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THE DEVELOPMENT OF THE PLASTICS INDUSTRY IN
BRAZIL, COLOMBIA, ARAB REPUBLIC OF EGYPT,
INDIA, INDONESIA, IRAN, LEBANON,
NIGERIA, PHILIPPINES, URUGUAY,
AND YUGOSLAVIA

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BRAZIL by Sergio BRIOSCHI SOARES and Carlos SCHNEIDER NOELLER

The Brazilian Petrochemical Industry

The year 1972 is pointed as the most important in the history of Brazilian Petrochemical Industry.

The "Petroquimica UNIAO" will begin its operations this year, and then will occur one complete transformation in that industry. The enterprise is one investment of Brazilian Government and private groups of Brazil, with a total value of U.S. \$ 125 million. The production schedule for the period 1972/1975 is as follows:

1972 - 355,000 tons
1973 - 714,000 tons
1974 - 760,000 tons
1975 - 840,000 tons
1976 - 990,000 tons

The financiers plans and the economic studies were made by "Compagnie Industrielle et Agricole de Ventes a l'Etranger" and it was selected the transformation process of West Germany and USA. The raw material is nafta.

The petrochemical industry began in Brazil during the year of 1957, with the installation of plants to produce amonia and fertilizers by the Brazilian Petroleum Co. (Petrobrás).

In 1958 was started, by the same company, the production of ethylene and polypropylene. In the same year, the Brazilian Petroleum Co. built another refinery to produce styrene, metanol and polyethylene LD.

With the increase of consumption of these materials, it was necessary to import raw materials, and in 1964 it was created the "Brazilian Petroquimica Co.", to stimulate and control all the projects in this area.

The chemical industry participation, in Brazil, is 18% of the total value of transformation industry and 6% of National Brute Product.

The Brazilian government approved 140 industrial projects in petrochemical area, with the investment of 770 million dollars. This project will permit this country to change its importation of raw materials to exportation and at the same time to satisfy the great expansion of internal market.

The actual estimation for the year of 1980, shows that the Brazil will be the first in South America and the seventh number in the world in petrochemical industry.

The situation of transformation industry at the moment to plastics materials is as follows:

1. P.V.C.

During 1972, the total production will be 105,000 tons and the consumption will rise up to 110,000 tons. The principal producers are:

- a) Elclor Industrias Quimicas
Production of 40,000 tons in this year. In the next year the production will rise up to 65,000 tons.
- b) Gean do Brasil
Production of 18,000 tons in 1972.
- c) Brasivil Resinas Vinilicas S.A.
Production of 40,000 tons in 1972 and 60,000 tons in 1973.

For the years of 1974 and 1975 the following firms will begin to produce:

- | | | |
|------------------|---|-------------------|
| Hils Brasil S.A. | - | 50,000 tons/year |
| Copamo | - | 100,000 tons/year |

2. Polyethylene - Low density

The actual situation: for the consumption of 105,000 tons/year, this year's production will be 60,000 tons.

The biggest producer is the Union Carbide Brasil S.A., with one production of 40,000 tons/year and during 1972 "Poliolefinas S.A." will start, which belongs to Brazilian Petroleum Co., with a production of 60,000 tons/year.

3. Polyethylene - High density

The principal producer is "Eletroteno Industrias Plasticas S.A.", whose production is 50,000 tons/year.

4. Polystyrene

The principal producers are:

- a) Dow Quimica S.A. - Actual production of 15,000 tons/year and will raise the production to 30,000 tons/year in 1974.
- b) Koppers Brasileira S.A. - Production in 1972 - 20,500 tons
Estimated production in 1973 - 41,000 tons

- c) BASF Brasileira S.A. - Actual production of polystyrene foam is 6,000 tons/year.

5. Thermosetting

Principal producers:

- a) Resana S.A. - Production of 10,000 tons/year.
- b) Resimpla S.A. - Estimate production for 1972 is 20,000 tons of formal and fenolic resins.
- c) Alba S.A. - The production will start in the next year with 80 tons/year of formal and 13,000 tons/year of resins.

6. Polyesters:

The consumption of Brazil is 600 tons/year. Principal producers are:

- a) Alba S.A.
- b) Resana S.A.
- c) Polidura S.A.
- d) Owens Corning do Brasil S.A.

7. Epoxides:

Annual consumption is 750 tons/year. Principal producers are:

- a) Dow Quimica S.A.
- b) Ciba-Geigy Quimica S.A.
- c) Indusquimica S.A.

8. Acrylate:

Actual production - 600 tons/year.

9. Polyimide:

Production - 250 tons/year.

10. Polypropylene:

Principal producers are:

- a) Polibrazil - 30,000 tons/year
- b) Montecatini Edison - 40,000 tons/year.

11. ABS:

The national production will begin in 1973 by Koppers.

12. Polyurethane:

Principal producers are:

- a) Projenasa - 14,000 tons / year.
- b) Du Pont - 23,000 tons / year.

COLOMBIA by Adolfo GALLOI

Colombian Plastics Industry

The plastics is a very fast growing industry. Taking 1964 as a basis, in 1972 it had an increase over 500% :

<u>Year</u>	<u>Consumption(Tons)</u>	<u>Index</u>
1964	9904	100
1965	11860	119
1966	14232	143
1967	24201	244
1968	30098	302
1969	34471	346
1970	40042	401
1971	45613	457
1972	52391	524

These figures show the tons of plastic resin consumed in the manufacturing of different articles. As an indication of the different types of uses, these are the percentages per industrial area in 1970:

1- Housewares	5.8 %
2- Clothing and personal usage	2.0
3- Footwear	14.5
4- Toys and sports	5.3
5- Building and electronics	8.1
6- Pipes	4.6
7- Packaging	7.0
8- Bottling	8.1
9- Rubber and vinyl cloths	15.4
10- Synthetic foams	3.0
11- Intermediate products (Films, sheets and plates)	21.9
12- Others (Medicine, Optics, bussiness and drawing)	3.3
	<hr/>
	100.0 %

The most important fields are "Intermediate products", "Footwear" and "Rubber and vinyl cloths" that in a whole are 50%. The industrial articles (numbers 5 to 12) are 70% of the total production.

Exports:

Colombia has been increasing its exports, both in raw materials and finished articles:

		<u>1970</u>	<u>1971</u>
Raw Materials	U.S.\$	926,800	1,323,600
Finished articles		<u>1,855,000</u>	<u>3,144,900</u>
	U.S.\$	1,781,800	4,468,500

This represents a net increase of 250,000.

In U.S.\$ the raw materials exports are detailed as follows:

		<u>1970</u>	<u>1971</u>
Polyvinyl chloride (P.V.C.)		380,000	492,600
Polystyrene		130,700	392,300
Urea and melamine formaldehyde		171,200	284,000
Vinyl compounds		8,800	35,900
Others		<u>236,000</u>	<u>118,800</u>
	U.S.\$	926,700	1,323,600

In 1971 the raw material exports were given to the Andean Group (55%), the Latin American Common Market (39%) and other countries (6%). In this same year the finished product exports were divided this way: Andean Group (13%), the Latin American Common Market (16%) and other countries (71%). The Andean Group is formed by Brasil, Venezuela, Peru, Bolivia, Chile and Colombia. The Latin American Common Market includes almost all the Latin American countries. The principal markets for finished product exports are West Germany, United States of America and the Caribbean area countries.

In the next chart, it is possible to say that the Colombian exports are well growing:

1968	U.S.\$	1,205,300	
1969		2,322,500	93%
1970		2,781,900	20%
1971		4,468,600	61%

According to official estimations, the finished product exports will vary in the next four years in this way:

	<u>Medium Value</u>	<u>High Value</u>
1972	U.S.\$ 3,300,000	3,710,000
1973	3,720,000	4,330,000
1974	4,330,000	5,090,000
1975	5,100,000	5,780,000

Imports:

The raw materials imports in 1971 were U.S.\$ 5,139,000, divided into raw material (3,300,000) and other raw material for the resin production and some other plasticizers (1,839,000). The main values were:

Styrene monomer	10 %
Vinyl chloride	14 %
Acrylics	11 %
Polyethylenes	32 %
Polystyrene	10 %
P.V.C. and others vinyls	13 %
Polypropylene	9 %

Net gains and losses in 1971:

Imports	U.S.\$ 5,139,000
Exports	4,468,500
Deficit	670,500

Machinery Imports: For the transformation industry, its value was U.S.\$ 15,000,000 from January 1966 to April 1971. From May to December 1971 is U.S.\$ 2,400,000. The imports for the raw material production were U.S.\$ 7,900,000 for the first period and U.S.\$ 36,900,000 for the second.

