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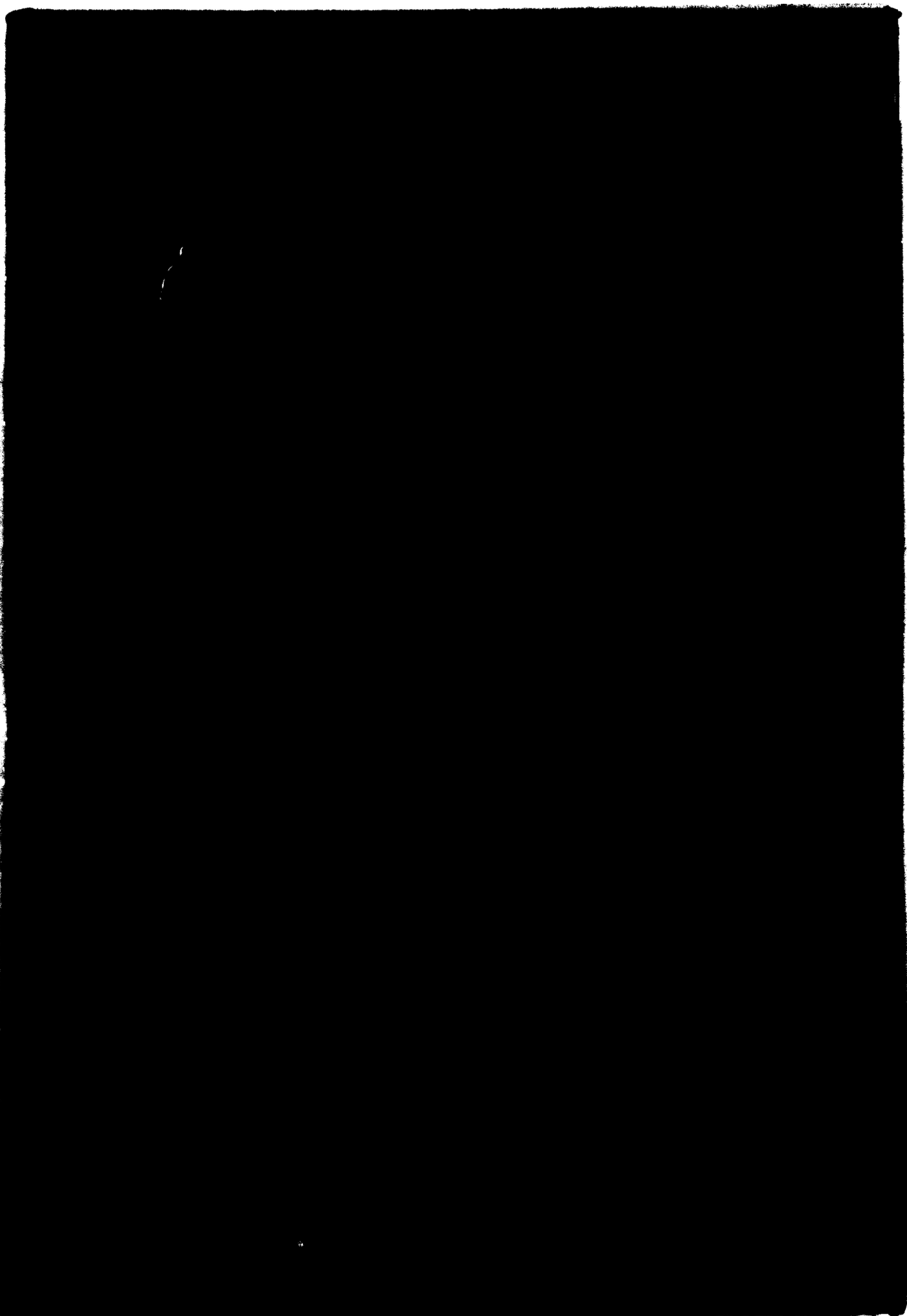

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The PETROCHEMICAL INDUSTRY in the DEVELOPING REGIONS

The Forecast for the Second Development Decade

pp 118
+ app.

by

M. MARTIN.

for

UNIDO.

With compliments.
11 May 1970.

Outlines

PREFACE

The author has been asked by UNIDO to produce a study of the prospects of the petrochemical industry in the developing countries for the Second Development Decade from 1970 to 1980.

As the basis for the study, three documents were available but only one of them, the Koenits Report, was of any great use, and the others were not as useful as they might have been. The documents of the Second Interregional Symposium were available only as drafts and the reports of the Regional Commissions often did not deal with the subject in the right manner. The most useful figures came from the report of Middle East Asia by Mr. Caeija. The third document, the report of the Verband der chemischen Industrie, e.V, gives only very few figures on petrochemicals since it deals with the whole chemical industry.

Nevertheless, it should have been possible to give a forecast for the evolution of the petrochemical industry by discussion, and supplementing the individual documents with the authors, if the author of this study had had reasonable time for it. Unfortunately there were only five weeks available, and the author had no possibility of discussing these reports with their authors; except for a short talk with Mr. Koenits, at the very beginning and a telephone conversation with him, the author of this study could only discuss "The Development of the Petrochemical Industry in Middle East Asia", with its author, Mr. Caeija.

Under these circumstances the forecast is mainly based on the Koenits Report and corrected only where the author found that the Koenits report deviated very far from the other documents or where it did not take into account important circumstances or the special situation of one region. Unfortunately, this makes the forecast data not as exact as it could be, although forecasts can never be as exact as figures from previous periods.

However, the figures can be corrected by some additional work; and the following may be recommended:

1. to invite two or three members of the largest petrochemical companies with world wide interests like Dupont, Dow Chemicals and ICI, to produce a study similar to the Rosnits Report, and

2. to ask the UNIDO regional field advisors to supply the UNIDO Headquarters in Vienna with detailed information on production, consumption, export, import, population growth, income per capita and so on for at least the ten years. With these figures in hand it should be possible, by using the time sharing computer of Bull-General-Electric Company for example, to elaborate economically UNIDO's own forecasts.

It should be possible to do this in one year, so that the forecast for the Second Development Decade would still be in time for the elaboration of a basic programme for the evolution of the developing countries.

INTRODUCTION

In the national economies of the industrial countries the chemical industry has continuously gained in importance over the last [illegible]-five years. This follows in part from the fact that the total industrial production around the world has more than tripled between 1950 and 1965, while the world's total chemical production has more than quadrupled during the same period. This growth is essentially due to the factors the universal economic functions of chemical products, and the exorbitant share of research intensity which is far above the average of the industry.

The universality of the economic function of the chemical industry and its products is the result of its closely woven relations with all production and consumption activities. In particular, nowadays we can say that there is no activity or production at all where chemical products do not play a more or less important role; this also applies in the case of iron and steel production as well as in the areas of agriculture, health and textiles. The chemical industry has an important function also in the food industry (which is often unfortunate). Everywhere is apparent the validity of the rule which says that the more advanced the technology, the more significant the share of the chemical industry.

It is not the aim here to discuss the relative importance of the production of the chemical industry as against its research intensity, but there is no doubt at all that the growth of the influence of chemicals is due to the enormous share of research work done in this field. Since with every research result new questions are being raised which need to be answered, the chemical industry can only operate by continuing to make a choice of tasks and solutions, manifesting itself in scientific and technical progress. This trend, strengthened by the competitive situation of the chemical industry, led finally to the chain reaction of the industrial chemical evolution which may result in the chemical industry becoming the most important one.

There are, of course, hundreds of branches in the chemical industry, all of which, with their continual creation of new materials have formed and continue to form the structure of the economy of the highly industrialized countries, and will also increasingly influence the economy of the developing countries. The chemical industries not only influence and substantially alter the technical and human customs by offering better or cheaper or more useful materials, they influence human life much more directly by their requirements for highly qualified staff to carry out the research work in the laboratories and the production work in the commercial plants. A few figures on world production and consumption of chemicals from the Readers Report may demonstrate the growing importance of the chemical industry:

production		Value in 1,000 millions US-$				
		1960	1965	1970*	1975*	1980*
World		72	[illegible]	150	[illegible]	347
developing countries of	Africa	0·35	[illegible]	0·89	1·18	1·64
	Latin America	2·11	[illegible]	5·08	6·95	6·60
	Asia	0·53	[illegible]	2·24	3·44	4·31
	total	3·39	5·39	8·14	11·57	14·60
U S A		29·0	[illegible]			
Western Europe		22·8	34·5			
consumption						
developing countries of	Africa	0·70	1·14	1·44	1·86	2·40
	Latin America	2·02	4·55	6·88	8·87	10·60
	Asia	1·68	2·77	3·66	4·74	6·05
	total	5·10	8·47	11·98	15·86	19·05
U S A		28·5	39·7			
West. Europe		21·8	33·5			

* expected figures

production		Value per capita in US-$				
		1960	1965	1970*	1975*	1980*
World		31	[illegible]	55	62-66	66-74
developing countries	Africa	1·27	[illegible]	2·59	3·10	3·56
	Latin America	10·96	12·04	19·05	22·60	25·37
	Asia	1·08	1·04	2·10	2·70	3·21
	total	2·6	2·8	4·3	6·1	7·0
U S A		166	193**			
West. Europe		74	95**			

consumption						
	Africa	3·7	3·8	4·6	5·0	5·6
	Latin America	13·9	13·5	23·7	27·2	30·3
	Asia	1·8	2·3	3·4	3·8	4·5
	total	3·9	4·7	6·8	7·9	8·9
U S A		167·9	180**			
West. Europe		79·1	86**			

* expected figures

** figures of 1964

Unfortunately, it was not possible to base this study on the whole chemical production for two main reasons. One reason is that there are a number of old and well-known chemicals which do not show any revolutionary change whatsoever and are already established in some developing countries. In order to produce a study for the entire chemical industry, it would be necessary to concentrate on the total figures only - otherwise the report would be extremely voluminous. The inclusion of the old, already established plants, some of them perhaps even retrogressive, would convey a false and distorted picture of the evolution of the chemical industry.

The second reason is time. In order to produce such a detailed study, so much time would be required that the study would be out date even before printing.

This study concentrates therefore solely on petrochemicals - and, to be more precise on only the most important petrochemicals. It is possible that other reports or studies may complete this preliminary survey and present finally a more detailed and complete picture of the situation in the entire chemical industry.

As far as the available data are concerned, it was sometime very difficult for the author of the reports to obtain the necessary information. Although the Governments of all the countries helped a great deal in providing them with the figures, they could not be of any assistance if no figures were available. Taking these circumstances into account, these countries are not mentioned separately; but if at any time the necessary information becomes available this study can be completed relatively easily.

THE SOURCES OF THIS STUDY

The present report is a study of the prospects for the petrochemical industry in the developing countries.

Following the United Nations system, it refers to the regions as follows:

AFRICA

Region East Africa:
Duty station: Addis Ababa

Botswana - Comore Islands - (East African Community) - Ethiopia - Kenya - Lesotho - Madagascar - Malawi - Mauritius - Ngwana (ex Swaziland) - Seychelles - Somalia - Sudan - Tanzania - Uganda - Zambia.

Region Central Africa:
Duty station: Congo Kinshasa

Burundi - Cameroon - Central African Republic - Chad - Congo Brazzaville - Congo Kinshasa - Equatorial Guinea - Gabon - Rwanda.

Region West Africa:
Duty station: Dakar

Dahomey - Gambia - Ghana - Guinea - Ivory Coast - Liberia - Mali - Mauritania - Niger - Nigeria - Senegal - Sierra Leone - Togo - Upper Volta.

Region North Africa:
Duty station: (ad hoc basis from Vienna)

Libya - Algeria - Morocco - Tunisia - U.A.R.

ASIA

Region East Asia

Duty Station: Bangkok

Brunei - Burma - Cambodia - Indonisia (West Irian) - Laos - Malaysia - Singapore - Thailand - Vietnam.

Region South East Asia

Duty Station: New Delhi

Ceylon - India - Maldive Islands - Mongolia - Nepal

Region Far East Asia

Duty Station: Manila

Australia - Japan - Korea - Nauru - New Zealand - Pacific Area: (British Solomon Islands - Ellice Islands - Fiji - Gilbert Islands - New Caledonia - New Hebrides - Tokelau and Cook Islands - Tonga, W. Samoa) - Papua and New Guinea - Philippines - Taiwan.

Region Near East Asia

Duty Station: Beirut

Bahrain - Iraq - Jordan - Kuwait - Lebanon - People's Republic of Southern Yemen - Saudi Arabia - Syria - Yemen Arab Republic - Turkey and Cyprus.

Region Central Asia

(ad hoc basis from Vienna)

Afganistan - Iran - Pakistan - Israel

LATIN AMERICA

Region : West LatAm
Duty Station: Santiago

Argentina - Bolivia - Chile - Colombia - Ecuador - Peru - Venezuela.

Region East LatAm
Duty Station: Rio de Janeiro

Brazil - Paraguay - Uruguay

Region North LatAm
Duty Station: Mexico City

Bahamas - Barbados - Bermuda - British Honduras - Costa Rica - Cuba - Dominican Republic - El Salvador - French Territories: (French Antilles - Guadeloupe - Martinique - French Guyana) Guatemala - Guyana - Haiti - Honduras - Jamaica - Mexico - Netherland Territories: (Netherlands Antilles - Aruba - Bonaire - Curacao - Surinam) - Nicaragua - Panama - Puerto Rico - Trinidad and Tobago - United Kingdom Territories: (Cayman Islands - Leeward Islands i.e. Antigua, Montserrat, St. Kitts, Nevis and Anguilla - Turks and Caicos Islands - Virgin Islands - Windward Islands i.d. Dominica, Grenada, St, Lucia, St. Vincent).

For each region the available figures are used for as many countries as possible. If no figures were available for one region, that region is not mentioned.

As far as the petrochemicals are concerned, it is quite usual that their products fall into three main categories whose titles indicate, to a certain extent, their respective locations between the feedstocks of petro-chemistry - natural gas, refinery gas and naphtha - and goods produced from petro-chemical raw materials. These main categories are:

1. end products,
2. intermediates, and
3. primary products.

This investigation will proceed to estimate the developing countries' requirements for the foremost petro-chemical end products and intermediates up to 1980, with a view to ascertaining thereby the size of the possible production within these countries to cover their own requirements. By 'back-calculations' from the assumed consumption quantities to the starting products like ethylene, propylene, butadiene, benzene, xylene, a.s.o., this investigation also provides the fundamental data on the petro-chemical industry to be established or expanded.

