 2)	470	749	736	860	1,110	1,230	10.6	6.1

Sources: Textile Organon
Kasen Geppo
(Japan Chemical Fiber Association)

Notes: 1) 1980, 1982; Estimate amount.
2) Including other synthetic fiber.