Raw Material production: There are 12 plants for the production of raw materials and for producing other basical items such as intermediate products. Some of them have two or three different resins. The next chart shows the situation in January 1972:

	<u>Capac. Ton/year</u>	<u>Product. (Tons/year)</u>	
		<u>1970</u>	<u>1971</u>
Polyester resins.	800	77	500
	600	—	12
	1,400	77	512

	<u>Capac. Ton/year</u>	Product. (Tons/year)	
		<u>1970</u>	<u>1971</u>
Phenolics (moulding)	1,000	164	600
	<u>240</u>	<u>160</u>	<u>120</u>
	1,240	324	720
Phenol-formaldehyde	800	190	220
	<u>1,400</u>	<u>80</u>	<u>1,000</u>
	2,200	270	1,220
Melamine-formaldehyde	1,300	128	250
	<u>1,000</u>	<u>600</u>	<u>800</u>
	2,300	728	1,050
Urea-formaldehyde	240		45
	<u>800</u>	<u>600</u>	<u>600</u>
	1,040	600	645
P.V.C. (suspension)	13,700	7,600	8,750
Polystyrene (general purpose and impact grades)	6,000	3,600	4,800
Polyethylene (low density)	17,400	812	3,695
Fiberglass	120	120	117
Plasticizers (Phthalics, adipics, malcics and epoxis)	8,900	5,591	5,923
Stabilizers	300	3	75
<u>Basic Materials:</u>			
Phthalic anhydride	1,800	900	1,100
	<u>2,900</u>	<u>2,243</u>	<u>2,218</u>
	4,700	3,143	3,318
Vinyl Chloride (monomer)	12,000	3,700	9,000
Ethylene	20,000	894	5,543

EGYPT by M. Zoweil

In Egypt there are three big factories dealing with the plastics industry. They are public enterprises.

The National Plastics and the Egyptian plastics Co. belong to the Ministry of Industry and the Medical Packing Co. belongs to the Ministry of Public Health.

National Plastics Co. is interested in producing household articles, either from thermoplastic or thermosetting materials. They use polyolefines, polycarbonates, as well as phenol formaldehyde and urea-formaldehyde. National Plastics have injection machines with wide range starting from 10 gms up to 3 Kgs. At the same time they have presses for thermosetting material up to 1,000 tons capacity. They have a unit to produce formica and several blowing machines to produce plastic containers (mainly from polyethylene) starting from 100 ccs up to 20 liters.

National Plastic Co. produce PVC pipes in various dimensions up to 6 inches diameter, which are used mainly for chemical industries and for sanitary purposes.

Egyptian Plastics Co. is specialized in producing articles for industrial purposes, such as spare parts for weaving and textile industries "pickers, cones, spinners, etc.". In the meantime, it produces all articles made from thermoplastics, as well as thermosetting materials, such as radio cabinets and the appropriate small parts, toilette seats, bottle crates, carboys for industrial uses and jerry canes.

Egyptian Plastics Co. produce flexible PVC pipes from rigid PVC which are used for wire insulation and they also have extruders for wire coating by soft PVC. This company is the only one in Egypt which produces expandable polystyrene which has the commercial name of STYROFOR. It is used as insulator in the building industry and used also as packaging for fragile articles. Nowadays, we are trying to introduce styrocork for packing fresh food to be exported abroad such as fish, vegetables and crabs.

Our consumption for this material is increasing very quickly especially for the purpose of packaging radio and TV-sets as a substitute for the corrugated paper.

In the Egyptian Plastic Co, there is a big plant for cloth coating by PVC and most of its product is exported abroad. We have a blowing machine, which already produces PVC bottles for vegetable oil instead of paper or glass containers.

We started in our company to produce PP strapping for packing as a substitute for steel bands.

We have small machines for thermoforming high impact polystyrene to produce light cups for ice-cream and it found a good market in Egypt. We have already imported an extruder to produce the profiles of PVC, and machines to produce insulators from the epoxy resin (Araldite) which is used in high voltage.

Our factory is going to import an extruder to produce high impact polystyrene films as well as PVC films, which will supply the above mentioned thermoforming machines with the sheets required. In the coming five years, Egyptian Plastics Co. will produce polyurethane foam, the soft one, which will be used as mattresses in hospitals, hotels and houses as a substitute for cotton mattresses. The rigid polyurethane foam will be used as insulator for refrigerators and packaging for articles.

There is a new trend to introduce polyurethane as packaging of textile fabrics.

Medical Packing Co. is specialized in producing articles for drug packing, either liquids or tablets. This company covers all the needs of the total pharmaceutical factories in Egypt.

INDIA by P.R. Malhan

Manufacture of plastic raw materials both thermo-plastics and thermosets entered an era of planned development in India around the year 1950, prior to the beginning of the first plan with the production of 324 tonnes of phenolic moulding powder. In 1955, prior to the beginning of the Second Plan, phenol formaldehyde again was the only material made and production was 715 tonnes. In 1960, prior to the beginning of the 3rd plan, phenol formaldehyde, Urea formaldehyde moulding powder, polystyrene and polyethylene were the materials produced, the total production being 3,226 tonnes. In 1965, prior to the 4th plan, phenol formaldehyde, urea formaldehyde, polystyrene, polyethylene, P.V.C. and cellulose acetate were produced and the total production was 37,017 tonnes. The production has crossed the mark of 1,000,000 tonnes in 1970. The production of plastic raw materials at the end of the 4th five-year plan has been estimated at 230,000 tons and by 1979-80, the target fixed is around 5 lakh tons. The production of various plastic raw materials during 1970, 71 is given in the following table:-

TABLE I

	1970 (tonnes)	1971 (tonnes)
1. P.F. moulding powders	5,330	4,477
2. U.F. moulding powders	1,680	1,945
3. Polyester Resin	355	405
4. Polystyrene	9,300	10,969
5. L.D. Polyethylene	2,300	26,000
6. H.D. Polyethylene	18,350	22,000
7. P.V.C Resin	38,700	41,648
8. C.A. Moulding Powder	1,050	1,276
		<u>108,730</u>

Plastic Conversion Industry

The origin of the Plastic Conversion Industry in India may be traced to the year 1940, when consumer goods like combs, soap - boxes and ashtrays were manufactured for the first time from imported raw materials. This was followed by introduction of injection moulding for the manufacture of various other consumer articles. The manufacture of industrial goods like leather cloth, P.V.C. sheeting, phenolic laminates, polythene film and lay flat tubing developed during the 50's.

Whereas the manufacture of raw materials is mainly in the large scale sector, the plastic conversion industry is more suited for development in the small scale sector. At present, there are only about 100 units making various plastic products in the large scale sector, whereas in the small scale sector there are about 4,000 units manufacturing various plastic items. Out of these 50 % are registered with the State Directors of Industries and the rest are unregistered units. To give an idea about the types of products manufactured in the small scale sector, a list has been given at appendix I. It would be seen from the list that the small scale sector produces a variety of products both for industrial and non-industrial use. During the last few years, the Small Scale Industries Development Organization have made efforts to develop some new types of products which were not being made in the country so far. Among them are blow moulded containers, acrylic sheets, polyurethane foam, metallic yarn, high density polythene woven sacks, P.V.C. rigid film, industrial components from ultra high molecular weight high density polyethylene, teflon components, etc.

The following table gives an idea about the distribution of plastic conversion units in the Small Scale Sector according to the process of manufacture. This information is not complete because some of the unregistered units have not been covered:-

TABLE II

<u>Technique of production</u>	<u>No. of units</u>
1. compression moulding	500
2. Injection moulding	900
3. Blow moulding	120
4. Fabrication (articles manufactured from plastic sheets, rods or tubes, etc.).	500

5. Extrusion (including polythene films and products made therefrom).	500
6. Monofilament from polyolefines.	100
7. Spectacle frames from sheets by fabrication technique or by injection moulding.	250
8. Others	600

Exports

The plastic industry has fared and continues to fair creditably in the sphere of exports. India's exports of plastic products during 1966-67 were only for Rs.3.2 crores which increased to Rs.6.10 crores during 1970-71. The details of the various plastic products exported during 1970-71 are given below in table III.

TABLE III

<u>Items</u>	<u>Exports (in lakhs)</u>
Linoenums	43.74
P.V.C. sheeting	53.87
P.V.C. leather cloth	76.66
Laminates	21.69
Electrical accessories	31.13
Spectacle frames	33.52
Bangles	19.84
P.V.C. fabricated goods	12.79
Fountain Pens and Ball point pens	35.51
Imitation Jewellery	34.89
Extruded goods	164.94
Moulded goods	80.77
Total :	609.35

Future Scope for Development :

In the industrially advanced countries like U.S.A., West Germany, Japan, U.K., etc., the plastic industry has made a phenomenal growth. This is reflected in the per capita consumption in pounds of plastics, 56 in West Germany, 50 in USA, 32 in Japan and 30 in U.K. As compared to this, the per capital consumption in India is very poor which is only 0.2 kg. Thus, there is great potential for further expansion of this industry in India.

Looking to the future availability of raw materials from the present production of a little over one lakh tonnes, the production during 1973-74 is expected to be of the order of 230,000 tonnes, whereas the targets for 1979-80 are around 5 lakh tonnes. Keeping this in mind, it can be anticipated that the conversion industry would multiply 5 to 6 times by the end of 1980's.