Dividing the developing countries into categories, such as highly, moderately and only slightly developed, has been deliberately avoided since assessments of value, which are bound to contain a suggestion of praise or reproof, are not only inappropriate, but also misleading. The most frequently used yardstick of a country's level of development is the per capita income, as this permits comparisons; but as regards the differences in the standard of living costs in the individual countries, even these are rather suspicious comparisons and must be very carefully considered before making use of the results.

However, a rich and thus "highly developed" country with only a few thousand inhabitants may well be less suitable for the establishment of its own petro-chemical industry than a poor and therefore "developing" one with a population of several hundred millions. All the following considerations are therefore made solely according to quantitative viewpoints.

This is a world-wide study and for that reason, cannot go into details for each individual country, as already mentioned. It would therefore be necessary to base any effective investment policy on specific studies to be made for each individual country.

For the investment policy and requirements, it has been born in mind that new investment projects in developing countries demand higher costs than in industrial ones, although the investment policy is generally accompanied by a number of national protection measures.

Examples of cost-raising factors are:

(1) Transport costs on long sea routes for important capital goods;
(2) Long transport distances overland;
(3) Transport insurance;
(4) Import duties;
(5) Higher construction and engineering costs owing to imported expert personnel;
(6) Longer building times than in industrial countries and
(7) Unfavourable climatic conditions.

It can hardly be expected that the practice of national protection policies will change, as it is based on national development plans or national self interest. This diagnosis will probably apply in the near future, and it should therefore be accepted as a realistic starting point that developing countries will generally pursue a strategy of national industrial expansion. This strategy is generally preferred over joint projects with other developing countries. As it has been already pointed out, national construction is normally accompanied by protection measures; this also applies to the construction and extension of the petrochemical industry. The dynamism of its expansion justifies endeavours to develop a petrochemical industry in those countries which

(a) possess sufficient reserves of feed stocks such as petroleum and natural gas;
(b) already have adequately developed consumer markets or
(c) already have consumer markets which can be developed to a considerable extent.

However, developing countries should in principle be careful not to have any illusions about the receptivity of the world market. Without a previously established selling organization it is hardly possible to take advantage of the export opportunities. Considerable price reductions would probably have to be taken into consideration.

Furthermore, the products available on the world market are of a high quality. In order to produce products of such quality, the production experience of some years is necessary.

For this reason it seems impractical for most of the developing countries to place their investment solely in export. To the contrary, the investment policy of the developing countries should be oriented towards raising the level of domestic consumption.

The advantage of orientation on the home market is that the products are relatively independent of the quality of goods on the world market, and the home industry has time to adapt itself slowly to the international situation. Otherwise, this emphasis on the domestic consumption makes it naturally difficult to carry out investment projects for petrochemicals in countries with a low consumption of petrochemical end-products. Although it is advisable from all points of view to complete petrochemical plants, it appears to be uneconomical to tackle the construction of a fully integrated petrochemical complex, solely to provide for the lack of an end-product to produce only the end-product and to wait for a better market situation before launching into the manufacture of other related products. This upgrading of the market situation may just be the result of a natural development, since the quality and competitiveness of the product grows automatically with wider production experience. Immediately if the consumption on the home and perhaps international market is large enough, the first step towards the production of the raw material should be considered.

This 'small-step investment policy' would best be initiated at a very early stage, i.e. at the end-processing stages. This would for example, include the moulding of plastics or the spinning of synthetics on the basis of imported polymers. For this purpose, the size of the capacities should be adapted to the level of the estimated end-consumption, i.e. the expected market opportunities. The capacities for the individual petrochemical starting products should be accordingly built only if the consumption of these products grow to such magnitude that production capacities is technically and/or economically viable since are feasible.

Until this point has been reached it seems advisable to import the necessary quantities of raw materials concerned.

In this way the complex of petrochemical industrial plants for the production of the individual raw materials and intermediates should be constructed step by step while at the same time the previous imports are being increasingly substituted by domestic production.

If the consumption of all intermediates has developed to the extent that a fairly balanced consumption of the total output range is reached, the industrial capacity could be built as the next to last investment stage which is that of processing the products as they come from the cracker; at the same time the cracker itself could be built.

The table on the following page shows the connexion between the end-products, intermediates and raw materials. If the investment steps are built in accordance with the technical minimum capacities then the petrochemical complex will be made up of smaller plants. The building of economically justifiable capacities in view of the considerable degression of costs generally requires larger production plant sizes. If the investment plants are for capacities which are smaller than the technical minimum capacity, the cost/price problem will arise immediately due to these technical aspects only, and it would be hardly possible to set out the prices on an attractively low level.

Keeping this in mind, the advantages of a domestically oriented market become even more obvious. The industrialization programme for such a market can succeed only if the inadequate international competition is excluded by a balanced protective and supporting policy of the government. Otherwise investors will hardly be prepared to take upon themselves the profitability risks of new investment projects.

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	-	-	Ethylene
[illegible]	-	-	-	Propylene
[illegible]	-	Styrene	-	Benzene + Ethylene
[illegible]	[illegible]	[illegible]	-	Ethylene + Chlorine
[illegible]	-	[illegible]	-	Ethylene + Acetic Acid
[illegible]	-		Styrene + Butadiene	Benzene + Ethylene + Butadiene
[illegible]	-	-	-	Butadiene
[illegible]	[illegible]	[illegible]	[illegible]	Benzene + Hydrogen
[illegible]	[illegible]	[illegible]	DMT	p-Xylene + Methanol
[illegible]	-	[illegible]	-	Propylene + Ammonia
[illegible]	-	-	Acetic Aldehyde	Ethylene + Oxygen
[illegible]	-	-	-)	Benzene + Propylene
[illegible]	-	-	-)	
[illegible]	-	-	Ethylene Oxide	Ethylene + Oxygen
[illegible]	-	[illegible]	-	o-Xylene/Propylene
[illegible]	-	-	-	Natural Gas
[illegible]	-	-	-	Naphtha or Natural Gas
[illegible]	-	-	-	Rock Salt + Electricity
[illegible]	-	-	-	Sulphur

The protective and supporting policy, differentiated in accordance with the investment steps, would have to be tailored to the growth strategy of the small ste.s. This means that for every newly planned investment project there must be a certainty that a limited (national) market will be protected against imports, at least for a number of years.

For such a protective and supporting policy it should be considered that:

(1) such plants correspond to the effective needs of the country and produce goods at reasonable prices, or that they are accessible to markets as wide as possible, and that

(2) the single plant should be built in such a way that it contains within itself the necessary possibilities for its subsequent expansion. This means reasonable conditions of profitability and self-financing.

These two criteria can be well fulfilled if the entire protective and supporting policy is fully integrated within the framework of a long-term and comprehensive development programme. This programme should include not only the first investment project and the next investment step; it should as far as possible contain all subsequent investment steps including the cracker.

Before initiating the first investment step, detailed market studies for all the individual products should be available. The study would enable the government to get a clear picture and a well-based market forecast of the present and future situation (see particularly Chapter VIII of the Report of the Interregional Petrochemical Symposium on the Development of the Petrochemical Industries in Developing Countries, Baku 1969).

It might be pointed out here again that the figures of the forecast in this study for the years 1970 - 1980 can only be a rough guess for the expected development and that detailed market forecasts - as a basis for the investment decisions - can only be made in each individual country.

The comprehensive development planning leads neither necessarily nor unavoidably to any specific type of national, international, private or public industrial structure, but provides the best requisites for all possible forms of co-operation for an optimal utilisation of the opportunities of industrialization.

This is why this planning should be ready before, rather than after, inviting, for example international institutions to participate in financial assistance.

The drawing-up of such industrialisation plans would surely make a contribution towards better co-ordination of the initiatives from international private enterprises.

Once the plan has been drawn up, steps must be taken to see that it is carried out in the minimum length of time. This speed is necessary due to the fact that the validity of investment projects itself is fairly brief for various reasons:

(1) new production projects set up under any given economic conditions;
(2) decrease of the prices of existing manufactures;
(3) modifications in the basic data considered during the calculation of the profitability of the project;
(4) appearance of new processes or new products.

It should also be taken into account that very often a number of different ministries must be consulted with regard to the necessary decisions on investment and on economic defensive measures. For that reason it would be advisable to introduce a "Specialized Technical Group" for permanent co-ordination as proposed in the Volume I, page 48 of the "Studies in Petrochemicals", presented at the United Nations Interregional Conference in Teheran 1964, New York 1966.

The building up of the industries could accordingly be facilitated by a pre-planned and consequently rapid granting of production licences as soon as the consumption forecast reaches the planned investment threshold. In the same way adequate import and foreign exchange licences for the import of machines, starting products, auxiliary materials and spare parts could be granted, and the fiscal supportive measures would have to come into force.

These include freedom from taxes for a certain time, import duty free capital goods, increased rates of depreciation and the possibility of balancing losses arising during the start-up against subsequent profits.

There would also have to be an examination of the second and subsequent steps concerning the ways in which licencing and know-how agreements could be made attractive to potential investors from industrial countries. It will also be necessary to give sufficient incentives for direct capital participation and to protect foreign capital; the transfer of licence fees and profits must be guaranted. All the taxes and duties which are normally passed on to the consumer via the selling price of the manufacturer, such as customs duty for the imported raw material, production taxes and so on, should be kept within such limits that they do not prevent the widest possible range of sales of the end products.

On the other hand it will be necessary to protect the new domestic production at each step by import restrictions such as a temporary erection of high import barriers via an import embargo, or via high import duties. If the domestic production were insufficient and, therefore, an additional import necessary, consideration should be given to granting the import rights to the domestic producers. The same applies to special types of products which are not, or not yet, produced by the domestic producers.

It may be pointed out here that all these considerations and supports are extremely important for the new domestic industry and should not be underestimated.

Finally, as far as time is concerned, it takes about two or three years from the signing of the order to the start-up of the plants, and this must be taken into consideration in planning as well, since it is very important to the success of the operation that the timing be carefully observed for the whole period.

As above mentioned there are three sources used for this study:

(1) The Ecanto Report;

(2) The Second Interregional Petrochemical Symposium (Baku, 20 to 31 October 1969), and

(3) The report of the Verband der Chemischen Industrie E.V., Frankfurt.

Since the Ecanto Report has been worked out just for this purpose and gives the best information for this study, it is discussed first and in much more detail than the other sources.

(1) [redacted]

The Koenits report was ordered by UNIDO in order to have background information for the forecasts of the Second Developing Decade. Not all of the petrochemical end products are investigated in his report, but the most important types of plastics, synthetic rubber and synthetic fibres are mentioned. In connexion with these products, the necessary intermediates and primary products and a few other primary petrochemicals are explored and dealt with.

The report is based on actual figures of production and consumption and on the trade figures of many of the developing countries for the year 1968. Since Mr. Koenits could often not obtain consumption figures, the available import and export data, and production figures were used (consumption = production + import - export). From this basis, and considering the necessary conversions with the same figures of the highly industrialised countries, were most of the data were most of the data for 1975 and 1980 estimated.

The consumption forecasts of the Koenits report deviate somewhat from those made by the regional economic commissions.

There are different reasons for these deviations. For the sake of comparison, a new, uniform, methodical approach has been chosen for this study.

The demand for principal petrochemicals has been calculated retrospectively, after, in the first instance, the consumption of plastics, fibres and intermediates has been forecast.

On the other hand, consumption figures have already been available for the period 1967 - 1968. The regional economic commissions based their data partially on figures related to previous periods.

Facts, figures and the experience which the author of the Koenits Report has gathered in the course of his visits to numerous developing countries over the last years, are also included.

To give actual forecasts of production is much more difficult. There is usually a very simple connexion between consumption and production (see above), but that is only applicable to domestic production and to those countries and products where there exists a free exchange of products and currency. As soon as any obstacles arise, this rule can no longer apply, and the stronger and higher the barriers, the further away from the theoretical figures are the actual data. Although it is easy to understand and is even recommended for the start of domestic production - the barriers for the free exchange of goods and, partly, of money are quite high everywhere, making production forecasts rather difficult. This applies even for the industrialized countries and unfortunately makes the forecasts for the developing countries very weak and uncertain.

Similar considerations apply in the forecasts for trade. Here again the connexion between consumption and production, and trade is very simple in cases where there are no exchange barriers for either goods or money; but since this assumption does not hold true for the developing countries, the figures of their forecasts are far removed from the theoretical ones.

For this reason the forecasts given by Mr. Roemits are not based only on the above-mentioned connexion plus the population growth over the next decade in calculating the figures for 1975 and 1980. The irreplaceable knowledge and experience of the Farbwerke Hoechst AG was also valuable in the correcting of the theoretical forecast data for the developing countries for the next decade.

Due to these circumstances Mr. Roemits's report differs widely from the data of the regional economic commissions, and the figures are in most cases neither comparable nor uniformly classified (see the Rahm paper, chapter VI). Nevertheless, it is expected that the targets or capacities for the second period of the decade, up to 1980 will be corrected when the exact figures for 1975 become available.

As far as plans and programmes were available for the various individual countries developing regions - regarding the extension of the petrochemical industry they have been considered in this study. The correlation between the development of the gross domestic product and the turnover of the chemical

(a) Plastics

There are numerous types of plastics known at the present time, but in Mr. Leenits's study it was possible to consider only the so-called "high-tonnage" ones, namely polyethylene, PVC, Polystyrene and polypropylene. The consumption quantities for the remaining plastics are smaller and in most cases not available.

In 1966 the world production of high-tonnage plastics covered more than 57% of the entire plastic production, and that may increase to about 67% by 1980. With regard to this data and to the difficulties and additional expenditure of time which would be necessary to make figures for the other plastics available, it seems justifiable to omit the remaining plastics from this investigation.

(aa) Consumption

The term "plastic consumption" covers the use of the polymers in their various marketed forms at the processing level. Neither the goods produced from this nor the semi-finished material are petrochemical products any longer. After passing through one or more finishing stages, they are products of the plastic processing industry or of the industries deriving their material from it.

The industrialized countries generally have an adverse balance of foreign trade in raw materials, but a favourable balance in the industrial goods. This position is just the reverse in the developing countries and, therefore, the actual end consumption of plastics in the developing countries is higher, and in the industrialized countries lower, than the consumption of the processing level. The following example may help to clarify the position.

If a country like the Federal Republic of Germany produces 3 million private cars annually, exports 1½ million and imports only half-a-million, this means that every year 1 million private cars, which[illegible] 20,000 tons of plastics, go to end consumers outside the Federal Republic, some of them therefore to developing countries. The large difference in the plastics consumption per

head of the population at the processing level, between industrialised and developing countries, is therefore governed not only by income but also by structure, since plastics processing, as a typical industrial consumption, rises proportionally to both the income level and the degree of industrialisation.