Similarly in the field of employment, the industry provides gainful direct employment to over 1 lakh workers. This is expected to increase to at least 5 to 7 times by the end of the decade.

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APPENDIX - I

Plastic items produced by Small Scale Sector:

(a) Non-Industrial:

Buckets, Lunch-boxes, Melamine crockery, Neon-sign letters, Pen-stands, Fountain pens, Ballpoint and refills, Spectacle frames, Bangles, Tie-hangers, Spoons, Magic-glass, Lamp-shades, Funnels, Beads, Key-chains, Imitation ivory, Tumblers, Plastic cane, Containers, Combs, Shopping bags, dishes and trays, Polythene tubing, Novelties, Advertising items, Tooth and shaving brushes, handles and containers, hair-brushes, umbrella handles, shields, water jugs, photo frames, boxes and caps, bottles, foot-mats, nylon buttons, collar-bones, buckles, cups and saucers, diary covers, wallets, folders and files, shaving cups, pencil and pen-caps, decorative flowers, nylon hair bristles, plastic toys and games, vacuum flask accessories and stoppers for flasks, zip-fasteners, rain-coats and table-tops, tubes, etc. etc.

(b) Industrial

Electric-lamp, table-lamp, wall-lamp accessories, cylinders, motor glasses, watch glasses, washers, nylon bearings, wall clock cases, level-indicators, radio cabinets and knobs, textile spares, electric board, industrial components, radio back covers, condensers, gear wheels, micro-motor parts, items for electronic and glass industries, industrial oil cups, dehydrators, bushes, bearings, stoppers, polypropylene, watch parts, nylon strips and rods, telephone cord, F.V.C. tubing and sleeves, door switches, automobile accessories, electrical accessories, bakelite meter covers, bobbins, carbons, stores for defence, plastic insulation base, radio dials, etc.

INDONESIA by H. Hadiwardjo

Indonesia in fact has sufficient natural resources which could be used mainly as raw materials for plastic purposes, i.e. petroleum and natural gas.

Especially in plastic industry, it is a real benefit whenever those natural resources could be processed to reach the end products. But since our country is still within the upbuilding period, where the sense of know how and the ability in technology is very scarce, such as processing the natural resources to the end products encounters various difficulties.

Among other difficulties which appear in the production process, using natural resources as the main raw material, especially in plastic industry, are:

1. The process of cracking, refining etc., which indicates to obtain the plastic raw material (i.e. ethylene, propylene, styrene, etc.). But the process in obtaining the plastic raw material in Indonesia is not efficient, for some results of it still can not be used, except ethylene, propylene, styrene.
2. By using natural resources as raw material, certainly needs the industries which pass the minimum economic size.

On the other hand, industries with full production capacities will create marketing problems:

- a. the products exceed the people's demand.
 - b. the domestic products have to compete with the imported goods, which obviously are of higher quality.
 - c. exporting purposes will face the competition from the more developed countries.
3. The scarcity of experts and qualified labours, especially within the plastic industrial field.
 4. Considering the above circumstances, it is more reasonable to use the intermediate products as raw materials, which have still to be imported temporarily.

The present situation of Plastic Industry in Indonesia

Since the year 1950 until today there are about more than 200 enterprises which run the plastic industries of which mostly consist of small private enterprises, only one or two of them acts in joint ventures.

- Each enterprise has about 10 to 400 employees.
- Regarding the raw materials, as had been explained before, at present, all kind of industries in Indonesia is still unable to process the basic raw material i.e. petroleum and natural gas, which is abundantly available as raw materials, but the intermediate products are the only raw materials to be used.

These intermediate products are mostly imported from Japan and Hongkong, which consist of the following kinds:

- Polystyrene
- Polypropylene
- Polyethylene
- Polyester
- P.V.C.
- Urea formaldehyd
- Nylon bristle
- etc.

The import of the intermediate products which will be used as raw materials, are mostly from the kind of: thermoplast resin, whereas the thermosetting resin plays only a minor part.

The following figures shows the result of a survey made by BEICIP.

Demand estimates for the thermoplastic resin:

	<u>1971</u>	<u>1972</u>	<u>1973</u>	(ton)
Polyethylene	10,990	13,200	15,840	
P.V.C.	3,960	4,560	5,240	
Polystyrene	1,580	1,770	1,980	

The need for other raw material occurs only within a smaller quantity.

Process

The procedures of the industrial process which are used by the enterprises, are very simple, i.e. the mechanic and physical process. This industrial process uses the following simple equipment:

hand press machine	extruder
hand injection	blowing
sheet machine	printing
injection moulding	

The chemical process which is available is still using the imported raw material, such as monomer, which runs through the polymerization to become polyethylene.

Products

Most of the product yields from the plastic industry could be seen as:

- household wares
- electric equipment
- packing materials
- boxes and containers for drugs, etc.
- children toys

We can not deny that the quality and the quantity and the kinds are still far from perfect and sufficient, compared with the imported ones. If we make a summing-up, the level of the plastic industry in Indonesia, just at the stage of processing the imported polymer to be the final products.

Industry's future prospect for development

- A. Due to the abundant basic raw materials which are available in Indonesia, surveys are held now through the co-operative works with foreign teams, in order to find out the up-to-date datas.

The survey is not only done within the plastic field, but also about petrochemical in general, which has a relation with the industries: plastic, detergent, fibres, auxiliary chemicals, pesticide, etc.

The teams who make the surveys and the feasibility study, are among others:

1. ECAFE/AIDC (1968).

Resulting in the identification of 16 possible joint venture projects, among others a petrochemical complex in Thailand and another one in Singapore.

The study was focused on naphta as raw material.

2. HEKIP (1971).

Similar to AIDC.

3. A World Bank's team (1971).

On the planning for Industrial Development in Indonesia.

The report contains a chapter on the petrochemical industry which is identified as one of the major project for accelerating industrial development.

The study was focused on natural gas as raw material.

4. EDCI.

Is still studying the report from ECAFE/AIDC and the World Bank's teams, meanwhile awaiting for the result of the survey made by UNILLO.

5. UNICO from Japan (1972).

The survey concerns the synthetic fibre of cotton, rayon and polyester which is involved within the following industry as:

Textiles, paper, polyester.

- The survey is mainly held in order to find out:
- a. the location which is suitable for rayon industry.
 - b. the possibility of the development on polymerization plant of the synthetic fibre and spinning units with the monomer as raw material, which monomer is known as the by-product from the other process.
6. Japan Gasoline Co. Ltd. (1970).
Together with UNIDO making the newly started survey on Petrochemical industries in Indonesia.

B. The launching efforts and the future strivings:

1. It has been planned to build up the P.V.C. industries, by using the imported Vinyl chloride as the raw material, which through the polymerisation becomes powder or grains of P.V.C., and capacity being about 15000 tons per year.

The joint venture with Hongkong.

2. The polypropylene industry is now 70% under construction, and its completion is to be expected in 1973. The raw material is propylene as the waste product from petroleum refining.

This industry possesses the production capacity of 20,000 tons per year Polypropylene.

Nowadays the seeding programme is being held by importing the Polypropylene, as the preparation to the coming product.

The production of Polypropylene has been planned to enable to fulfil the marketing condition in Indonesia, and there are several companies that have stated their willingness to use it. This project is considered as a National Enterprise with a loan from the U.S.A. for process and equipment.

The process with is used to produce this Polypropylene has been planned to be extended on the following processes:

1. Blown film
2. Injection moulding
3. Extrusion for:
 - a. monofilament
 - b. ribbon filaments, tapes
 - c. molded container

This project is meant to utilize the waste product from petroleum refining, and to produce especially packing sacks for fertilizer.

3. Gresik Petrochemical General Enterprise, is the second Petrochemical factory in Indonesia, with the main products: Fertilizer ZA - 150,000 tons/year, and as by-products: Fertilizer Urea - 45,000 tons/year. The by-products are: sulphuric acid, ammonia, oxygen and argon gas.

Fuel oil and sulphur being used as raw material.

This enterprise also plans to promote the plastic industry, by producing the Urea formaldehyd, which could be used as:

- a. glue in plywood processing.
- b. plastic substance for many kind of purposes.

(It should be noticed that the first Petrochemical Industry in Indonesia that produces Urea Fertilizer by using natural gas as raw material).

G. Planning of the petrochemical industries development:

The present situation on the industrial development in Indonesia could be viewed from:

1. The abundant basic raw material.
2. The ability to run and to promote the industries.
3. The amount of people's needs.
4. The marketing of the products.

The Department of Industries of the Republic of Indonesia has made special planning in the Petrochemical/Plastic Industrial field, which could be divided within the short run and the long run planning:

1. The Short Run Planning:

To improve the technology and the present process of the intermediate products to reach the end products.

2. The Long Run Planning:

To study the improvement in technology and process of the basic raw material to reach the end products.