In order to ascertain the consumption of plastics in the developing countries, the export figures from the main suppliers (Canada, USA, Japan, Belgium, Germany, France, Italy, Netherlands, UK and Australia) to the individual states in Africa, Latin America and Asia have been taken. The total import figures - boosted, where appropriate, by home production - have been the indicator and have been compared with all available data, to correct or supplement that first indicator. Then the remaining gaps were filled by estimates and recorded in table form.

As the plastic consumption in most of the developing countries is still very small, imports of polyethylene and PVC films and PVC floorings are also included in the following figures. This is not usually done, but it seems to provide a more balanced picture of the consumption trend, avoiding the discrepancies in consumption at the processing level.

A forecast for the period up to 1980 has been prepared on the basis of present consumption development; it was ascertained by the procedure outlined above and utilises all available information on future consumption levels. In the forecast the population, gross national product and degree of industrialisation of the individual countries were also considered for their importance. In the following tables there are only those countries listed whose expected plastic consumption for the individual types would reach at least 5,000 t/y in 1980.

As far as the growth of the high-tonnage plastic consumption in the developing countries is concerned, the increase during the next 12 years may be slightly higher than the world average; it may grow from 7.4% to 9.6%. This average growth does not seem spectacular but looks different after explanation. On one hand, the growth rates in

the industrialised areas are still very high, which means that the consumption growth rate of high-tonnage plastics is correspondingly quite high. That puts the world consumption growth already on a higher average than other industrial products. On the other hand, in the developing countries there are no - or only a few - viable branches of the industry with a high demand for plastics, for example, the automobile or electrical industry. For this reason the plastic consumption is concentrated much more in the packaging sector and in the building industry than in the other plastic consumer branches and is, in addition, being limited with regard to the low level of the income in these countries. Under these circumstances the average growth which is still above the world average, is rather high.

So long as the market for domestic goods and other simple consumer products is not saturated, the plastics processing industry can expect high rates of increase, but as soon as the restricted opportunities for use in the technical sector manifest themselves, the initially rapid growth rate slows down.

The slight decrease in the proportion accounted for by the developing countries in the world's high-tonnage plastic consumption from 1968 to 1970 is attributable to the competition in the industrialised countries. Figures for 1967 and 1968 were slightly down, but those for 1969 and 1970 may well turn out to be above average. As the growth diagram in the industrialised areas shows a climbing curve indicating a smaller supply of PVC than that for polyolefineru, and as the developing countries still have a lot of ground to cover in their PVC requirements - not least in the production of artificial leather - their share of the world PVC consumption will show a sharp rise, from 8.2 % to 13.2 %.

The following list shows the prospective plastic consumption in the developing countries in relation to the corresponding estimates for world consumption. The values for the individual high-tonnage plastics have been determined within the frame-work of a world forecast which envisages the following evolution for the world plastic consumption

1968 .. .. 23 millions
1970 .. .. 31 "
1975 .. .. 56 "
1980 .. .. 90 "

bb) Production and Investment

At present there are only a few developing countries producing their own plastics. In the establishment of petrochemical industry the first step in the plastic sector is to construct the polymerisation plants. As developing countries are able at first to produce for the home market only, relatively small plants can operate quite economically in most cases. When a stage plan is being prepared, in order to be able to draw comparisons the following uniform pre-conditions should apply:

(1) As soon as the requirements reach 75% of the expected production capacity of the relevant first plant, this plant must be ready for commissioning. The next plant should then be built before the demand overtakes the output;

(2) In each case where a plant with a minimum economical capacity is being built, the expansion of the capacity occurs in stages. The assumed minimum capacities are:

Plastic	Capacity in tons per annum	Approximate investment costs based on battery limits (in millions of US Dollars)
Low-density polyethylene	40,000	16
High-density polyethylene	20,000)	10
Polypropylene	14,000)	
PVC	24,000	3.5
PVC (for even smaller markets)	6,000	1.5
Polystyrene	24,000	4
Polystyrene (for even smaller markets)	6,000	1.5

It would be possible to reduce the investment costs per t/y by building larger polymerisation plants, but this would mean that the projects would have to be postponed for several years until the domestic demand had grown to the appropriate magnitude, b/ which time the price increases occuring in the interim in the building of the plant might have eliminated the rationalisation effect of the drop in investment costs. The minimum capacities given above - up to 6,000 t/y are large enough, on the other hand, to induce foreign partners, in certain cases, to participate in such a scheme as a joint venture.

As far as intermediates and primary products are concerned, vinylchloride and styrene are the only intermediates for plastics, since ethylene and propylene are already primary products. The extension of capacity of these starting products is computed in a similar manner to the plastics capacities, the following minimum capacities being the basis:

	Capacity	Investment costs based on battery limits
Vinyl chloride	24,000 t/y	4 million US $
Styrene	24,000 t/y	5 million US $

Table 4

Expected evolution of polyethylene consumption in the developing countries in 1,000 t/y .

			1968	1970	1975	1980
Africa	Region North	Algeria	4	3	10	20
		Morocco	2.5	5	7	10
		Tunisia	1.2	1.5	3	4
		U.A.R.	1.0	2	6	15
		total	6.7	9.5	26	57
	Region East	Ethiopia	0.3	0.5	2	5
		Kenia	1.0	1.5	3	5
		Sudan	0.3	0.5	2	5
		Tanzania	0.5	0.7	2	5
		total	2.1	3.2	9	21
	Region Central	Congo (Brazzaville)	2.8	1.5	4	10
	Region West	Ivory Coast	1.4	2	5	10
		Ghana	0.8	1.0	3	7
		Nigeria	0.5	1.0	6	20
		Senegal	0.6	1.0	3	5
		total	3.3	5	16	42
	Other developing countries		7.1	9	28	68
Latin America	Region West	Argentina	28	40	80	150
		Bolivia	0.7	0.8	2	5
		Chile	6	9	25	70
		Ecuador	2	2.5	7	15
		Colombia	4.5	7	25	70
		Peru	6.5	8	25	80
		Venezuela	8	10	25	90
		total	59	81	192	480
	Region North	Costa Rica	2.5	3	6	10
		Dominican Rep.	0.6	1	3	7
		El Salvador	1.5	2.5	5	10
		Guatemala	2.5	3	5	8
		Rep. Honduras	3	3.5	5	7
		Jamaica	0.3	0.5	2	5
		Mexico	48	60	125	250
		Nicaragua	1.5	2	4	8
		Trinidad	0.5	1.0	3	6
		Panama	1.2	1.5	3	6
		total	62	78	161	316

continued

Table 4 (cont.)

Expected evolution of polyethylene consumption in the developing countries in 1,000 t/y .

continued

			1960	1970	1975	1980
Latin America	Region East	Brazil	[illegible]	30	[illegible]	[illegible]
		Uruguay	[illegible]	[illegible]	[illegible]	[illegible]
		total	[illegible]	[illegible]	[illegible]	[illegible]
	Other developing countries		[illegible]	[illegible]	[illegible]	[illegible]
Asia	Region East	Burma	[illegible]	[illegible]	[illegible]	[illegible]
		Indonesia	[illegible]	[illegible]	[illegible]	[illegible]
		Cambodia	[illegible]	[illegible]	[illegible]	[illegible]
		Malaysia	[illegible]	[illegible]	[illegible]	[illegible]
		Singapore	[illegible]	[illegible]	[illegible]	[illegible]
		Thailand	[illegible]	[illegible]	[illegible]	[illegible]
		South Vietnam	[illegible]	[illegible]	[illegible]	[illegible]
		total	[illegible]	[illegible]	[illegible]	[illegible]
	Region South East	Ceylon	[illegible]	[illegible]	[illegible]	[illegible]
		India	[illegible]	[illegible]	[illegible]	[illegible]
		total	[illegible]	[illegible]	[illegible]	[illegible]
	Region Far East	South Korea	[illegible]	[illegible]	[illegible]	[illegible]
		Philippines	[illegible]	[illegible]	[illegible]	[illegible]
		Taiwan	[illegible]	[illegible]	[illegible]	[illegible]
		total	[illegible]	[illegible]	[illegible]	[illegible]
	Region Near East	Iraq	[illegible]	[illegible]	[illegible]	[illegible]
		Lebanon	[illegible]	[illegible]	[illegible]	[illegible]
		Syria	[illegible]	[illegible]	[illegible]	[illegible]
		Saudi Arabia	[illegible]	[illegible]	[illegible]	[illegible]
		Turkey	[illegible]	[illegible]	[illegible]	[illegible]
		total	[illegible]	[illegible]	[illegible]	[illegible]
	Region Central	Afghanistan	[illegible]	[illegible]	[illegible]	[illegible]
		Iran	[illegible]	[illegible]	[illegible]	[illegible]
		Israel	[illegible]	[illegible]	[illegible]	[illegible]
		Pakistan	[illegible]	[illegible]	[illegible]	[illegible]
		total	[illegible]	[illegible]	[illegible]	[illegible]
	other developing countries		[illegible]	[illegible]	[illegible]	[illegible]
Summary			358	482	1080	2250

Table 5

Expected evolution of the PVC consumption in the developing countries in 1,000 t/y .

			1980	1990	1995	2000
Africa	Region North	Nigeria	4	5	15	25
		Morocco	4	5	10	20
		Tunisia	0	1.2	2.5	5
		U A R	2.5	3	8	15
		total	11.5	14.2	34.5	65
	Region East	Ethiopia	1.6	2	4	8
		Kenya	0.8	2	3	6
		Sudan	-	2	2.5	5
		total	2.6	4.4	9.5	19
	Region Central	Congo (Kinshasa)	4	8.5	8	19
	Region West	Ivory Coast	1.8	3.5	5	10
		Ghana	0.4	0.8	2.5	5
		Nigeria	1.5	20	8	20
		Senegal	1.0	1.0	3.0	8
		total	5.7	25.3	18.5	43
	Other developing countries		7.2	8	28	58
Latin America	Region South	Argentina	30	40	80	150
		Bolivia	0.3	1.2	2.5	5
		Chile	3	4	6	15
		Ecuador	0	1.8	3.5	7
		Colombia	8	12	30	60
		Peru	3	12	30	50
		Venezuela	8	10	25	60
		total	52	81	196	347
	Region North	Costa Rica	0.8	0.5	2	4
		Dominican Rep.	0.4	0.7	2	5
		El Salvador	1.0	2	4	8
		Guatemala	0.5	0.8	2	5
		Rep. Honduras	0.2	0.4	1.5	5
		Mexico	30	60	80	200
		Nicaragua	0.8	1.0	2.5	5
		Panama	1.0	1.2	2.5	5
		total	34.7	67.6	102	231
	Region South	Brazil	55	85	160	300
		Uruguay	0.3	1.4	3	7
		total	55	86	163	307
	Other developing countries		2.0	4.5	13.5	26.4

Table 5 (cont.)

Expected evolution of the PVC consumption in the developing countries in 1,000 t/y .

continued

			1968	1970	1975	1980
ASIA	Region East	Burma	1'0	1'5	4	10
		Indonesia	3'5	5	20	50
		Cambodia	1'0	3	25	5
		Malaysia	1'5	2'0	5	25
		Singapore	3	4	8	25
		Thailand	10	12	35	80
		South Vietnam	0	2	7	20
		total	2	28	84	174
	Region South East	Ceylon	1'4	1'5	3'5	8
		India	20	30	45	150
		total	21'4	31'5	78'5	158
	Region Far East	South Korea	7	10	30	60
		Philippines	9	12	30	70
		Taiwan	45	55	70	150
		total	61	77	145	280
	Region Near East	Iraq	2'5	3'5	5	9
		Lebanon	4	5	9	20
		Saudi Arabia	1'0	1'5	3	5
		Syria	0'9	1'0	3	6
		Turkey	9	12	30	63
		total	17	22	51	93
	Region Central	Afghanistan	2'5	3	5	8
		Iran	9	12	30	75
		Israel	10	12	25	50
		Pakistan	4	6	15	40
		total	25	33	75	173
	Other developing countries		0'7	1'2	3'5	8'4
Summary			330	430	950	1940

Table 6

Expected evolution of polystyrene consumption in the developing countries in 1,000 t/y .

			1968	1970	1975	1980
Africa	Region North	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
		Morocco	[illegible]	[illegible]	[illegible]	[illegible]
		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
		total	[illegible]	[illegible]	[illegible]	[illegible]
	Region [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Other developing countries		[illegible]	[illegible]	[illegible]	[illegible]
Latin America	Region [illegible]	Argentina	[illegible]	[illegible]	[illegible]	[illegible]
		Chile	[illegible]	[illegible]	[illegible]	[illegible]
		Colombia	[illegible]	[illegible]	[illegible]	[illegible]
		Peru	[illegible]	[illegible]	[illegible]	[illegible]
		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
		total	[illegible]	[illegible]	[illegible]	[illegible]
	Region North	Mexico	[illegible]	[illegible]	[illegible]	[illegible]
	Region East	Brazil	[illegible]	[illegible]	[illegible]	[illegible]
	Other developing countries		[illegible]	[illegible]	[illegible]	[illegible]
Asia	Region East	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
		Singapore	[illegible]	[illegible]	[illegible]	[illegible]
		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
		South Korea	[illegible]	[illegible]	[illegible]	[illegible]
		total	[illegible]	[illegible]	[illegible]	[illegible]
	Region South East	India	[illegible]	[illegible]	[illegible]	[illegible]
	Region Far East	South Korea	[illegible]	[illegible]	[illegible]	[illegible]
		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
		Taiwan	[illegible]	[illegible]	[illegible]	[illegible]
		total	[illegible]	[illegible]	[illegible]	[illegible]
	Region Near East	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
		total	[illegible]	[illegible]	[illegible]	[illegible]
	Region Central	Iran	[illegible]	[illegible]	[illegible]	[illegible]
		Israel	[illegible]	[illegible]	[illegible]	[illegible]
		Pakistan	[illegible]	[illegible]	[illegible]	[illegible]
		total	[illegible]	[illegible]	[illegible]	[illegible]
	Other developing countries		[illegible]	[illegible]	[illegible]	[illegible]
Summary			121	156	342	680

continued/...

Table 1

Expected evolution of polypropylene consumption in the developing countries.

in 1,000 t/y.

			1968	1970	1975	1980
Africa		total	2	3·1	12·4	38
Latin America	Region West	Argentina	2·8	4	12	30
		Chile	0·6	0·8	3·8	10
		Colombia	0·8	1·0	3·8	12
		Peru	0·7	0·9	3·8	12
		Venezuela	0·8	1·0	3·8	12
		total	5·6	7·8	27	76
	Region North	Mexico	4·8	6	19	50
	Region East	Brazil	3·8	5·5	18	50
		other developing countries	1·9	2·6	8·4	22
Asia	Region East	Indonesia	0·6	1·0	4·5	14
		Singapore	0·8	1·0	3	8
		Thailand	2·5	3	9	20
		South Vietnam	0·8	1·0	3	8
		total	4·9	6	19·5	50
	Region South East	India	3	5	15	40
	Region Far East	South Korea	1·9	1·5	4·3	16
		Philippines	1·0	1·5	4·3	16
		Taiwan	2·5	3	9	24
		total	4·5	6	17·6	56
	Region Near East	Turkey	0·8	1·0	4·5	14
	Region Central	Iran	0·8	1·2	4·5	15
		Israel	1·1	1·5	3·8	10
		Pakistan	0·6	0·7	3	10
		total	2·5	3·4	11·3	35
	other developing countries		0·9	1·3	5·2	17·2
Summary			35	48	158	448

Table

Expected evolution of the consumption of large-tonnage plastics in the developing countries in 1,000 t y.

			1968	1970	1975	1980
Africa	Region North	Algeria	6'6	9	28	58
		Morocco	7'7	9'5	20'5	42
		Tunisia	2'2	2'7	5'5	12
		U.A.R.	4'5	6'2	16'5	35
		total	21	27	71	142
	Region East	Ethiopia	2'1	2'5	6	12
		Kenya	1'8	2'3	6	12
		Sudan	1'8	1'7	4'5	10
		Tanzania	0'5	0'7	2	5
		total	6'7	7'6	18'5	39
	Region Central	Congo (Kinshasa)	2'8	4	8	20
	Region West	Ivory Coast	3'2	4'5	10	20
		Ghana	1'2	1'8	5'5	12
		Nigeria	2'5	3'7	10'5	41
		Senegal	2'0	2'8	6'5	12
		total	8'9	12	32	91
	Other developing countries		14'4	24	58	135
Latin America	Region West	Argentina	74	102	201	280
		Bolivia	1'4	1'9	4'5	10
		Chile	14	18	51	107
		Ecuador	3	4	9'5	17
		Colombia	21	27	69	138
		Peru	18	26	68	138
		Venezuela	21	26	64	130
		total	163	205	474	941
	Region North	Costa Rica	2'8	3'6	8	16
		Dominican Rep.	1'0	1'3	3	12
		El Salvador	2'0	4'5	8	16
		Guatemala	3'0	3'7	7	18
		Rep. Honduras	3'2	3'8	6'5	12
		Jamaika	0'3	0'5	2	5
		Mexico	85	120	264	570
		Nicaragua	2'1	3	6'5	13
		Panama	1'2	1'5	3	6
		Trinidad	1'5	2'2	5'5	10
		total	113	148	316	678

continued/...

- 10 -

[illegible] developing countries in [illegible], 1965 - 1980.

Unit: [illegible]

			1965	1970	1975	1980
Latin America	Region East	Brazil	128	166	333	670
		Uruguay	2·3	3·2	8	17
		total	131	169	341	687
	[illegible] countries		11	16	43	98
Asia	Region East	Burma	2	3	8	20
		[illegible]	1·5	2	5	13
		[illegible]	13·5	18	62	151
		[illegible]	3·5	4·5	11	25
		[illegible]	13	16	36	81
		[illegible]	41	49	103	181
		[illegible]	11	14	34	78
		total	85	107	258	555
	Region South East	Ceylon	2·1	2·5	7	15
		India	61	85	215	440
		total	63	88	222	455
	Region Far East	[illegible]	20	30	73	176
		[illegible]	23	33	78	189
		Taiwan	83	103	188	344
		total	126	166	342	709
	Region Near East	Iraq	3·3	4	8	20
		Lebanon	3	3	10·5	22
		Syria	1·5	1·8	6	16
		Saudi Arabia	1·3	2	5	10
		Turkey	21	28	77	169
		total	35	44	116	257
	Region Central	Afghanistan	2·6	3·5	7	13
		Iran	21	28	75	190
		Israel	27	34	65	130
		Pakistan	12	16	47	114
		total	63	82	193	447
	Other developing countries		52	104	21	58
Summary			588	1120	2520	5810

Table ...

... of plastics ... world ... by geographical areas ...

	1968		1970		1975		1980	
	million tons	%	million tons	%	million tons	%	million tons	%
Polyethylene	5,1	100,0	7,4	100,0	15,3	100,0	27	100,0
PVC	4,5	100,0	6,1	100,0	10,7	100,0	16	100,0
Polystyrene	2,8	100,0	3,6	100,0	6,2	100,0	10	100,0
Polypropylene	0,8	100,0	1,2	100,0	2,8	100,0	7	100,0
Large-tonnage plastics	13,2	100,0	18,3	100,0	35,0	100,0	60	100,0
[illegible]								
Polyethylene	0,020	0,4	0,031	0,4	0,083	0,5	0,188	0,7
PVC	0,031	0,6	0,042	0,7	0,098	0,9	0,198	1,2
Polystyrene	0,009	0,3	0,011	0,3	0,030	0,5	0,065	0,6
Polypropylene	0,002	0,2	0,003	0,2	0,012	0,4	0,038	0,5
Large-tonnage plastics	0,062	0,4	0,089	0,5	0,223	0,6	0,489	0,8
Polyethylene	0,173	3,4	0,234	3,2	0,511	3,3	1,040	3,8
PVC	0,154	3,4	0,198	3,2	0,428	3,9	0,859	5,4
Polystyrene	0,064	2,2	0,080	2,2	0,161	2,6	0,304	3,0
Polypropylene	0,016	2,0	0,022	1,8	0,072	2,6	0,198	2,8
Large-tonnage plastics	0,407	3,0	0,534	2,9	1,172	3,3	2,401	4,0
Polyethylene	0,165	3,2	0,227	3,1	0,498	3,2	1,061	3,9
PVC	0,147	3,3	0,192	3,1	0,429	4,0	0,896	5,6
Polystyrene	0,049	1,8	0,064	1,8	0,151	2,5	0,312	3,1
Polypropylene	0,017	2,1	0,023	1,9	0,073	2,6	0,212	3,9
Large-tonnage plastics	0,378	2,9	0,506	2,8	1,151	3,3	2,481	4,1
Polyethylene	0,358	7,0	0,492	6,4	1,092	7,1	2,289	8,4
PVC	0,332	7,4	0,432	7,1	0,955	8,9	1,943	12,1
Polystyrene	0,122	4,4	0,157	4,4	0,342	5,5	681	6,8
Polypropylene	0,035	4,4	0,048	4,0	0,157	5,6	448	6,4
Large-tonnage plastics	0,847	6,5	1,129	6,2	2,546	7,3	5,361	8,9

Table 10

... de o... the polyethylene capacit... developing countries.

			progressive extension in 1,000 t/y.				investment requirements for this extension in millions of US dollars		
			1968	1970	1975	1980	1970 to 1975	1975 to 1980	1970 to 1980
Latin America	Region West	Argentina	25	41	121	181	36	26	62
		Chile	-	20	20	80	-	26	26
		Columbia	16	16	56	76	16	10	26
		Peru				60	-	26	26
		Venezuela	-	50	50	70	-	10	10
		total	41	127	247	467	52	98	150
	Region North	Mexico	24	75	155	275	36	52	88
	Region East	Brazil	30	82	162	322	36	68	104
Asia	Region East	Indonesia	-	-	-	100	..	42	42
		Malaysia/Singap.	-		-	60		26	26
		Thailand		-	60	120	26	26	52
		total	–	–	60	280	26	94	120
	Region South East	India	46	87	147	207	26	26	52
	Region Far East	South Korea	28	50	50	130	-	36	36
		Philippines	-		-	120	-	52	52
		Taiwan	33	33	98	153	26	26	52
		total	61	83	148	403	25	114	140
	Region Near East	Turkey	-	11	71	111	16	10	26
	Region Central	Iran	-	-	–	120	–	52	52
		Israel	20	20	20	80	-	26	26
		Pakistan	9	19	19	79	-	26	26
		total	29	39	39	279	-	104	104
Summary			231	504	1034	2344	218	566	784

Table 11

Schedule of the PVC capacities in the developing countries .

			progressive extension in 1,000 t/y.				investment requirements for this extension in millions of US dollars		
			1968	1970	1975	1980	1970 to 1975	1975 to 1980	1970 to 1980
Africa	Region North	Algeria	-	-	-	48	-	11	11
		Morocco	-	-	-	24	-	5.5	5.5
		Tunisia	-	-	-	6	-	1.5	1.5
		U.A.R	-	-	12	18	3	1.5	4.5
		total		-	12	96	3	19.5	22.5
	Region East	Ethiopia	-	-	-	12	-	3	3
		Kenya	-	-	-	6	-	1.5	1.5
		Sudan	-	-	-	6	-	1.5	1.5
		total	-	-	-	24	-	6	6
	Region Central	Congo (Kinshasa)	-	-	6	12	1.5	1.5	3
	Region West	Ivory Coast	-	-	6	12	1.5	1.5	3
		Ghana	-	-	-	6	-	1.5	1.5
		Nigeria	-	-	-	24	-	5.5	5.5
		Senegal	-	-	-	12	-	3	3
		total	-	-	6	54	1.5	11.5	13
Latin America	Region West	Argentina	54	54	102	150	11	11	22
		Bolivia	-	-	-	6	-	1.5	1.5
		Chile	-	15	15	38	-	5.5	5.5
		Ecuador	-	-	-	12	-	3	3
		Columbia	18	18	42	66	5.5	5.5	11
		Peru	6	6	30	54	5.5	5.5	11
		Venezuela	-	25	25	73	-	11	11
		total	78	118	214	400	22	43	65
	Region North	Costa Rica	-	-	-	6	-	1.5	1.5
		Dominican Rep.	-	-	-	6	-	1.5	1.5
		El Salvador	-	-	-	12	-	3	3
		Guatemala	-	-	-	6	-	1.5	1.5
		Rep. Honduras	-	-	-	6	-	1.5	1.5
		Mexico	33	47	95	215	11	27.5	38.5
		Nicaragua	-	-	-	6	-	1.5	1.5
		Trinidad	-	-	-	6		1.5	1.5
		total	33	47	95	263	11	40	51
	Region East	Brazil	56	56	188	248	16.5	27.5	44
		Uruguay	-	-	-	12	-	3	3
		total	56	56	188	260	16.5	30.5	47

continued .../.

Table 11 (cont.)

Schedule of the PVC capacities in the developing countries.

continued.

			progressive extension in 1,000 t/y.				investment requirements for this extension in millions of US dollars		
			1968	1970	1975	1980	1970 to 1975	1975 to 1980	1970 to 1980
Asia	Region East	Burma	-	-	-	12	-	3	3
		Indonesia	-	-	24	72	5·5	11	16·5
		Cambodia	-	-	-	6	-	1·5	1·5
		Malaysia/Singapore	-	-	-	48	-	11	11
		Thailand	-	-	48	72	11	5·5	16·5
		South Vietnam	-	-	-	24	-	5·5	5·5
		total	-	-	72	234	16·5	37·5	54
	Region South East	Ceylon	-	-	-	12	-	3	3
		India	70	90	90	162	-	16·5	16·5
		total	70	90	90	174	-	19·5	19·5
	Region Far East	South Korea	25	25	25	73	-	11	11
		Philippines	6	6	30	78	5·5	11	16·5
		Taiwan	73	73	97	169	5·5	16·5	22
		total	104	104	152	320	11	38·5	49·5
	Region Near East	Iraq	-	-	6	12	1·5	1·5	3
		Lebanon	-	-	-	24	-	5·5	5·5
		Saudi Arabia	-	-	-	6	-	1·5	1·5
		Syria	-	-	-	13	-	3	3
		Turkey	-	-	48	72	11	5·5	16·5
		total	-	-	54	127	12·5	17	29·5
	Region Central	Afghanistan	-	-	6	12	1·5	1·5	3
		Iran	20	20	44	92	5·5	11	16·5
		Israel	-	-	48	72	11	5·5	16·5
		Pakistan	-	-	24	48	5·5	5·5	11
		total	20	20	122	184	23·5	23·5	47
Summary			263	435	951	2138	128·5	288·5	411

Table 12

Schedule of the polystyrene capacities in the developing countries .

			progressive extension in 1,000 t/y.				investment requirements for this extension in millions of US dollars		
			1968	1970	1975	1980	1970 to 1975	1975 to 1980	1970 to 1980
Africa	Region North	Algeria	-	-	-	12	-	3	3
		Morocco	-	-	-	12	-	3	3
		U.A.R.	-	-	-	6	-	1.5	1.5
		total	-	-	-	30	-	7.5	7.5
	Region West	Nigeria		-	-	12	-	3	3
Latin America	Region West	Argentina	16	16	40	64	4	4	8
		Chile	-	-	12	12	3	-	3
		Columbia	6	6	12	18	1.5	1.5	3
		Peru	-	-	12	18	3	1.5	4.5
		Venezuela	-	-	12	18	3	1.5	4.5
		total	22	22	88	130	14.5	8.5	22.5
	Region North	Mexico	12	12	36	84	4	8	12
	Region East	Brazil	24	24	48	96	4	8	12
Asia	Region East	Indonesia	-	-	12	18	3	1.5	4.5
		Singapore	-	-	-	12	-	3	3
		Thailand	-	-	12	18	3	1.5	4.5
		S. Vietnam	-	-	6	12	1.5	1.5	3
		total	-	-	30	60	7.5	7.5	15
	Region South East	India	18	18	42	66	4	4	8
	Region Far East	S. Korea	-	13	13	37	-	4	4
		Philippines	-	-	-	24	-	4	4
		Taiwan	-	-	48	72	8	4	12
		total	-	13	61	133	8	12	20
	Region Near East	Lebanon	-	-	-	12	-	3	3
		Turkey	-	-	-	48	-	8	8
		total	-	-	-	60	-	11	11
	Region Central	Iran	-	-	-	48	-	8	8
		Israel	-	-	-	24	-	4	4
		Pakistan	-	-	6	18	1.5	3	4.5
		total	-	-	6	90	1.5	15	16.5
Summary			76	89	311	765	44	88	132

Table 13

Schedule of the polypropylene capacities in the developing countries.

			progressive extension in 1,000 t/y.				investment requirements for this extension in millions of US dollars		
			1968	1970	1975	1980	1970 to 1975	1975 to 1980	1970 to 1980
Latin America	Region West	Argentina	-	-	14	42	10	20	30
		Chile	-	-	-	14	-	10	10
		Columbia	-	-	-	14	-	10	10
		Peru	-	-	-	14	-	10	10
		Venezuela	-	-	-	14	-	10	10
		total	-	-	14	98	10	60	70
	Region North	Mexico	-	-	28	56	20	20	40
	Region East	Brazil	-	-	28	56	20	20	40
Asia	Region East	Indonesia	-	-	-	14	-	10	10
		Thailand	-	-	-	28	-	20	20
		total	-	-	-	42	-	30	30
	Region South East	India	-	-	28	42	20	10	30
	Region Far East	South Korea	-	-	-	28	-	20	20
		Taiwan	-	-	-	28	-	20	20
		total	-	-	-	56	-	40	40
	Region Near East	Turkey	-	-	-	14	-	10	10
	Region Central	Iran	-	-	-	28	-	20	20
		Israel	-	-	-	14	-	10	10
		Pakistan	-	-	-	14	-	10	10
		total	-	-	-	56	-	40	40
Summary			-	-	98	424	70	230	300

Table 14

Necessary vinylchloride capacities for the PVC-production in the developing countries up to 1980 . (in 1,000 t/y) .