The above explanation could be summarized as follows:

A. The present stage of the Plastic Industry in Indonesia.

1. Still using the imported intermediate products as raw materials.
2. The equipments and the methods of process available are still very simple, and even as the backward process.
3. The industry is just as an assembled industry.
4. The production capacities still do not reach the consumers' need.
5. The size of the industries are mostly of the small ones.

B. The survey and feasibility studies are setting forward on the basic raw materials which we have abundantly, and also to find out the possibility of the development and improvement of the settled industries, and to consider the usage of domestic raw materials.

C. The final planning on this purpose is just to possess the ability in processing the basic raw materials to be the end products, efficiently and economically.

This is the conclusion of our brief explanation on the situation about the plastic industry in particular and the petrochemical industry in general in Indonesia.

IRAN by Bagher SHAKOORI-BAKHTIAR

Plastics fabrication in Iran started about 1947 with injection molding of small articles. The initial operations were on a very modest basis, and only ready-made compounds of polystyrene were imported from Western Europe as raw materials. At the beginning and for a number of years to come, transfer molding was the main system of fabrication. The machines used during early stages were generally hand-operated equipments of small capacities.

Pioneering work on a large scale began in 1956, when a government owned company started fabricating certain plastic articles.

During the years 1947-1956 some other developments took place. Many individuals and companies came into the field of plastics fabrication, and in 1950 for the first time polyethylene and polyvinyl chloride compounds were used.

It was not until the fifties that we see internally made plastics products begin to move on markets long held by imported goods and also by traditional materials such as glass, wood, paper and metal. These basic items were and are continued to be the base materials for construction, household, consumer and industrial uses. But despite all the competition by the traditional materials, the Iranian plastics industry grew at remarkable pace. Still the per capita consumption in the country was very insignificant.

It is not until 1960 that we can talk about consumption of relatively substantial quantities of plastics in Iran. The internal consumption of plastics in 1960 was about 11,000 tons compared with 1968 consumption of 69,000 tons.

In 1964 per capita consumption of various plastics in the country was slightly over one kilogram. The situation changed very rapidly, and in 1971 Iran is in a new position with a per capita consumption of almost three kilograms.

In terms of foreign trade, Iran imported approximately 11,000 tons of various plastic raw materials in 1960 with a total value of about 5,000,000 USD. The total cost of plastic resin and compounds imported into Iran until 1968 is well over 130,000,000 USD. This is a considerable outflow of foreign exchange.

Production of 20,000 tons of P.V.C. means a foreign exchange saving of about 6,000,000 USD. per year for Iran, and with the expansion programme under consideration, this saving would be easily doubled.

Early in 1968 the production of P.V.C. started at Abadan Petrochemical Complex and it is planned that certain other plastics such Polyethylene and Polystyrene be made locally. Despite this plan, all plastics except P.V.C. will continue to be imported into Iran for a number of years to come.

The original market study on which the design capacities of the Abadan Complex was based, predicted that internal consumption of P.V.C. would reach 20,000 tons per year by 1971-1972. Prior to 1971 it was intended to export the surplus P.V.C. production.

The production capacity of suspension type polymer is 20,000 tons per annum, which is well below the present local demand for P.V.C.

It has already been confirmed by consumers of local P.V.C. that the product of Abadan Complex "ARVAND" based on B.F. Goodrich technology and know how meets the highest standard of quality. The technical agreement with B.F. Goodrich is very broad in scope and provides for continuing exchange of technological information. In this way it is expected to keep the local industry supplied with the best P.V.C. resin for many years to come.

At present, local produced resin consists of four different suspension types, with "K" values of 60, 65, 70 and 75. The experience shows that 80 per cent of total demand is "K" value 65 type.

Great opportunities still exist for investors in entering the field of plastic fabrication in Iran since the demand for plastic articles is ever increasing.

However, the rapid expansion of the plastic fabrication in Iran, to some extent, has taken place with insufficient attention to market demands for certain articles.

Production of all plastic shoes, sheets and films is already well developed, wire and cable applications are off to a good start, but many opportunities still exist in the areas of agriculture products, packaging, industrial products, automotive accessories and specialities.

Greatest future growth is expected to be in production of pipes and fittings, wire and cable, building products. For most of this growth the domestic activity will be replacing materials either presently imported in finished forms from abroad or replacing other products made of other materials. It is also expected that P.V.C. flooring will gradually win part of the market at present held by other materials.

The import of plastic fabricating machinery from abroad is growing rapidly and with the expanding market demand for finished plastic goods, import of machinery is expected to continue. At present the total value of plastic machinery in Iran is estimated at 13,000,000, USD.

It can be concluded that fabrication of plastics in Iran which has been underway for the past ten years, is taking a proper shape and will be growing at a much more rapid rate with incoming petrochemical industries providing the necessary raw materials.

With the rapidly growing population of Iran at the rate of 2.8 per cent per annum and increasing purchasing power of the people, the plastics industry has no choice but to expand at a higher rate to be able to cope with the increasing market demand for plastic goods.

Nobody, who visits Iran fairly regularly can fail to notice changes in the growth of plastics industry. To the west and south west of Teheran, modern industrial suburbs have risen. Foreign and domestic investors are continuously expanding their original establishments, and new plants for plastics are being created regularly.

Iran's economic growth is big, and so is plastic's share in it. Those concerned with plastics are well aware of the growing penetration plastics have been making in the Iranian market, and they will realize that this penetration will depend considerably in the years ahead.

Though, in a short period plastics industry, in Iran has had a remarkable growth, but still there are many problems in this field. There is a considerable lack of knowledge regarding chemical and mechanical behaviour of plastics, which results in a poor quality product and not using the right material for the right job. The die and mould fabrication has improved, but there is a lack of knowledge in design calculations, and mostly the work in this field is based on experimental and try and error methods, this system causes considerable amount of delay in mould fabrication and still the end result is not the best.

LEBANON by A. Kanafani

Typical of a developing country is to emulate the western countries in their industrial products. No product has caught on, internationally, and so fast, as much as the plastic products. Lebanon, being among the quickly developing countries is no exception to this rule. The impact of the plastic age has made the Lebanese plunge into the plastic products in a frenzy.

At first, it was the importers who reaped the benefits of this boom. But later on a few industrially-minded Lebanese ventured into the full production of plastic products. In spite of the size of Lebanon (pop. 2,5 million) no less than a dozen major manufacturers of plastic material supply the needs of this country and its immediate neighbours. These manufacturers put out a variety of plastic products starting with the thermoplastic polymers (P.E., P.P., P.S., P.V.C., etc.) to the highly sophisticated melamine tableware. PLASTEX Co. where I serve as production manager, is the sole manufacturer and supplier of melamine products in Lebanon. We also export our melamine, as well as our P.E. products to the surrounding countries and to those of North Africa.

The most common line of production of plastic material here in Lebanon is the injection moulding of P.E., P.P., P.S., P.V.C. Most of the plastic household appliances and kitchen ware is locally manufactured by the injection moulding technique. Being such a simple process, the small time, as well as the large manufacturers find it very profitable to get into this line of plastic manufacturing. For this reason, one will find that the majority of plastic manufacturers here have one or more injection machine in their factory. Most of these machines come from Germany, Italy and U.S.S.R. The size of these machines vary from 80 gram, to the 2 Kg. giants. The moulds are mostly manufactured locally, but for complicated parts they are imported from abroad. Typical of what we manufacture on our injection machines at Plastex are the P.E. bag handles, P.S. water tumblers, P.P. textile spool core and many other handles and knobs.

Next in line of popularity comes the P.E. extruded film. It does not take much to buy an extruder, set it up in a room, order the raw material from a supplier, and extrude P.E. film. For its simplicity, extrusion of P.E. film has spread to most manufacturers of Plastic in Lebanon. But as everyone knows, extrusion leads to many other operations such as: printing, laminating, bag making, packaging, etc. It is when one manufacturer indulges in some of those processes that problems start.

As mentioned before, all raw material and machinery is imported from Europe. Hence, this poses the first limitation on production. We are at the mercy of the supplier, freighter, customs official, and so forth down the line until we receive and install the machinery. Next comes the raw material. Many suppliers will balk at an order which is less than 500 to 1,000 tons, little do they know the consumption rates we have in a small country like ours. Hence we are obliged to get our yearly or six month supply of raw material and suffer the problems of storage, spoilage, and waste.

Next we have to worry about the know-how. Locally it is very rare that we find an experienced worker in extrusion, printing, laminating or any other lines of production. It means that for solving the problem of expansion, and replacing lost old hands we have to train unskilled laborers. When you take into consideration that Lebanon is among the developing nations you can imagine the quality of the unskilled labour we are faced with to train into a highly artistic profession such as P.E. film printing for example.

As the machines and other equipment get old we are faced with the problems of maintenance and spare parts. A maintenance group will have to be trained and nursed in our own factory so as to be able to tackle our machines. It is absolutely hopeless to try to find (locally) an expert to fix one of our machines, say a hydraulic injection machine. Those experts, or even skilled technicians in specialised areas are plane non-existent on a will-call basis here.