			1968	1970	1975	1980
Africa	Region North	Algeria	-	-	-	51
		Morocco	-		-	25
		Tunisia	-	-	-	6
		U.A.R	-	-	13	19
		total	-	-	13	101
	Region East	Ethiopia	-	-	-	13
		Kenya	-	-	-	6
		Sudan	-	-	-	6
		total	-	-	-	25
	Region Central	Congo (Kinshasa)	-	-	6	13
	Region West	Ivory Coast	-	-	6	13
		Ghana	-	-	-	6
		Nigeria	-	-	-	25
		Senegal	-		-	13
		total	-	-	6	57
Latin America	Region West	Argentina	57	57	108	159
		Bolivia	-	-	-	6
		Chile	-	16	16	41
		Columbia	19	19	45	70
		Ecuador	-	-	-	13
		Peru	6	6	32	57
		Venezuela	-	27	27	77
		total	82	125	228	423
	Region North	Costa Rica	-	-	-	6
		Dominican Rep.	-	-	-	6
		El Salvador	-	-	-	13
		Guatemala	-	-	-	6
		Honduras Rep.	-	-	-	6
		Mexico	35	50	101	228
		Nicaragua	-	-	-	6
		Trinidad	-	-	-	6
		total	35	50	101	277
	Region East	Brazil	59	59	136	263
		Uruguay	-	-	-	13
		total	59	59	136	276

continued .../.

Table 14 (cont.)

Necessary vinylchloride capacities for the PVC - production in the developing countries up to 1980 (in 1,000 t/y) continued.

			1968	1970	1975	1980
Asia	Region East	Burma	-	-	-	13
		Cambodia	-	-	-	6
		Indonesia	-	-	25	76
		Malaysia / Singapore	-	-	-	51
		Thailand	-	-	51	76
		South Vietnam	-	-	-	25
		total	-	-	76	247
	Region South East	Ceylon	-	-	-	13
		India	79	95	95	172
		total	79	95	95	185
	Region Near East	Iraq	-	-	6	13
		Lebanon	-	-	-	25
		Saudi Arabia	-	-	-	6
		Syria	-	-	-	13
		Turkey	-	-	51	76
		total	-	-	57	133
	Region Central	Afghanistan	-	-	6	13
		Iran	21	21	43	90
		Israel	-	-	51	76
		Pakistan	-	-	25	51
		total	21	21	123	225
	Region Far East	South Korea	23	23	23	77
		Philippines	6	6	32	83
		Taiwan	77	77	103	178
		total	110	110	158	338
Summary						

Table 15

Schedule for the vinylchloride capacities in the developing countries.
(minimum capacity : 24,000 t/y)

			progressive extension in 1000 t/y				investment requirements for this extension in millions of US dollars		
			1968	1970	1975	1980	1970 to 1975	1975 to 1980	1970 to 1980
Africa	Region North	Algeria	-	-	-	72	-	12	12
		Morocco	-	-	-	48	-	8	8
		U A R	-	-	-	24	-	4	4
		total	-	-		144	-	24	24
	Region West	Nigeria	-	-	-	48		8	8
Latin America	Region West	Argentina	48	48	120	168	12	8	20
		Chile		18	18	42	-	4	4
		Colombia			48	72	8	4	12
		Peru			48	72	8	4	12
		Venezuela			48	96	8	8	16
		total	48	66	282	450	36	28	64
	Region North	Mexico	24	48	120	240	12	20	32
	Region East	Brazil	48	48	144	264	16	20	36
Asia	Region East	Indonesia	-	-	48	96	8	8	16
		Malaysia/Singapore		-		72		12	12
		Thailand			72	96	12	4	16
		South Vietnam	-	-	-	48	-	8	8
		total	-	-	120	312	20	32	52
	Region South East	India	48	48	96	192	8	16	24
			-						
	Region Far East	South Korea	-	-	48	96	8	8	16
		Philippines	-	-	48	96	8	8	16
		Taiwan	-	96	120	192	4	12	16
		total	-	96	216	384	20	28	48
	Region Near East	Lebanon	-	-	-	48	-	8	8
		Turkey	-	-	72	96	12	4	16
		total	-	-	72	144	12	12	24
	Region Central	Iran	-	-	48	120	8	12	20
		Israel	-	-	72	96	12	4	16
		Pakistan	-	-	48	72	8	4	12
		total	-	-	168	288	28	20	48
			144	306	816	1488	156	288	360

Table 16

Necessary ethylene capacities for the production of vinylchloride in the developing countries in 1,000 t/y .

			1968	1970	1975	1980
Africa	Region North	Algeria	-	-	-	37
		Morocco	-		-	25
		U.A.R	-	-	-	12
		total	-	-		74
	Region West	Nigeria	-	-	-	25
Latin America	Region West	Argentina	25	25	62	87
		Chile	-	2	2	2
		Columbia	-	-	25	37
		Peru	-	-	25	37
		Venezuela	-	-	25	50
		total	25	34	146	233
	Region North	Mexico	12	25	62	125
	Region East	Brazil	25	25	75	137
Asia	Region East	Indonesia	-	-	25	50
		Malaysia Singapore		-	-	37
		Thailand	-	-	37	50
		South Vietnam	-	-	-	25
		total	-	-	62	162
	Region South East	India	25	25	50	100
	Region Far East	South Korea	-	-	25	50
		Philippenes	-	-	25	50
		Taiwan	-	50	62	100
		total	-	50	112	200
	Region Near East	Lebanon	-	-	-	25
		Turkey	-	-	37	50
		total	-	-	37	75
	Region Central	Iran	-	-	25	62
		Israel	-	-	37	50
		Pakistan	-	-	25	37
		total	-	-	87	149
Summary			87	159	624	1250

Table 17

Necessary chlorine capacities for the production of vinylchloride in the developing countries in 1,000 t/y .

			1968	1970	1975	1980
Africa	Region North	Algeria				48
		Morocco				32
		U.A.R.				16
		total				96
	Region West	Nigeria				32
Latin America	Region West	Argentina	32	32	79	111
		Chile	-	12	12	28
		Columbia	-	-	32	48
		Peru	-	-	32	48
		Venezuela	-	-	32	63
		total	32	44	187	296
	Region North	Mexico	16	32	79	158
	Region East	Brazil	32	32	95	174
Asia	Region East	Indonesia	-	-	32	63
		Malaysia Singapore	-	-	-	48
		Thailand	-	-	48	63
		South Vietnam	-	-	-	32
		total	-	-	80	206
	Region South East	India	32	32	63	127
	Region Far East	South Korea	-	-	32	63
		Philippines	-	-	32	63
		Taiwan	-	63	79	127
		total	-	63	143	253
	Region Near East	Lebanon	-	-	-	32
		Turkey	-	-	48	63
		total	-	-	48	95
	Region Central	Iran	-	-	32	79
		Israel	-	-	48	64
		Pakistan	-	-	32	48
		total	-	-	112	180
Summary			112	203	801	1027

Table 18

Necessary ethylene capacities for the production of polyethylene in the developing countries in 1,000 t/y .

			1968	1970	1975	1980
Latin America	Region West	Argentina	27	43	128	192
		Chile	-	21	21	85
		Columbia	17	17	58	80
		Peru	-	-	-	63
		Venezuela	-	53	53	74
		total	44	134	261	494
	Region North	Mexico	85	80	164	294
	Region East	Brazil	32	87	172	341
Asia	Region East	Indonesia	-	-	-	106
		Malaysia/Singapore	-	-	-	68
		Thailand	-	-	63	127
		total	-	-	63	296
	Region South East	India	48	92	156	220
	Region Far East	South Korea	30	53	53	137
		Philippines	-	-	-	137
		Taiwan	35	35	98	162
		total	65	88	151	436
	Region Near East	Turkey	-	12	84	75
	Region Central	Iran	-	-	-	137
		Israel	21	21	21	85
		Pakistan	10	20	20	84
		total	31	41	41	306
Summary			305	787	1578	2984

[illegible]	Region North	[illegible]	-	-	-	12
		[illegible]	-	-	-	12
		[illegible]	-	-	-	6
		[illegible]	-	-	-	25
	Region West	[illegible]	-	-	-	12
Latin America		[illegible]	25	25	37	50
		Chile	-	-	12	12
		[illegible]	6	6	12	25
		Peru	-	-	12	12
		Venezuela	-	-	12	25
		Total	31	31	49	136
	Region North	Mexico	12	12	25	25
	Region East	Brazil	25	25	49	99
Asia	Region East	Indonesia	-	-	12	12
		Singapore	-	-	-	12
		Thailand	-	-	12	12
		South Vietnam	-	-	6	12
		Total	-	-	30	62
	Region South East	India	12	12	43	62
	Region Far East	South Korea	-	13	13	38
		Philippines	-	-	-	25
		Taiwan	-	-	43	74
		Total	-	13	62	137
	Region Near East	Lebanon	-	-	-	12
		Turkey	-	-	-	49
		Total	-	-	-	61
	Region Central	Iran	-	-	-	49
		Israel	-	-	-	25
		Pakistan	-	-	-	13
		Total	-	-	-	93
Summary			78	91	316	784

b) Synthetic rubber

There are various types of synthetic caoutchouc but the most important ones are the styrene-butadiene and the polybutadiene rubbers. Only these two types are therefore included in this investigation.

The production of synthetic caoutchouc depends very much on the number of motor vehicles in the particular country. Only those countries can be considered for a synthetic rubber production which have a sufficiently large stock of cars and motor bicycles.

The annual requirements for every million motor vehicles are approx. 16,000 tons per year styrene-butadiene and 8,000 tons per year polybutadiene rubber, plus some quantities of natural caoutchouc and a smaller amount of special types of synthetic rubber. This size would cover the home market and is usually also the economical minimum.

The investment costs for such a plant (based on battery limits) amount to about US-$ 8 million.

The following schedule for the progressive extension of synthetic rubber capacities is based on the expected evolution of motorization in the individual countries.

Table 21

Summary styrene capacities for the production of styrene-butadiene-rubber in the developing countries in 1,000 t/y .

			1968	1970	1975	1990
Latin America	Region West	Argentina	8	12	17	21
		Columbia	-	-	-	4
		Peru	-	-	-	8
		Venezuela	-	-	8	12
		total	8	12	25	45
	Region North					
		Mexico	12	12	12	17
	Region East					
		Brazil	17	17	21	29
Asia	Region South East					
		India	8	8	8	12
		Summary	45	49	66	103

		Production capacity in 1000 t/y				Investments to eliminate sulphur dioxide emissions in 1000 $		
		500	500					
	Argentina	-	-					
	Colombia	-						
	Chile	-	-					
	Venezuela	-	-					
	total	-	-					
	Mexico		-					
	Brazil	-	-					
	Indonesia	-	-					
	Thailand	-	-					
	total	-	-					
	India	-						
	Korea	-	-	-				
	Philippines	-	-	-				
	Taiwan	-	-					
	total	-	-					
	Turkey	-		-				
	Iran	-	-	-				
	Israel	-	-	-				
	Pakistan	-	-	-				
	total							
	summary	-	-					

	Region West	Argentina				
		Colombia				
		Peru				
		Venezuela				
	Region East	Brazil				
	Region North	Mexico				
	Region South East	India				
	Summary					

	Region West	Argentina	–	–	[illegible]
		[illegible]	–	–	–
		Peru	–	–	–
		[illegible]	–	–	[illegible]
		[illegible] total	–	–	[illegible]
	Region North	Mexico	–	–	[illegible]
	Region East	Brazil		–	[illegible]
	Region South	[illegible]	–	–	–
		Thailand	–	–	–
		[illegible] total	–	–	[illegible]
	Region South East	India	–	–	[illegible]
	Region Far East	[illegible]	–	–	[illegible]
		[illegible]	–	–	[illegible]
		Taiwan	–	–	[illegible]
		[illegible] total	–	–	[illegible]
	Region Near East	Turkey	–	–	20
	Region Central	Iran	–	–	26
		Israel	–	–	[illegible]
		Pakistan	–	–	9
		total	–	–	52
Summary			–	–	139	370

Region [illegible]	[illegible]	–	–	[illegible]	–
	[illegible]	–	–	–	[illegible]
	[illegible]	–	–	–	[illegible]
	[illegible]	–	–	–	[illegible]
	[illegible]	–	–	–	[illegible]
	[illegible]	–	–	–	[illegible]
Region North	[illegible]	–	–	[illegible]	[illegible]
Region East	[illegible]	–	–	[illegible]	[illegible]
	[illegible]				
Region South	[illegible]	–	–	–	[illegible]
	Tunisia	–	–	–	[illegible]
	[illegible]	–	–	–	[illegible]
Region South East	[illegible]	–	–	[illegible]	[illegible]
	[illegible]				
Region Far East	[illegible]	–	–	–	[illegible]
	[illegible]	–	–	–	[illegible]
	Taiwan	–	–	–	[illegible]
	[illegible]	–	–	[illegible]	[illegible]
Region Near East	[illegible]	–	–	–	[illegible]
	[illegible]				
Region Central	Iran	–	–	–	[illegible]
	Israel	–	–	–	[illegible]
	Pakistan	–	–	–	[illegible]
	[illegible] total	–	–	–	[illegible]
Summary		–	–	304	1054

Region Central	Iran	-	-	25	215
	Israel	21	21	53	162
	Pakistan	10	20	48	130
	total	31	41	126	497
Region Near East	Lebanon	-	-	-	25
	Turkey	-	12	81	101
	total	-	12	81	126
Region Far East	South Korea	30	30	31	94
	Philippines			25	125
	Taiwan	30	38	150	218
	total	60	68	206	437
Region South East	India	20	114	202	630
Region East	Hong Kong	-	-	-	75
	Indonesia	-	-	-	50
	Malaysia	-	-	100	150
	Vietnam	-	-	-	50
	Thailand	-	-	120	325
Region West					
Region North					
Region East					
Summary		332	693	1342	4198

Table

Investment requirements for the expected polyethylene-, PVC-, polystyrene-, polypropylene-, VC- and styrene capacities in millions of US dollars.