The spare parts pose another problem yet to the plastic manufacturers in Lebanon. Short of buying a replacement for every component of a machine we can never predict where the next malfunction is going to be on the machine. Some spare parts come with the new machine as recommended by the machine supplier, other spare parts are ordered as yet extra pieces when we buy a machine, relying on our past experience of the type and make of the machine. Some spare parts which get needed urgently are requested by cable from the European supplier, and airfreighted to us in 10 to 20 days. Finally, if all this fails, we find ourselves forced to manufacture the spare parts locally.

One can see from this the seriousness and cost of this problem, manifesting themselves in down time of the machine, administration expenses and headaches, transportation cost, and finally actual exorbitant costs for local manufacturing of a one piece spare part that is usually produced by the supplier of the machine en masse and at a fraction of the cost.

An additional factor to the difficulties we encounter in plastic manufacturing here in Lebanon is the kind of clientele we have. Particularly in the printed P.E. bags, the clientele is such an exacting, hard to please, perfectionist who sets standards for the produced items which can never be met. This creates a very challenging job for our marketing and sales department to try to force the customer into accepting his finished order. Some clients would actually return 25 bags with bad printing out of an order of 10,000 bags. It is in vain to try to explain to him that rejects of less than 1/4 % is actually admirable !

Finally a word about the essence of all those above mentioned problems: organization. Having hit this country in the slap-handed way mentioned earlier, the plastic industry in Lebanon was not based on strong foundation of organization, administration, and management. This has lead to plastic factories which are so tangled up in their chaos and mess that it would be easier to tear the whole outfit down and start again rather than try to correct them. Most such factories

have gotten into plastic manufacturing earlier in the 60's, and once they found out the acceptance of their products they neglected and sometimes refused to modernize their outfits. They could not be bothered with interrupting the old age processes to introduce new ways and techniques, this has lead to stagnation in the diversification of plastic products. Witness to this is the plastic furniture industry. Practically all of the plastic furniture is imported from Europe.

Therefore, we find now that to do both: introduce new ideas and techniques, and to re-organize is one of the most monumental challenges we face in the plastic industry in Lebanon.

NIGERIA by C.O. Ailinborewa

The Federal Republic of Nigeria is the largest single geographical unit along the West Coast of Africa and occupies a position where the western parts of the African Continent meet the equatorial Africa. Nigeria is divided into three major and unequal geographical sectors by the River Niger and its main tributary the River Benue. Nigeria's area of over 356,669 square miles is entirely within the tropical zone extending northward from the Coastline for over 650 miles. Its population of over 65 million is by far the largest in Africa.

Nigeria's potentials in human and natural resources are high. The growth of Industries since independence in 1960 is equally high. Amongst the various spheres of industrial growth are the plastic Industries.

When Nipol the first plastics factory in Nigeria, was established in 1957, enamelware was the traditional domesticware. There was very little plastic used and imports were negligible. There existed no pattern of usage or import statistics and extruded polyethylene water piping was considered the most suitable starting product. Piping was not successful as there was a general reserve against it, ancilliary fittings gave stocking problems and the anticipated rapid increase in water development did not materialise. Between 1960 and 1962, Nipol extended into injection moulding and film extrusion but at that time found it hard to establish a demand for plastic items. Gradually demand improved and other plastic manufacturers opened factories. Water piping continued to be made by Nipol, but was finally dropped from production in 1965, by which time there was a steady growing demand for domestic-ware and film products. As demand grew so did the number of factories which today number 60 plastic factories, with 30 of them in the same product group with Nipol while the rest concentrate mainly on plastic shoes. The plastics Industry in Nigeria, was a few years ago still very young and in a developing stage but today it can be said that the industry has conservatively doubled itself.

Other than P.V.C. shoe manufacture, the plastics industry in Nigeria, covers mainly injection moulded market items and extruded film products. It has suddenly changed from one of under-capacity to over-capacity and the annual review of the Standard Bank Nigeria, says "there are about 60 companies operating in plastics and

several new projects have yet to commence production - this is the most highly competitive market in Nigeria at this time and the older established companies are now turning their attention to the industrial market and the production of more sophisticated articles".

Nipol's performance in both profitability and return on capital are very good, considering the company's size and the relative small management team controlling it. Much of its success is due to the deep loyalty and hard-working of a small group of experienced managers who have been able to generate this spirit to their subordinates. It has also been helped considerably by the efficient servicing from Unacil London as well as the Central Services of Niger House Nigeria.

Nipol's expansion has been steady unlike some other plastic industries in Nigeria, it has both injection and film production which may counter any dramatic drop in one specific section.

Industrially, Nipol's strong point has been its ability to keep a high standard and because its well-equipped tool-room is able to do running mould repairs and to make urgently required machine parts.

Problems in the Plastics Industry

(1) There are still several problems to be solved especially in terms of production variety. Although some of the problems here are centred on advance mould designing. Mould designing offers unique production techniques and economics as well as desirable thermal, electrical and mechanical properties where experts are scarce, in Nigeria. Sophisticated Moulds are being ordered from Europe at high costs which only very few plastics industries can afford as a result, most of the companies restrict their production to the already saturated lines such as tea-cups, tea-spoons, small bowls, lunch boxes, etc.

Here again Nipol has acquired the technical skill of designing and manufacturing moulds of limited complications.

(2) Recognising the commercial prospects offered by plastics and cross-checking these in the light of technical and profitability considerations. This may involve the merger of mushroom plastic industries to incorporate their human resources in a single channel to effect greater results and soundness.

Trained and skilled personnel are few, the negative attitude of some plastic industries to develop their personnel is causing concern. Much is being left to very few with no desire to fortify the new entrants into the industry with sound technological training. As a result, products in the market are far below standard with signs of poor moulding techniques.

There has been a general awareness from the consumers to distinguish between one company's products and the others. "Nipol is noted for quality and products which will last so much longer" is often heard in the markets.

The future assessment of the plastics industry is that the Industry must grow to cover some of the more difficult processes not yet surveyed. Such as :

- (1) Industrial blow moulding to fine tolerances.
- (2) Patented injection-blow moulding.
- (3) Vacuum/Pressure foaming for the packaging industry.
- (4) Crate making.
- (5) Shrink wrap and high molecular films.
- (6) Large diameter pressure and sewage pipes.
- (7) Woven Sacks.

The rate of progress is the unknown factor but without some new application or considerably increased industrial demand, the natural growth in market lines will be more fiercely fought for and some firms may have to close. Industrial printed film should be well centered for but quality and service will always influence prices.

PHILIPPINES by T.G. Chaves, jr.

I. Historical background

In the Philippines, the plastics industry started way back in the late 1947. The product introduced was plastic tiles made by Plastics Inc. Although it was short-lived, the 1950's brought in varied other plastic products like pipes and fittings, toys and flowers, ballpens, insulation items, thermo products and sheets, and molded products.

Cheaper raw material from Japan, Taiwan, Korea and U.S.A. increased production and usage of plastics in the 1960's. Cheap P.B. resin brought an end to the virtual monopoly of jute bags in the packaging of agricultural products such as rice, sugar, corn, among a few. Notable contribution was the entry of Mabuhay Vinyl Corporation in the production of P.V.C. resin, the country's first plastics resin maker in 1965. The first three to four years production was more than the local demand of resin but on the latter part of the 1960's, local supply was short of demand. August 1972 saw Mabuhay Vinyl's capacity expanded to 20,000 MT/year.

It is generally believed that plastics in the Philippines achieved maturity as an industry in the early sixties. Most of the local companies are engaged in the fabrication processes, converting raw resin and molding powders to finished products. Thus, the growth of the business can be easily seen through importation figures of different raw materials and finished products available to the market.

II. The industry

There are presently close to 400 companies engaged in the plastics industry throughout the country. At least 200 plants operating are directly related to the industry. The 400 companies may be grouped into four classes:

1. Plastics raw material maker and suppliers - who produces basic plastics resins, compounds, additives like plasticizer, pigment, stabilizers, etc..

2. Processors who convert resins or compounds to desired shapes as semi-finished or finished products.
3. Fabricator and/or finisher
4. Machinery manufacturers and suppliers - specialized plastics processing.

Available Equipments are:

Compounder -

- | | |
|-------------|----------------|
| 1. Mixers | 4. Pelletizing |
| 2. Blenders | 5. Milling |
| 3. Banbury | 6. Knending |

Fabrication -

- | | |
|----------------------|--------------------------------|
| 1. Extruders | 7. Blow Molding |
| 2. Injection Molding | 8. Vacuum Forming |
| 3. Foaming | 9. Welding and Sizing |
| 4. Calenders | 10. Casting |
| 5. Compression | 11. Blister and Skin Packaging |
| 6. Coating | 12. Weaving |

III. Supply and Demand

Table 1 shows past supply picture of most common synthetic resins. Please note the percentage (%) increase of grand total figures which averages 45%. Except for P.V.C., all other resins were imported.

Table 2 shows the projected demand based on BOI petrochemical projections.

To help in the local supply of raw materials, there is a plan to put up a petrochemical complex by 1976. Also another P.V.C. plant is in the planning stage and may be operational by 1974.

TABLE 1
PAST SUPPLY OF SYNTHETIC RESINS (MT)

<u>Year</u>	<u>P E</u>		<u>PP</u>	<u>PS</u>	<u>P V C</u>		<u>Total</u>	<u>Grand</u>	<u>%</u>
	<u>HD</u>	<u>LD</u>			<u>Local</u>	<u>Imports</u>		<u>Total</u>	<u>Increase</u>
1962	1085	121	n.a.	322		3107	3107	4635	
1963	2615	291	n.a.	470		3693	3693	7069	52.5
1964	2645	295	818	681		4857	4857	9296	31.5
1965	3235	360	3348	458	213	4615	4828	12229	31.5
1966	5160	573	4325	705	3743	2553	6296	17059	39.5
1967	7024	780	5183	1322	4764	3067	7831	22140	29.8
1968	13800	1644	11960	3500	6566	2575	9141	40045	80.9
1969	n.a.	2100	n.a.	2870	7578	1861	9439	-	-
1970	14711	7400	13441	4146	7531	856	8387	-	-
1971	n.a.	n.a.	17310	3657	9447	1250	10697	-	-

Source - Board of Investments and MVC Files.

N.A. - Not Available.

TABLE 2
PROJECTED DEMAND (MT)

<u>Year</u>	<u>P E</u>				
	<u>LD</u>	<u>HD</u>	<u>PP</u>	<u>PS</u>	<u>PTC</u>
1972	36740	10060	21960	7750	20740
1973	47460	13380	25170	10790	26960
1974	61310	17780	28500	13900	35050
1975	79160	23650	32040	16900	45560
1976	96800	29740	35710	19900	59230
1977	114200	36060	39490	22900	77000
1978	131360	42630	43220	26800	100100
1979	148280	49430	46950	29000	130120
1980	164970	56470	50670	32000	169150

Source - Board of Investments (BOI)

IV. Applications in the Philippines

1. ABS - Automotive parts, containers, telephone housing, appliance bases, suit cases, toilet bowl parts.
2. Acetal - Plumbing parts, automotive parts, terminal blocks, gears and bushings and valves.
3. Acrylics - Sign facing, telescope lenses and skylights, light diffusers, dividers, displays, decorative panels.
4. Cellulosics - Automotive steering wheels, eyeglass frames, shoe heels, pen and pencil parts, toys and sheets, combs, outlets, etc.
5. Nylon - Zippers, glass, bushings, special wire insulation, etc.
6. Polycarbonates - street lights, globes, industrial parts, camera parts and coil forms, bottles.
7. Polyethylene - containers, packaging films, toys, pipes and tubings, household wares, bottles, ropes, closures, etc.
8. Polypropylene - Containers, packaging films, wire insulation, filament, household wares, woven mats, closures, woven bags, ropes, etc.
9. Polystyrene - Seat and covers, toys, packaging films, eyeglasses' frames, appliances, advertising posters, household wares, lamp shades.
10. Polyurethane - Cushioning, clothing and appliance insulation, padding, structural parts, toys.
11. Vinyl - Toys, flexible film and sheeting, phonograph records, floor tiles, garden hoses, pipes and fittings, wire and cable insulation, sandals and footwear, packaging bottles, rigid films, soft and rigid profiles, tank liners, bags, etc.

V. Problems of the Industry

1. Profile of the Filipino plastics entrepreneurs - local fabricators have been accused of forsaking quality. This is largely true because of the nature of some fabricators who just operate when scraps are available as raw materials. He tries to outsell legitimate fabricators through price cutting. This is aggravated by the fact that prospective end-users or buyers put more emphasis on price rather than quality. This could very well be related to the lack of standardization.
2. Standardization - Lack of standardization has hampered the growth, specifically of the PVC pipe industry. Before Mabuhay came into the picture, there was already an existing pipe maker following Japanese standards, probably because they started with Taiwan machines. Following the entry of Mabuhay, another pipe maker put up a big plant following US standards.
3. Lack of supply of basic plastics raw materials - Importations caused high prices and large capitalization for inventory which is eventually passed on to the consumers.
4. Establishment of a plastics training institute - This can help educate end-users and the general public on the nature and uses of plastic. This will also promote knowledge and technical know-how and provide laboratory equipment and testing equipment to carry out tests and research projects.
5. Absence of good mold and die makers - This specific problem will greatly aid in the betterment of plastic products. In this connection, the acquisition of the right machine shop equipment and tooling is imperative.
6. Absence of reliable statistics - Whenever a market study on plastic or specifically any particular polymer, one is always faced with a virtual blank wall. There are no reliable statistics to help in the formulation of a market study. This is aggravated by so much technical smuggling in connection with the importation of raw materials, equipment, semi-finished and finished products.

URUGUAY by J. Hofstaedter

General information on Uruguay

Uruguay has an area of approximately 130,000 square kilometers and a population nearing the 3,000,000 mark. Montevideo, home of 41% of Uruguay's population, gears much of its industry (which represents almost 90% of the total industrial output of the country) on processing wool, meat and hides. The economy of the country is based on agriculture (cattle, sheep, wool, hides, wheat, rice) with meat and wool accounting for 80% of total exports.

The industrial development of the country had its beginnings after World War I but the process gained momentum during World War II when Uruguay herself had to produce articles formerly imported from highly industrialized countries, at that time absorbed in their war efforts. At the same time, her exports were fetching high prices and an import - and favourable trade balance was thus created. This accumulation of foreign currencies enabled Uruguay to import in the post-war years the equipment and industrial machinery which was used to lay the foundations of the true development of the country's industry.

History of the Plastics Industry in Uruguay

The first factories for the industrialization of plastics on a large scale were established from 1945 to 1950 after the war, to manufacture cellulose acetate and polystyrene for kitchenware and pharmaceutical containers; phenol formaldehyde and urea formaldehyde for electrical fixtures and fittings; polyvinyl chloride, etc.

When at the end of the forties polyethylene became available on an industrial scale, several industries (C. Ferretti S.A., ATMA S.A., Niboplast S.A. and Plastisur S.A.) commenced operations and are now leaders in the field, our company (Plastisur S.A.) having been established in 1953.

From 1950 to 1954 big-size injection equipment with a range of from one to three kilograms, (Watson Stillman by Plastisur Peco, H.P.M., Battenfeld) was imported, which machinery continues operating adequately and would be almost irreplaceable today. These may be considered the beginnings of the plastics industry in Uruguay, which were accompanied by the growth of the household wares industry, refrigerators parts, etc. which could make good use of parts made from plastics.

Slowly products manufactured with polyethylene, of excellent mechanical strength, good impact strength, light weight and attractive colouring began to replace similar ones formerly manufactured in galvanized and enamelled iron. Plastic articles came into competition with glass containers in the production of attractive and well printed products when the first blow moulding machines were introduced, taking over the market for containers to package pharmaceutical products, food, etc. It is then that the boom in our plastics industry took place, paralleling on our limited scale, the world-wide development in that industry. The present situation of the plastics industry in Uruguay may be summarized as follows:

Injection Moulding

Production: Household ware, accessories for industrial purposes, sanitary ware (covers for toilets), pails used in the building industry, etc.etc.

Factories: As mentioned above, there are four important firms which count with blow moulding, extrusion and other techniques, Plastisur being one of them.

The problem of moulding by basic injection in a market as limited as ours is that it is necessary to invest in expensive moulds, not easily amortisable because of the relatively reduced output. The solution seems to be the rental or purchase of moulds in other markets which would be later in turn resold or rented to others. This practice, which calls for good business connections and a highly experienced organization, has already been put into operation by some local manufacturers. We operate at present in the manufacture of ready-made standard quality articles but always keep in mind the possibility of adopting the above practice which allows for a constant renewal in the products offered to clients.

Extrusion

Production: Polyethylene films and bags which represent 40 to 50 % of total consumption of manufactured polyethylene. The market for films is estimated at 400 tons per month and is constantly on the increase. (the last important use is the packaging of milk in polyethylene bags).

Factories: There are three main manufacturers of polyethylene film and bags, which count with modern plants, i.e. Strong S.A., Bolsas Plasticas S.A. and Rodelco S.A.

The extruded film industry manufactures bags for industrial use in the packaging of chemical products, fertilizers, ground minerals, etc.

This line of production has developed well and export business is under discussion.

Nonfilaments and Tapes

Production: Cord, ropes, also lightweight bags and plastic mesh-wire.

Factories: There are two companies with modern plants producing such bags, etc., Sinca and Edasa, one of which exports articles to the United States.