			1970 - 75	1975 - 80	1980 - 90
AFRICA	Region North		-	20	50
			-	15	10
			-	10	7
			3	3	10
			3	51	77
	Region East				
				5	
			-	7	7
			-	7	
	Region West				
			15		
			5		
LATIN AMERICA	Region West		15		
			41		
			15		
			7		
			10		
	Region North				
			58	120	50
			-		
	Region East				
			107	150	200
			-		
			107		

continued .../.

Table (cont.)

Investment requirements for the expected polyethylene-, PVC-, polystyrene-, polypropylene-, VC- and styrene capacities in millions of US dollars

			1970 - 75	1975 - 80	1980 - 90
A		Burma	-	3	[illegible]
		Indonesia	16	[illegible]	[illegible]
		Cambodia		1	1
		Malaysia		[illegible]	
		Thailand	52	5	[illegible]
		South Vietnam	1	1	[illegible]
		[illegible]			
		total	70	211	[illegible]
		Ceylon		[illegible]	
		India	33	[illegible]	[illegible]
		total	33	[illegible]	[illegible]
		South Korea	8	[illegible]	[illegible]
		[illegible]	[illegible]	[illegible]	
		[illegible]	[illegible]	-	[illegible]
		[illegible]	[illegible]	[illegible]	[illegible]
		Iraq	15	15	
		Lebanon	-	[illegible]	[illegible]
		Saudi Arabia	-	[illegible]	[illegible]
		Syria		[illegible]	
		Turkey	35	[illegible]	[illegible]
		total	40	[illegible]	[illegible]
		Afghanistan	1.5	1.5	[illegible]
		Iran	13	115	[illegible]
		Israel	23	[illegible]	[illegible]
		Pakistan	15	[illegible]	[illegible]
		total	52	[illegible]	25
Summary					

c) Synthetic fibres

A) [illegible]

aa) Consumption

In the past the end consumption of synthetic fibres in most of the developing countries has been insignificant in both relative and absolute terms. Even today this situation still applies in a number of these countries or regions. Consequently, a realistic estimation of the future synthetic fibre consumption of these countries is very difficult.

The Market Research Department of Farbwerke Hoechst has therefore followed an indirect course in working by way of the forecast for the total textile fibre consumption at the end consumer stage. For this purpose, the method of regression analysis with the independent variables of population and national income was chosen. As is known there is a close connexion between the development of population and income on the one hand and the consumption of textile fibres on the other. The consumption of man-made fibres, divided according to whether cellulosics or synthetics was estimated at the same time.

This method of estimating the future consumption of synthetics does not contain any forecast for the evolution of the main chemical groups of polyacrylics, polyamides and polyester. However, this information is necessary in order to determine the future requirements for the starting materials, such as acrylonitrile AN salts or caprolactam and DMT. Consequently the consumption of synthetics by the industry, divided according to the main chemical groups was ascertained parallel to the above end consumer forecast. The consumption by the industry is defined as the industry's own production of synthetic filaments and staple fibres, plus the external trade balance for these raw mats and the external trade balance for synthetic staple fibre yarns. The term consumption by the industry is thus understood to mean the input of the weaving and knitting industries.

Undoubtedly, there are some divergencies between the consumption of the industry and the end consumption. This stems from:

1) the technical development of the textile industry engaged in the further processing (relatively advanced technical development is usually associated with countries having a net surplus of exports over imports so far as woven and knitted fabrics and ready-to-wear textiles are concerned); and

2) the foreign exchange situation; (countries with relatively limited technical equipment, or ones where there is little technical progress generally, have a surplus of imports over exports in woven and knitted fabrics and ready-to-use textiles).

In countries belonging to group 1), such as South Korea or Taiwan, with their highly developed textile and clothing industries, the industrial consumption of synthetics is substantially higher than the end consumption. This also holds true for the other textile fibres. Large quantities of semi-finished and ready-to-use textiles leave the country as exports or "re-exports". On the other hand, some 9% of the developing countries - following group 2) - have a higher end consumption of synthetics than the consumption of these materials by the industry. In the subsequent stages, woven and knitted synthetic fabrics and ready-to-use textile articles - made of 100% synthetics or of blended yarn - are imported. Because of the shortage of foreign exchange reserves however, these imports are not on a very large scale, and consequently, the difference between the industrial consumption and the end consumption is very small.

a.1) End consumption of textile and synthetic fibres from 1966 to 1969

In the developing countries the total fibre consumption, i.e., cotton, wool and man-made fibres, was about 4.7 millions of tons in 1968. Considering the world consumption of 20.2 millions of tons, the developing areas' share was 23.2%. On the basis of the above-mentioned forecast, the world textile fibre consumption is likely to be 31 million of tons in 1980, since the consumption of the developing countries would rise by that time to some 8.4 millions of tons. This means that these countries' share of the world consumption would increase to 26.8%.

The following survey illustrates the evolution in details:

Textile Fibre Consumption 1966-80

(in 1,000 t)

	1968	1970	1975	1980
World	20,200	21,800	26,000	31,000
Developing countries' share of above	4,680	5,200	6,400	8,300
	(23.2 percentage)	24	25	27

Developing countries' percentage share of world consumption

Africa	[illegible]				
	[illegible]				
	[illegible]				
	other countries				
	[illegible]				
Latin America	[illegible]				
	Chile				
	Costa Rica				
	Mexico				
	Nicaragua				
	Brazil				
	other countries				
	total				
Asia	Indonesia	65	100	200	300
	India	1,330	1,750	1,800	2,100
	Philippines	85	85	140	200
	South Korea	105	115	140	150
	Taiwan	65	85	150	210
	Turkey	150	210	240	250
	Afganistan	45	45	60	85
	Iran	110	120	150	220
	Israel	65	87	90	95
	Pakistan	310	340	450	610
	other countries	487	603	675	790
	total	2,330	3,210	4070	5,130
Summary		4,500	5,050	6,870	8,080

... consumption of synthetic fibres reached a figure of about 0.4 ...s of tons in the developing areas in 19[illegible]. Related to the total ... consumption in these countries, synthetics hold a share of 0.4%. ...nthetic fibre consumption in the developing countries in 1968 was ... of the total world synthetic fibre consumption for that year.

According to the forecast estimates, the world consumption of synthetics will reach about 11 millions of tons by 1980. The consumption of synthetic fibres in the developing countries may be 1.6 million by that time. The developing countries' share of the world synthetic fibre consumption would be 14%.

The following survey shows the details:

Consumption of synthetic fibres (end uses) 1965-80

	in 1,000 tons			
	1965	1970	1975	1980
World	3,761.0	4,900	7,700	11,000
Developing countries' share of above	381	533	955	1,470
	(as a percentage)			
Developing countries' percentage share of world synthetics consumption	10.1	11	12	14
Percentage share of synthetics in total textile fibre consumptions				
World	18.6	22	30	35
Developing countries	8.4	12	15	19

As indicated, the synthetic fibre consumption in the developing countries is likely to increase by a yearly average of 17% from 1970 to 1980. In the same period the world consumption of synthetics is likely to increase by an average of only 12% per annum.

Table 8 gives the consumption data of synthetics for all regions, listing separately the most important consumer countries.

Synthetics consumption (end-uses) of the developing countries from 1968-80

(in 1000 tons)

		1968	1970	1975	1980
I	Africa	22.4	35	65	120
	including:				
	U.A.R.	3.0	6	29	64
	Morocco	6.5	8	11	17
	Algeria	4.7	6	9	14
II	Latin America	131	195	290	440
	including:				
	Mexico	21.2	29	40	48
	El Salvador	1.3	2	3	4
	Panama	1.6	2	3	3
	Brazil	30.5	65	120	170
	Argentina	27.1	31	45	62
	Colombia	9.4	15	23	32
III	Asia	228	323	600	910
	including:				
	Taiwan	24.7	34	69	109
	South Korea	45.2	55	80	101
	Philippines	17.2	21	30	40
	India	39.4	63	135	179
	Indonesia	3.4	12	31	65
	Pakistan	4.3	12	36	51
	Iran	12.5	18	50	90
	Israel	10.4	13	20	33
	Lebanon	4.3	7	13	24
	Turkey	19.5	28	40	60
	Total:	381	553	955	1470

aa 2) Consumption by the industry

The preceding section gave a general picture of the trend in the consumption of synthetics. However, it is intended to provide information on the future requirements for petrochemical products and starting products for synthetic fibres in the developing countries 1970 to 1980, with a view to facilitating decisions on investment in these countries. In this context, the difficult factor is the timing for the construction of petro-chemical plants and of the chemical and man-made fibre industry. Consequently, the present and future consumption rates of synthetic fibres and staple fibres by the industry in the developing countries are the criteria determining whether or not a policy of investments merits further consideration.

In 1960, the industrial consumption of synthetic fibres in the developing regions was about 340,000 tons, the largest share being allotted to polyamide filaments and staple fibres with 53.7 %, followed by polyester fibres with 28,8 %. Polyacrylnitrile fibres come third with 14.2 %, though that leaves only about 3.3 % allotted to other types of synthetic fibres.

In 1980, the synthetic fibre consumption by the industry is likely to reach some 1.6 millions of tons. The following survey illustrates the estimated evolution of this industrial consumption.

Africa	Region North	Algeria	0·6	0·9	1·0	2·2
		Morocco	0·5	0·8	0·9	0·9
		Tunisia	-	-	0·1	0·1
		[illegible]	0·4	0·5	1·0	1·0
		Libya	-	0·1	0·1	0·1
		Total	1·5	2·3	3·1	3·1
	Region East	Ethiopia	-	0·1	0·2	0·2
		Kenya	-	0·1	0·1	0·1
		Madagascar	-	-	0·1	0·1
		Sudan	-	0·1	0·1	0·1
		Tanganyika	-	-	0·1	0·1
		Total	-	0·3	0·6	0·6
		Congo (Kinshasa)	-	0·1	0·2	0·2
	Region West	Ghana	-	0·1	0·1	0·1
		Ivory Coast	-	0·1	0·1	0·1
		Nigeria	-	0·2	0·4	1·1
		Senegal	-	0·1	0·1	0·1
		Total	-	0·5	1·0	2·1
	Other developing countries		0·8	1·2	2·4	4·7
Latin America	Region West	Argentina	0·2	0·3	3·0	8·3
		Columbia	0·2	1·5	3·0	4·0
		Chile	0·2	0·5	0·8	1·0
		Ecuador	1·0	1·5	2·0	3·0
		Peru	1·0	2·0	2·5	3·0
		Venezuela	0·9	1·5	2·0	4·5
		Total	3·5	10·0	15·3	24·2
	Region North	Costa Rica	-	-	0·1	0·2
		El Salvador	-	-	-	0·1
		Guatemala	0·2	0·3	0·5	0·5
		Rep. Honduras	-	-	0·1	0·2
		Mexico	2·2	3·5	5·0	8·0
		Nicaragua	-	-	0·1	0·1
		Panama	-	-	0·1	0·1
		Total	2·4	3·8	5·9	8·2

continued .../.

Asia	Region East	Brazil	0·2	0·3	0·5
		Malaysia	-	-	-
		Thailand	0·1	0·1	0·2
	Region East	Cambodia	-	-	0·1
		Laos	-	-	0·1
		Viet Nam (Democratic)			
		Thailand	0·1	0·1	0·2
		Viet Nam (Republic)	0·1	0·1	0·2
			0·2	0·2	0·5
	Region South East	Ceylon	0·1	0·2	0·3
		India	0·3	0·3	0·6
		Total	0·4	0·5	0·9
	Region Far East	South Korea	-	0·1	0·1
		Philippines	0·1	0·2	0·3
		Taiwan	0·2	0·2	0·4
		Total	0·3	0·5	0·8
	Region Near East	Cyprus	-	-	0·1
		Iraq	-	0·2	0·3
		Jordan	-	-	0·1
		Lebanon	0·1	0·2	0·3
		Syria	-	0·1	0·2
		Turkey	0·8	0·8	1·7
		Total	0·9	1·3	2·7
	Region Central	Afghanistan	-	-	0·1
		Iran	1·8	2·5	7·0
		Israel	0·3	0·7	1·1
		Pakistan	-	-	0·2
		Total	2·1	3·2	8·3
Other developing countries			-	0·1	0·2
Summary			40·6	73·5	137·1

		1960	1970	1975	1980
Africa	Region North: Algeria	2.1	2.8	4.0	5.2
	Libya	-	0.1	0.4	0.6
	Morocco	1.2	2.0	2.6	3.2
	Tunisia	0.5	0.9	1.5	2.0
	U.A.R.	2.1	3.0	4.0	5.0
	total	5.9	10.5	15.3	20.1
	Region West: Ethiopia	0.2	0.2	0.3	1.0
	Kenya	0.1	0.2	0.5	0.6
	Mozambique	-	0.1	0.4	0.4
	Sudan	0.1	0.6	1.0	1.3
	Tanzania	0.2	0.4	1.1	1.6
	total	0.6	1.5	3.2	5.1
	Region Central: Congo (Leopoldville)	0.2	0.3	0.4	1.0
	Region West: Ghana	-	0.2	0.3	0.4
	Ivory Coast	0.1	0.2	1.6	1.6
	Nigeria	0.3	0.6	1.2	2.0
	Senegal	0.1	0.4	0.6	1.0
	total	0.5	1.4	3.7	5.0
Other developing countries		3.8	5.0	7.8	8.3
Latin America	Region West: Argentina	13.0	20.0	23.3	25.2
	Bolivia	0.2	0.5	0.8	1.0
	Columbia	5.2	7.0	10.0	12.0
	Chile	2.4	3.6	5.0	8.0
	Ecuador	1.2	1.7	3.0	5.0
	Peru	3.2	5.0	7.5	9.5
	Venezuela	3.4	4.5	7.0	10.0
	total	28.8	42.3	56.6	70.2
	Region North: Costa Rica	0.6	0.7	0.8	1.0
	El Salvador	0.8	1.0	1.2	1.4
	Guatemala	1.7	2.2	2.6	3.0
	Rep. Honduras	0.4	0.8	1.2	1.5
	Mexico	15.0	18.0	20.0	22.0
	Nicaragua	0.3	0.5	0.8	1.0
	Panama	0.5	0.7	1.0	1.3
	total	19.3	23.9	27.6	31.2

continued ..../.