An important industry has emerged on the basis of monoaxially stretched film tapes which are cut from flat or tubular film, especially so in the manufacture of sacks to replace jute and sisal ones. The vegetable fibres demanded large extensions of land for planting and because their quality was dependant on climatic hazards, it proved expensive to produce and process. The many advantages of high-density polypropylene and polypropilene ribbons in comparison with jute have resulted in the former displacing the natural products because of their many advantages (they do not rot, nor rust, are not affected by acids, solvents nor fats; are physiologically harmless, light in weight, of even production and unaffected by climatic hazards).

Lamination and Thermoforming of Plastic Laminates

Two of the principal Uruguayan factories (the already mentioned ATMA and Niboplast) also manufacture by extruding high-impact polystyrene laminates parts for household refrigerators, which are vacuum formed. This permits the manufacture of relatively large parts without need of building expensive injection moulds.

Containers - the manufacture of non-returnable (disposable) thin-walled containers used for sundry foods, such as milk products, jams, etc. is included in this heading. The line merits special study for further development.

Pipes

Black polyethylene pipes which although sold on a lesser scale than films, are finding a steadily growing market. Of monthly sales of 50/60 tons, Plastisur S.A. supply a third part. We commenced production in 1956 and now have a highly reputed and constant output.

Rigid polyvinyl pipes are in good demand for electrical installations.

Polypropylene pipes - we likewise manufacture them and are slowly building a market for this product. Polyvinyl chloride water hoses - little used in our country.

Blow Moulding

Production: An ample variety of containers for pharmaceutical and veterinary products, food, etc.

Low cost toys are manufactured on a large scale by this process.

Factories: There are two medium-sized factories engaged exclusively in the packaging by blow-moulding (Tuboplast S.A. and Cauren S.A.) while other firms have added this technique to their other lines of production. Plastisur S.A. is one of such firms and has a special interest in studying new techniques of blow moulding.

Calendering

Production: Tablecloths, curtains, tapestry, etc.

Factories: There are two important and well installed plants which have modern equipment and a high quality production, Neosul and Haim. The first mentioned has begun exporting tapestry for cars to Argentina.

A complementation agreement has been signed with Argentina whereby Uruguay imports kits for local assemblage of automobiles and exports spare parts and accessories, such as tyres, batteries, polyvinyl chloride tapestry, brake linings and, eventually, injected plastics accessories. As regards the last mentioned product, the demands are for high-grade special materials: nylon, acetals, styrene copolymers, polycarbonate, polypropilene or copolymers, generally with metallic insets or cores. This may prove a difficult market because of their high demands as regards quality and we would like to bring this problem before UNIDO for guidance and assistance.

The above mentioned items for use in the automobile industry may find an additional market as a project is under consideration to sign a similar agreement to supply the Brazilian automobile industry with parts.

Reinforced Plastics

Production: We are already exporting automobile bodies of polyester reinforced resins with fiber glass to Argentina for use in the Citroen factory.

Factories: There are three plants producing ondulated sheets for coverings (roofs), light-weight partitions, decorative panels, boats, etc. - Dacar S.A., ATMA S.A., Cassarino S.A. Another untapped market is the manufacture of automobile accumulators or batteries which are still made here of ebonite; we understand injected boxes are being used elsewhere.

Coating of materials

Production: Coating of materials with polyvinyl for use in tapestry, luggage and sportswear. The plasticizing agent used (dioctylephthalate) is manufactured locally.

Factories: There are several which coat fabrics but none which coat other materials.

High-Pressure Laminates

Production: Thermosetting laminates, i.e. laminates for facing and decoration purposes, of the Formica type. Widely used for facing kitchen and bathroom cupboards, office furniture and hardy tables, cupboards and chairs of relatively low cost. Products compare favourably with those of highly developed countries, are widely used locally and exported to Argentina.

Factories: There are two important firms in our market, Olivera and Cia. and Samic, engaged in the manufacture of laminates on a thermosetting basis.

Rotation Moulding

Production: Plastic footwear, of which boots find the best market. Produced by this classic method of manufacturing flexible one-piece elements. Independently, there are manufacturers of shoe soles by injection.

Factories: Two factories which have been in operation for seven years now and produce good quality articles, i.e. Panam and F-brica Uruguaya de Alpargatas S.A.

Foaming

Production: Polystyrene and polyurethane foam is produced. Expanded polystyrene is used for building purposes as insulation between floors and in industrial refrigeration plants.

Factories: Tuboplast and Bromyros S.A. The market has not been fully developed.

Production: Manufacture of mattresses, pillows and fillings, used as interlining by the textile industry, etc.

Factories: Polifom S.A.

Rigid polyurethane foams, which we understand are widely used in other countries, is not produced locally.

Reprocessing of Scraps

Recovery of film and refuse scraps is conducted on a fair scale.

Plastisur S.A. recovers material which is later applied to the manufacture of several low-cost products of wide sale, i.e. reinforced pails for industrial purposes and the building industry; protecting pipes for electric cables, widely used for public lighting; protecting baskets for demi-johns used by wine and oil dealers and other industries, etc. All these articles require an important tonnage of reprocessed polyethylene. Our industry would be specially interested in further information on this subject.

THE FUTURE OF THE PLASTICS INDUSTRY IN URUGUAY

The State is fomenting housing plans and we understand the use of plastics for building purposes should be promoted. Although it is already being used on an important scale in polyvinyl chloride venetian blinds, the possibilities of use of plastic profiles in window and door frames remains untapped. Neither has the use of foam covered by sundry materials such as plywood and concrete for use in prefabricated partitions and walls been availed of although they are resistant, give good acoustics and thermic isolation and are cheap to use from the labour viewpoint. Several years ago the writer saw the intense work carried out in developing foam for prefabricated partitions for building purposes during his visit to the Koppers plant in Pittsburgh, United States.

Neither are polyvinyl chloride nor polypropylene pipes used in sanitary installations for the inlet and outlet of residual water, ventilation and the channeling of rain water, as is the case in other countries.

Argentine makes intense use of polyvinyl chloride for housing but the fact that there are many types and measurements of fittings in use, proves a limiting factor for Uruguay. Perhaps either these fittings or their corresponding moulds might be imported temporarily.

2. A second item where there is room for development is the spare parts and accessories for household ware lines. Also in the automotive industries in the export to Argentine and, eventually, to Brazil. This in itself calls for a specialization because it requires studying special materials, conditions for processing them and the adequate moulds and machinery.

3. Another feature to be studied is the production of disposable containers which are not as yet extensively used. These correspond to blown and thermoformed containers and we understand they are being extensively used in the packaging of food, pharmaceutical products, cosmetics, etc. in other countries. We believe this is a line of production which merits study and future development.

This is a summary of the situation of the plastics industry in Uruguay and prospects for its future development. What we shall learn in the course and in our visits to factories shall, evidently, widen our perspectives and in the light of such additional information, we shall revert to the subject and bring before UNIDO our views on Uruguay's future needs for further information, assessment and assistance.

YUGOSLAVIA by Z. Acović

Plastic Industry in Yugoslavia started almost 15 years ago, but on a small scale. During the last 5 years consumption of plastics increased very fast and during this period many manufacturers of plastic products and some raw materials producers came into existence.

Today, there is no real big petrochemical complex with the result that plastic processors have to import most of raw materials from abroad. The market is fast developing, and some of these raw materials are now being made within the country.

In the following pages is described the various plastic raw materials produced within the country, the companies producing them, and their production whenever available. The various fields of applications of this raw materials have also been mentioned. Estimated present and future consumption have also been given.

Polyvinyl Chloride (PVC)

The producers of raw materials are:

	<u>'000 t/y.</u>	
	<u>1971</u>	<u>1975</u>
"Jugovinil" - Split	18	?
"OHIS" - Skopje	6	?
"HIP" - Pančevo	—	40
"Vinilplastika" - Zadar	—	20
	<u>24,000</u>	<u>60,000</u>

PVC consumption in the 1971 was much higher than the country's production so that this material had to be imported from W. Germany, France, U.K., etc. It is estimated that the consumption of PVC during 1971 was of the order of 60,000 tons.

With the starting up of the new plants as mentioned above, the major imports of PVC are likely to be stopped.

The most common fields of application are:

- 1) Floor covering
- 2) Sheets
- 3) Profiles
- 4) Pipes
- 5) Miscellaneous

According to the plans of manufacturers the consumption of PVC-products should be of the order of 140,000 t/year in the 1975.

Some of these manufacturers of PVC-products are:

- (I) "Jugovinil" - Split
- (II) "Vinilplastika" - Zadar
- (III) "Cetinka" - Trili

Polyethylene low density (PELD)

Raw materials producers are:

	<u>'000 t/y.</u>	
	<u>1971</u>	<u>1975</u>
"OKI" - Zagreb	20	?
"HIP" - Pancevo	—	45
	<u>20,000</u>	<u>45 - ?</u>

The present consumption is higher than production, so that the imports were over 30,000 tons in the year 1971. With the new capacities that are expected to come up the imports are likely to be stopped by 1975.