Table 7

...ected consumption of pet... in Others in the Developing countries, ... '000 tons.

		1970	1975	1980
Region Latin America	Brazil	0.5	35.0	60.0
	Mexico	-	2.1	5.2
	Other LA	0.3	1.5	4.5
	Total	0.8	38.6	69.7
Region Black Africa	Ghana	0.1	0.2	0.3
	Cameroon	0.2	0.6	0.7
	Ivory Coast	0.6	1.5	3.0
	Malawi, Zambia, Rhodesia	1.0	2.0	4.0
	Zaire	2.4	4.6	6.7
	South Africa	0.2	0.5	3.5
	Total	4.5	9.4	18.2
Region South East Asia	Ceylon	0.3	1.1	1.6
	India	2.1	27.5	60.0
	Total	2.4	28.6	61.6
Region Far East	South Korea	2.1	20.3	30.3
	Philippines	1.0	2.1	3.5
	Taiwan	1.7	2.1	3.5
	Total	4.8	24.5	37.3
Region Near East	Cyprus	0.1	0.6	0.7
	Iraq	0.1	0.5	1.7
	Jordan	0.2	0.4	0.6
	Lebanon	1.6	1.7	3.4
	Syria	2.0	3.4	5.2
	Turkey	5.0	10.0	15.0
	Total	10.4	16.6	26.6
Region Central	Afghanistan	-	0.2	2.0
	Iran	2.1	8.6	18.0
	Israel	6.1	6.5	7.0
	Pakistan	1.1	5.5	10.0
	Total	9.3	20.8	37.0
other developing countries		0.4	0.6	1.4
Summary		101	271	443

Region North					
Region East					
Region Central					
Region West					
Other developing countries					
Latin America	Region (West)				
		Total	13·6	22·7	41·3	64·3
	Region North	Costa Rica	0·2	0·4	0·6	1·1
		El Salvador	0·4	0·6	1·1	1·5
		Guatemala	1·0	1·5	2·5	3·5
		Rep. Honduras	0·2	0·4	1·0	2·0
		Mexico	2·0	12·0	15·0	20·0
		Nicaragua	–	0·2	0·5	1·0
		Panama	0·1	0·3	0·7	1·5
		Total	9·9	15·4	21·4	30·6

continue! ...../..

Region East					
Region East					
Region South East					
Region Far East	South Korea	-	2·2	30·0	32·2
	Philippines	0·6	5·0	5·0	10·0
	Taiwan	0·5	8·4	30·0	38·4
	Total	30·8	47·1	70·0	100·0
Region Near East	Cyprus	-	0·2	0·6	0·8
	Iraq	0·1	0·4	1·4	2·0
	Jordan	-	0·2	0·5	1·0
	Lebanon	0·8	1·7	0·8	3·0
	Syria	0·8	1·1	2·5	5·0
	Turkey	6·8	11·0	24·0	30·0
	Total	8·5	15·2	30·0	52·2
Region Central	Afghanistan	-	-	1·5	5·5
	Iran	2·1	4·8	20·0	25·0
	Israel	3·8	4·5	8·1	16·0
	Pakistan	0·2	6·2	25·0	30·0
	Total	6·1	15·6	54·0	65·6
Other developing countries		0·2	0·3	1·0	2·6
Summary		94·1	158·0	355·5	580

		1960	1970	1975	1980
Region North	Algeria	3.0	4.1	7.0	10.5
	Libya	-	0.4	1.0	2.0
	Morocco	10.0	13.0	19.0	
	Tunisia	1.0	1.7	3.0	5.0
	Total	22.0	30.0	43.0	57.0
		16.1	33.4	49.1	74.5
Region East	Ethiopia	0.6	0.6	2.5	5.0
	Kenya	0.4	0.7	3.0	5.0
	Madagascar	0.7	0.5	1.0	1.5
	Sudan	0.1	0.2	1.5	3.5
	Tanzania	0.2	0.5	1.0	2.0
	Total	1.2	2.1	10.4	17.0
Region Central	Congo (Brazzaville)	0.3	0.6	1.0	2.0
Region West	Ghana	0.2	0.8	2.5	5.0
	Ivory Coast	0.3	0.5	2.0	4.0
	Nigeria	0.5	1.2	3.0	7.0
	Senegal	0.4	0.6	1.1	2.5
	Total	1.0	3.1	10.0	17.5
Other developing countries		0.3	0.7	1.7	3.6
Region West	Argentina	19.5	30.3	44.3	60.0
	Bolivia	0.4	0.7	1.2	2.0
	Columbia	2.4	14.2	32.5	50.0
	Chile	5.0	7.7	10.3	20.2
	Ecuador	2.5	3.5	7.5	12.0
	Peru	5.0	9.6	17.5	10.0
	Venezuela	5.6	9.0	15.0	25.5
	Total	40.3	84.4	117.3	166.5
Region North	Costa Rica	0.8	1.1	1.5	2.5
	El Salvador	1.2	1.6	2.2	3.0
	Guatemala	2.0	4.0	5.6	7.1
	Rep. Honduras	0.6	1.2	2.3	3.8
	Mexico	25.3	33.7	41.0	51.5
	Nicaragua	0.3	0.7	1.4	2.1
	Panama	0.5	1.0	1.8	2.9
	Total	31.7	43.3	55.8	72.6

continued ...../.

(Table 7 (cont.))

Annual consumption of all types of fibres in the developing countries, by regions and by fibres.

		1961	1970	1975	1980
Region East Asia	Burma	2[illegible]	[illegible]	11[illegible]	15[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Region South East Asia	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Region South East Asia	Ceylon	1·3	1·8	2·4	3·0
	India	13·7	22·0	17·5·0	17·5
	Total	15·0	23·8	[illegible]	1[illegible]
Region Far East	[illegible]	[illegible]	[illegible]	3·5	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Total	[illegible]	[illegible]	[illegible]	[illegible]
Region Far East	Cyprus	0·1	0·2	1·5	2·5
	Iraq	0·2	1·1	3·5	6·0
	[illegible]	[illegible]	0·6	1·2	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Syria	[illegible]	[illegible]	[illegible]	[illegible]
	Turkey	10·0	23·2	[illegible]	[illegible]
	Total	[illegible]	40·6	[illegible]	[illegible]
Region Central	[illegible]	-	0·2	3·5	[illegible]
	Iran	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Pakistan	[illegible]	[illegible]	[illegible]	[illegible]
	Total	27·2	50·1	100·1	175
Other developing countries		0·6	1·0	2·0	5·0
Summary		34·2	431	818	1265

Industrial consumption of synthetic fibres from 1968 to 1980

(in 1,000 tons)

	1968	1970	1975	1980
I. Africa	38.4	56	129	218
II. Latin America	188	192	394	430
III. Asia	184	201	507	892
Summary comprising:	262	329	1030	1540
Acrylic	48	73	186	213
Polyamide	191	264	443	507
Polyester	201	274	394	670
Other synthetics	9	18	37	58

For the second decade from 1970 to 1980, the average annual increase in the consumption of synthetics by the industry may reach 19 % while at the same time the polyester consumption increases at the disproportionate rate of 30 % per annum, and the polyamide consumption by only 13 %.

The evolution of the industrial consumption of synthetic fibres in individual countries of the developing regions are shown in the tables.

bb. Production

It is almost impossible to give reliable figures on the production capacities of synthetic fibres within a short interval of time, because of the dependence of the effective capacity on the thickness of the produced filament yarn and staple fibres. The "denier-programme" of plants which are under construction or even in a planning stage are usually not ready before the starting up and can vary afterwards with the other existing plants according to the market requirements.

The extensions of the capacities up to 1971 / 1972 , shown in table 33 , reflect probably developments on the basis of plants existing and known up to the present. Only those projects were considered for which a number of detailed questions have been clarified (financing, allocation of know-how, a.s.o.) so that they can be ready by 1971/1972 . Publicised intentions which have not got reached a concrete planning stage are therefore not taken into account.

Table 33

...pacities of the synthetic fibres 1960 to 1972

in 1,000 t/y.

		Polyester fibres			Polyacrylic fibres		PAN fibres	
		Capacity end 1969	Increase	Planned capacity end 1972	Capacity end 1969	Increase	Capacity end 1969	Increase
Western Europe								
	Austria	20	-	-	-	-		
	Belgium	40	50	90	-	-		
	Germany	140	90	160	-	-	18	60
	Spain							
	France							
	Italy	210	2					
	Netherlands	5						
	Portugal							
	Switzerland	10	20					
	United Kingdom							
	Sweden	20						
	Finland							
	Norway	20	10					
	Greece							
	Ireland							
	Denmark							
	Iceland							
	Total	460	180	250				
Eastern Europe								
	Bulgaria	60	120	180				
	Czechoslovakia							
	German Democratic Republic	70	120	190				
	Hungary		50					
	Poland							
	Rumania	120	80	200				
	USSR							
	Yugoslavia	60		90				
North America								
	USA	-	460	460	20	20		
	Canada				10	-		
	Mexico							
	Total	-	460	460	30	20	30	10
Summary		670	1080	1760	640	480	520	220

The calculations of the extensions for 1975 and 1980 are based on the two figures: expected consumption and present production capacities; the following assumptions were made by estimating extensions to capacities:

1. If a country has no production plants of its own, the investments will be made as soon as the consumption reaches the level of a technically or economically efficient minimum capacity.
2. The extension of production plants already installed, takes place in steps of multiples of the minimum capacities (otherwise it would be impossible to compare the investment costs in the individual countries).
3. The whole industrial synthetic fibre consumption is broken down into the main fibres: polyamides, polyesters and PAN, but not into staple fibres and filament yarns, since the minimum capacities for fibres and filament are different.
4. For the various kinds of synthetic fibres the following minimum capacities were taken as the basis:

PAN fibres:	4,000 t/y
Polyamide fibres:	3,000 t/y
Polyester fibres:	3,000 t/y.

The following tables show the progressive extension of synthetic fibre capacities based on the future industrial consumption for the Second Development Decade. In accordance with the extension the investment requirements are also calculated.

[illegible]

[illegible] for the progressive extension and for the investment requirement of this extension of [illegible] fibres.

			capacities in 1000 t [illegible]			[illegible]	
			planned	expected			
			1972	1975	1980	[illegible]	[illegible]
[illegible]	Region [illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
		U.A.R.		[illegible]	200	18.0	[illegible]
		Total	-	[illegible]	[illegible]	[illegible]	[illegible]
	Region [illegible]	Argentina	[illegible]	7.2	[illegible]		[illegible]
		Colombia	[illegible]	[illegible]		-	-
		Peru	[illegible]	[illegible]	[illegible]	-	-
		[illegible]			[illegible]	-	[illegible]
		Total	172	72	[illegible]	-	[illegible]
	Region [illegible]	Mexico	152	[illegible]	[illegible]	-	
	Region [illegible]	Brazil	76	80	200	20	[illegible]
	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
		[illegible]	-	[illegible]	[illegible]	6.0	-
		Total		[illegible]	[illegible]	[illegible]	[illegible]
	Region [illegible]	India	[illegible]	210	[illegible]	[illegible]	-
	[illegible]	[illegible]	[illegible]	[illegible]			[illegible]
		Philippines	-	[illegible]	[illegible]	6.0	[illegible]
		Taiwan	[illegible]	[illegible]	[illegible]	-	[illegible]
		Total	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Region Near East	[illegible]	[illegible]	[illegible]	[illegible]	-	[illegible]
	Region [illegible]			[illegible]	[illegible]	12.0	[illegible]
		Iran	-				
		[illegible]	[illegible]	[illegible]	-	-	-
		[illegible]					[illegible]
		Pakistan	-			-	
		Total	[illegible]	[illegible]	[illegible]	12.0	12.0
[illegible]			[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

... for the progressive extension and for the investment requirement of this extension of polyamide (nylon ...) fibres.

			Capacities in 1000 t/y planned			Investment in ...	
			1982	1985	1990		
Africa	Region North	Algeria			60		
		Morocco	-	60	90		
		U.A.R.	0.8				
		total	0.8				
	Region West	Nigeria			30		10.5
Latin America	Region West	Argentina	24.0	24.0	24.0		
		Chile					
		Columbia					
		Ecuador					
		Peru					
		Venezuela	4.0				
		total					
	Region South	Brazil					
		Colombia					
		total	20.0	21.0			
	Region East	Cuba					
		total					
Asia	Region East	Indonesia	-		21.0		
		Malaysia					
		Thailand	1.5				
		Japan					
		total		28.5	45		
	Region South East	India	3.0	60			
		Philippines					
	Region Far East	South Korea	14.0				
		Taiwan					
		Philippines					
		total	30.0	81.0	100.0		
	Region Near East	Iraq	-	-	30	-	
		Lebanon	-	3.0			
		Syria	-				
		Turkey	12.0	15.0			
		total					
	Region Central	Afghanistan	-		30	-	
		Iran	5.0				
		Israel					
		Pakistan	3.2	9.0			
		total	10.5	33.0	72.0		
Summary			192.8	375.5	499.0	632.4	439.8

...er the progressive extension and for the improvement
of this extension of polyester ...

			Capacities to be ...			...	
			planned	...	...		
			...	...	780		
Latin America	Region North	Algeria			3'5		
		Morocco		7.0	10.5		
		U.A.R.		1.0	21		
		total			35		
	Region South West	Ethiopia	-	-	3'5		
		Nigeria			3'5		
		Argentina			4.2		
		Chile	9.2				
		Colombia					
		Ecuador			3'5		
		Peru					
		Venezuela					
		total					
	Region North	Guatemala					
		Puerto Rico					
	Region East	Brazil					
		Thailand		3.6			
		total					
Asia	Region Near East	Iran		28'0			
		Taiwan			49		
		total	43.7		105		
	Region Near East	Iraq	-	-	3'5		
		Lebanon	-	3'5	7.0		
		Syria	-	3'5	7.0		
		Turkey	20.2	24'5	31		
		total					
	Region Central	Afghanistan	-	-	7'0	-	
		Iran	4'6	21'0			
		Israel	-	7'0			
		Pakistan	-				
		total	4'6	52'5	91'0		
Summary			175'5	317'0	556'5	323'8	47'2

b. Intermediates for synthetic fibres

The requirement for acrylonitrile, caprolactam and DMT has been calculated on the basis of the fibre production with the hypothesis of a full maintenance, but only a maintenance for the fibre plants. To make this study more distinct nylon 66 and the corresponding intermediates are treated as nylon 66 plants; this is acceptable since the primary product for both is benzene and the quantitative requirement of benzene has not to be changed by this assumption.