The main fields of applications are:

- 1) Packaging
- 2) Pipes
- 3) Miscellaneous

Some of PELD Products manufacturers are:

- (I) "Bukulja" - Beograd
- (II) "OKI" - Zagreb
- (III) "Galdovo" - Sisak

POLYETHYLENE HIGH DENSITY (PEHD)

In Yugoslavia there are no PEHD producers at present. Chemical Industry "PANCEVO" - PANCEVO is making a plant for PEHD production with a capacity of 50,000 t/year in the year 1975.

The import of this material during 1971 was about 30,000 tons.

There are about 30 manufacturers of PEHD products, which plan to make 40,000 t/year products in 1975.

Some of them are:

- (I) "Iplas" - Koper
- (II) "Plastika" - Zemun
- (III) "Analit" - Osijek

The main fields of applications are:

- 1) Injection moulding (crates, boxes)
- 2) Blow moulding
- 3) Pipes

POLYPROPYLENE (PP)

There is no domestic production of PP at present, and there are no plans for its indigenous production until 1975.

20 manufacturers of PP products plan to produce about 8,500 t/year in the year 1975. Some of them are:

- (I) "Dunav" - Celazovo
- (II) "Analit" - Osijek
- (III) "Bukulja" - Boograd

The main fields of applications are:

- 1) Packaging (woven and non-woven bags)
- 2) Injection molding

POLYSTYRENE (PS)

There is domestic production for this material. During the last ten years the demand has grown. The producer of raw material is "OKI" - Zagreb:

	<u>1972</u>	<u>1975</u>
"OKI" - Zagreb	11,000	20,000

So, the indigenous production is enough to meet the country's demand.

There are 20 producers of PS products. Some of them are:

- (I) "Plastika" - Zemun
- (II) "OKI" - Zagreb
- (III) "M. Blagejević" - Lučani

The main fields of applications are:

- 1) Packaging
- 2) Construction
- 3) Industry parts

ACRYLONITRIC BUTADIENE - STYRENE (ABS)

There is no domestic production.

The producers of products consumed about 7,000 t/year in the year 1971. The import is from West Europe and U.S.A.

The main field of applications is electrical accessories.

CELLULOSEACETATE (CA)

There is domestic production of this material and there are a few units manufacturing various products, but the consumption is not high.

POLYESTERS

Polyester is not produced in the country, i.e., there are about 10 manufacturers of final products, but the components are imported from abroad.

The main fields of application are:

- 1) Tanks for storage of chemicals
- 2) Boats
- 3) Sheets

POLYURETHANE

There are some polyurethane producers, but the components are imported from abroad. Some of them are:

- (I) "Prva Iskra" - Barič
- (II) "Obodina" - Cetinje

During the last year they have also started production of rigid polyurethane foam for construction, etc.

The main fields of application are:

- 1) Building
- 2) Furniture
- 3) Automotive

POLYAMID

There is no domestic production.

The consumption is small.

FORMALDEHYDE AND MELAMINE RESINS

There is no domestic production of raw materials, but there are a number of units manufacturing various products. The main fields of application are in the electrical industry, furniture, etc.

CONCLUSION

In the end it would be appropriate to recapitulate what has been mentioned in the foregoing pages about the availability of plastic raw materials in Yugoslavia, which is indicated in the table below.

Raw Material	1971		1975	
	Domestic product.	Import	Domestic product.	Import
P.V.C.	+	+	+	+
PELD	+	+	+	+
PEHD	-	+	+	+
P.P.	-	+	-	+
P.S.	+	+	+	+
A.B.S.	-	+	-	+
C.A.	+	+	+	+
Polyesters	-	+	-	+
Polyurethane	-	+	-	+
Polyamid	-	+	-	+
Formaldehyde, melamine	-	+	-	+

(+) = existant

(-) = non-existant

As it is shown in the table, Yugoslav plastic industry is oriented for import, as in the year 1971, so in the year 1975. There is domestic production of some raw materials, thermoplastics for example, but import is still very high and important.

With 20 mil. citizens and 600 U.S. per head, Yugoslav market has been growing, so that the consumption of some plastics is quite high.

For example, the consumption targets for the thermoplastic raw materials for the year 1975 are as follow:

P.V.C.	-	140,000 tons
PELD	-	90,000 tons
PEHD	-	50,000 tons
P.P.	-	10,000 tons

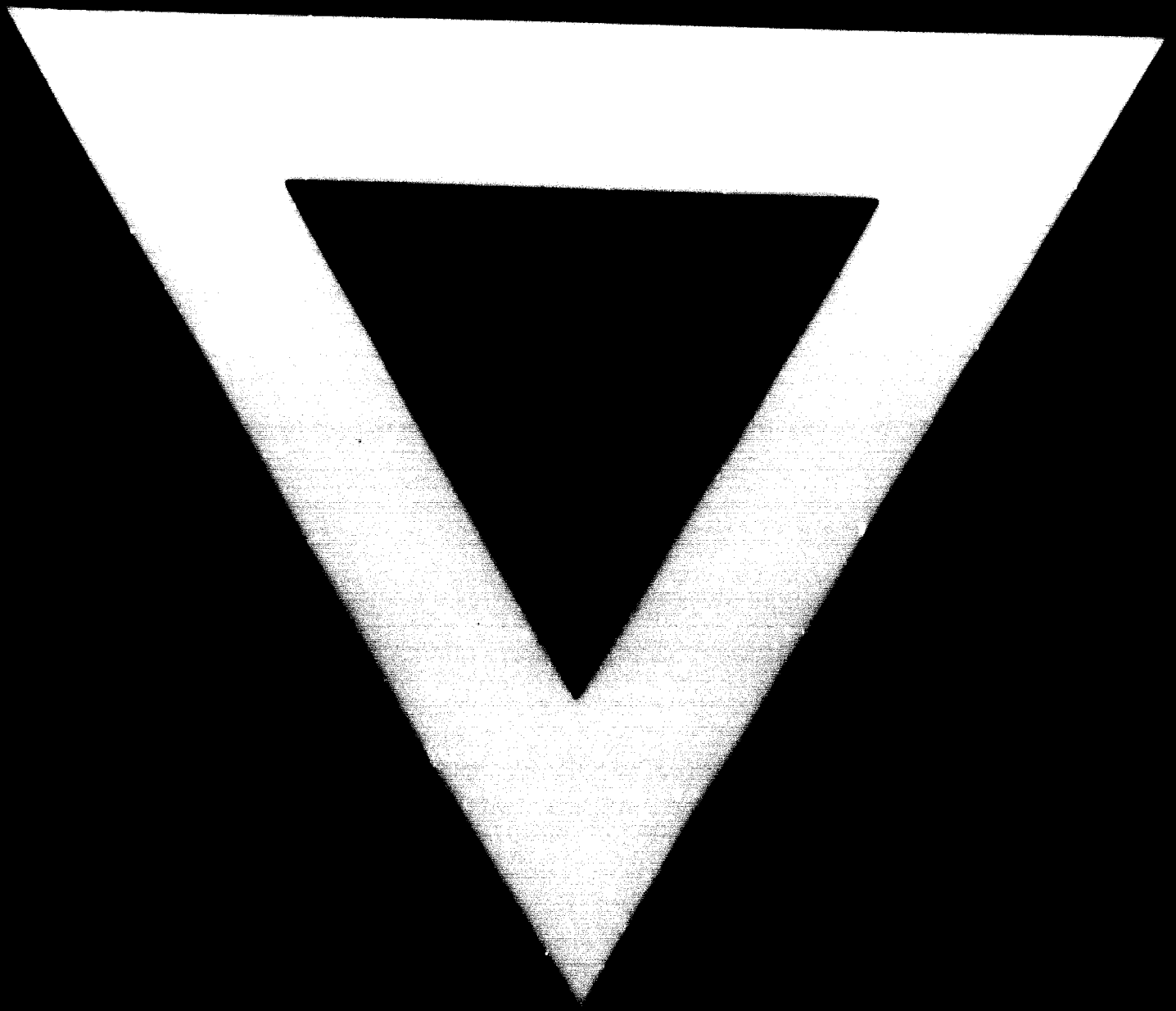
At present the production of ethylene is small, enough for PELD Production of 20,000 t/year. However, there are plans that in two years time one of the firms,

i.e. "HIP" - PANCEVO
26000 Pancevo,

would be producing about 200,000 t/year of ethylene. It will be used for PELD, P.V.C., PEHD production and propylene will be sold to some other country, maybe Romania. But, at a later stage it would be in the interest of the country to make their own P.F., if required, with some foreign technical collaboration.*

With the above expansion programmes during the years to come, UNIDO can play an important role in assisting our country. This could be in the following manner:

- 1) By putting our firm in touch with other firms of the developed countries, who could provide the necessary Know-how for the manufacturing of products other than PELD, PEHD, P.V.C.
- 2) By arranging for necessary training for our people (technicians of this firm),
- 3) By carrying out surveys and preparing reports on the future potentialities for plastic industry in Yugoslavia, and by suggesting the specific fields that should be developed,
- 4) And lastly, by deputing some experts in the field of plastics to guide the industry in that country.



23.7.74