As far as ethylene glycol is concerned which is required for the manufacture of polyester fibres, it is with in the group of basic products, although it is not a genuine one, but with regard to the fact that some chemicals and petrochemicals are very common and used as primary products, as for example ethylene oxide, acetic acide, cyclohexane, and some others; they are mentioned under 'basics'.

The production of the necessary intermediates for the synthetic fibres is the next step forward to built a complete petrochemical complex. There are also recommended minimum capacities for them; Mr. Roemits gives these minima as follows: acrylonitrile: 10,000 t/y, caprolactame 20,000 t/y, DMT 30,000 t/y.

He took into account that these capacities cannot be built up lower. Otherwise the production costs for the end-product would reach a level which would be higher than the world market price for this end-product, conclusively because of the 'uneconomical' capacity of the intermediate. Considering smaller sizes of plants for the production of the intermediates, Mr. Roemits points out that the customs taxations have to be much higher than the usual protective ones and the high prices of the end-product would influence strongly the consumption, independently of its quality.

These considerations are right but acceptable only for much smaller minima, and the right minimum capacities might be for each between 6,000 t/y and 8,000 t/y.

Unfortunately, all the following calculations for the progressive extension of the capacities to maintenance the corresponding fibre plant with the necessary intermediate and the following calculations for the investment requirements for these extensions are based on Mr. Roemitz's high minima. It seems therefore that the expected capacities and investment requirements of the following tables should in fact be higher.

c. Basic products for synthetic fibres

The next step backwards from the monomers gives a mixture of primary products like propylene (for the acrylonitrile production) and already advanced petrochemicals like ethylene oxide (for the EO production). They are discussed here altogether under 'basic products' (see above under "B").

The most important ones are propylene, (acrylonitrile), cyclohexane, (caprolactam) and benzene (cyclohexane), and ethylene glycol, and methanol (DMT), and propylene (ethylene glycol), and ethylene for most of the advanced petrochemicals. It has been already discussed that the establishing of a basic cracker can only be considered if most of the products have a reasonable domestic market and if its capacities are big enough. Therefore, as far as synthetic fibres are concerned all the necessary genuine basic products do not reach the level of the minimum capacity for the economical erection of a cracker. For that reason, in the following tables there are only given the necessary capacities to provide a full maintenance of the synthetic fibre plants with raw materials except ethylene.

Acrylonitrile a) necessary capacities for the PAN fibre produc...
b) Schedule for the progressive extension
c) Investment requirements for this extension

In 3?

		Necessary capacities in 1000 t			capacities in 1000 t/year to be planned			Investments in mio Dm
		1972	1975	1980	1972	1975	1980	1972 to 1975 / 1975 to 1980
Africa	Morocco	-	4.8	8'5				
Region Africa	U.A.R.	-	12'7	21'2	-	10'0	20'0	3'3 / 3'3
	total	-	17'0	29'7		10'0	20'0	3'3 / [illegible]
Latin America	Argentina	7'6	7'6	2'0	3'0	3'0	3'0	
Region Latin	Columbia	4'3	4'3	4'3				
	Peru	6'4	6'4	6'4				
	Venezuela	-	-	4'3				
	total	18'3	18'3	27'0	3'0	3'0	5'0	
[illegible]	Mexico	16'0	16'0	16'0	24'0	24'0	24'0	
[illegible]	Brazil	8'1	17'0	21'0	15'0	15'0	20'0	- / [illegible]
[illegible]	Indonesia	-	4'3	17'0	-	-	20'0	6'6
Region [illegible]	Malaysia [illegible]	-	4'3	4'3				
	total	-	8'6	21'3			40'0	
[illegible]	India	13'8	22'5	22'5	-	20'0	20'0	6'6 / -
[illegible]	S. Korea	20'5	20'5	20'5	14'0	14'0	24'0	3'3 / -
	Philippines	-	4'3	8'5				
	Taiwan	10'6	10'6	15'0	-	10'0	20'0	
	total	31'1	35'4	53'0	14'0	34'0	64'0	10'0 / 10'0
[illegible]	Turkey	10'6	10'6	15'0	-	10'0	20'0	3'3 / 3'3
[illegible]	[illegible]							
	Iran	-	8'5	12'3	-	10'0	10'0	3'3 / -
	Israel	5'3	5'3	6'3				
	[illegible]	-	-	4'3				
	total	5'3	13'8	22'8	-	10'0	10'0	3'3 / -
		108'2	158'2	227'3	62'0	132'0	224'0	43'6 / 43'6

Capacitation : a) necessary capacities for the polyamide fibre production
b) schedule for the progressive extension
c) investment requirements for this extension

		Necessary capacities in 1,000 t/y			capacities in 1,000 t/y up to planned		prospective	investment in million US-$	
		1972	1975	1980	1972	1975	1980	1972 to 1975	1975 to 1980
Africa	Region North								
	Algeria	-	3·6	7·2					
	Morocco	-	7·2	0·7					
	U.A.R.	1·0	3·6	10·2					
	total	1·0	14·4	28·6					
	Region West								
	Nigeria	-	-	3·6					
Latin America	Region West								
	Argentina	28·6	28·6	28·5	30·0	30·0	30·0	-	-
	Chile	6·0	7·2	10·7					
	Columbia	9·5	10·7	14·3					
	Ecuador	-	3·6	3·6					
	Peru	4·8	5·4	7·2					
	Venezuela	4·8	7·2	7·2					
	total	53·7	62·7	75·1					
	Region North								
	Mexico	23·8	25·0	25·0	40·0	40·0	40·0	-	-
	Panama	-	-	3·5					
	total	23·8	25·0	28·5					
	Region East								
	Brazil	30·3	71·4	71·4	-	80·0	80·0	56·0	-
Asia	Indonesia	-	14·3	25·0	-	-	20·0	-	-
	[illegible]	-	7·1	10·7					
	Thailand	3·0	9·0	10·7					
	[illegible]	-	3·6	7·2					
	total	33·3	105·4	125·0					
	Region South East								
	India	38·1	71·4	78·5	20·0	60·0	50·0	28·0	14·0
	Region Far East								
	S. Korea	20·2	46·4	50·0	20·0	40·0	60·0	-	42·8
	Philippines	2·4	10·7	14·3					
	Taiwan	23·8	39·3	64·2	5·0	40·0	60·0	24·5	21·4
	total	46·4	96·4	129·0	25·0	80·0	120·0	24·5	21·4
	Region Near East								
	Iraq	-	-	3·6					
	Lebanon	-	3·6	10·7					
	Syria	-	7·2	7·2					
	Turkey	14·5	17·9	25·0	25·0	25·0	25·0	-	-
	total	14·5	28·7	46·5					
	Region Central								
	Afghanistan	-	-	3·6					
	Iran	6·0	21·5	60·0	-	20·0	40·0	14·0	14·0
	Israel	2·1	7·1	14·3	-	-	20·0	-	14·3
	Pakistan	4·4	10·7	17·8	-	20·0	60·0	14·0	28·6
	total	12·5	39·3	82·1					
Summary		260·7	514·7	668·4	162	337	455	122·5	82·8

DMT. a) necessary capacities for the polyester fibre production
b) schedule for the progressive extension
c) investment requirements for this extension

		necessary capacities in 1,000 t/y			capacities in 1,000 t/y up to planned		prospective	investment in million US-$	
		1972	1975	1980	1972	1975	1980	1972 to 1975	1975 to 1980
Africa	Region North	Algeria	-	-	4·1	-	-	-	-	-
		Morocco	-	8·3	12·4	-	-	-	-	-
		U.A.R	-	8·3	28·9	-	-	30·0	-	9·5
		total	-	16·6	45·4					
	Region East	Ethiopia	-	-	4·1	-	-	-	-	-
	Region West	Nigeria	-	-	4·1	-	-	-	-	-
Latin America	Region West	Argentina	12·4	6·5	24·8	14·0	14·0	30·0	-	5·1
		Chile	10·9	10·9	12·4	-	-	-	-	-
		Columbia	10·1	10·1	16·5	-	-	-	-	-
		Ecuador	-	-	4·1	-	-	-	-	-
		Peru	3·5	4·1	4·1	-	-	-	-	-
		Venezuela	9·3	9·3	12·4	-	-	-	-	-
		total	46·2	50·9	77·3					
	Region North	Guatemala	-	-	4·1	-	-	-	-	-
		Mexico	21·6	21·6	24·8	-	-	30·0	-	9·5
		total	21·6	21·6	28·9					
	Region East	Brazil	3·2	[illegible]	[illegible]	22·0	30·0	60·0	2·5	[illegible]
		Indonesia	-	8·3	20·9	-	-	30·0	-	3·5
		Malaysia and Singapore	-	8·3	12·4	-	-	-	-	-
		Thailand	4·2	4·2	8·2	-	-	-	-	-
		S. Vietnam		4·1	8·3	-	-	-	-	-
		total	4·2	24·9	57·9					
	Region South East	India	22·3	33·0	82·6	-	30·0	90·0	9·5	13·0
	Region Far East	S. Korea	24·5	37·2	49·5	-	30·0	60·0	[illegible]	[illegible]
		Philippines	6·4	8·3	16·5	-	-	-	-	-
		Taiwan	20·7	[illegible]	57·8	-	30·0	60·0	[illegible]	[illegible]
		total	51·6	82·7	123·9	-	60·0	120·0	19·0	13·0
Asia	Region Near East	Iraq	-	-	4·1	-	-	-	-	-
		Lebanon	-	4·1	8·3	-	-	-	-	-
		Syria	-	4·1	8·3	-	-	-	-	-
		Turkey	24·5	28·9	37·2	25·0	30·0	30·0	1·6	-
		total	24·5	37·1	57·9					
	Region Central	Afghanistan	-	-	8·3	-	-	-	-	-
		Iran	5·4	24·8	41·3	-	30·0	30·0	[illegible]	-
		Israel	-	8·3	20·7	-	-	30·0	-	[illegible]
		Pakistan	-	28·9	37·2	-	30·0	30·0	[illegible]	-
		total	5·4	62·0	107·5	-	60·0	90·0	9·0	9·5
Summary			207·0	364·2	656·8	51	224	510	[illegible]	[illegible]

Table 10

...cessary propylene c... needed to ... the ... of polyacrylonitrile fibres (... monomer) in ... developing countries.

			in 1,000 t/y.		
			1972	1978	1985
Africa	Region North	U.A.R.	-	14·0	20·0
Latin America	Region West	Argentina	12·5	12·5	12·5
	Region North	Mexico	30·5	30·5	30·5
	Region East	Brazil	21·0	21·0	30·0
Asia	Region East	Indonesia	-	-	28·0
	Region South East	India	-	20·0	20·0
	Region Far East	S. Korea	19·5	30·5	30·5
		Taiwan	-	14·0	20·0
		total	19·0	47·5	61·5
	Region Near East	Turkey	-	14·0	20·0
	Region Central	Iran	-	14·0	14·0
		Summary	101	185	269

			in 1,000 t/y		
			1972	1975	1980
Latin America	Region West	Argentina	[illegible]	200	300
	Region North	Mexico	[illegible]	[illegible]	[illegible]
	Region East	Brazil	-	[illegible]	[illegible]
Asia	Region South	Indonesia	-	-	[illegible]
	Region South East	India	[illegible]	[illegible]	[illegible]
	Region Far East	S.Korea	[illegible]	[illegible]	[illegible]
		Taiwan	[illegible]	[illegible]	[illegible]
		Total	[illegible]	[illegible]	[illegible]
	Region Near East	Turkey	[illegible]	[illegible]	[illegible]
	Region Central	Iran	-	[illegible]	[illegible]
		Pakistan	-	-	[illegible]
		Total	-	[illegible]	[illegible]
Summary			132	337	450

TABLE 42

[illegible] benzene capacities for the production of cyclo-[illegible] (polyamide fibres) in the developing countries.

			in 1,000 t/y.		
			1972	1975	1980
Latin America	Region West	Argentina	[illegible]	[illegible]	[illegible]
	Region North	Mexico	[illegible]	[illegible]	[illegible]
Asia	Region South East	India	-	[illegible]	[illegible]
	Region Far East	S.Korea	[illegible]	[illegible]	[illegible]
	Region Central	Iran	-	-	[illegible]
Summary			[illegible]	[illegible]	[illegible]

			1,000 E/Y		
			10	100	1000
Africa	Region North	Algeria	–	–	1·4
		Morocco	–	2·8	4·2
		Libya	–	–	1·4
			5·6	15·4	
	Region East	Ethiopia	–	–	1·4
	Region West	Nigeria	–	–	1·4
Latin America	Region West	Argentina	4·2	5·6	5·6
		Chile	4·2	4·2	4·2
		Columbia	2·8	2·8	2·8
		Ecuador	–	–	1·4
		Peru	1·4	1·4	1·4
		Venezuela	2·8	2·8	2·8
		Total	15·4	17·0	20·2
	Region North	Guatemala	–	–	1·4
		Mexico	7·0	7·0	5·6
		Total	7·0	7·0	5·6
	Region East	Brazil	10·6	10·4	20·6
Asia	Region South	Indonesia	–	2·8	5·6
		Malaysia/Singapore	–	2·8	4·2
		Thailand	1·4	1·4	2·8
		S. Vietnam	–	1·4	2·8
		Total	1·4	8·4	15·4
	Region South East	India	7·0	11·2	21·0
	Region Far East	S. Korea	8·0	12·6	18·0
		Philippines	2·8	2·8	5·6
		Taiwan	7·0	12·6	19·6
		Total	17·6	28·0	42·0
	Region Near East	Iraq	–	–	1·4
		Lebanon	–	1·4	2·8
		Syria	–	1·4	2·8
		Turkey	8·8	9·8	12·6
		Total	8·8	12·6	15·6
	Region Central	Afghanistan	–	–	2·8
		Iran	1·8	8·4	14·0
		Israel	–	2·8	7·0
		Pakistan	–	9·8	12·6
		Total	1·8	21·0	36·4
Summary			70·1	127	223

Annex [illegible] -

[illegible] machinery equipment [illegible]
(Polyester fibres) in the [illegible].

			in 1000 t/y.		
			[illegible]	[illegible]	[illegible]
Africa	Region North	U.A.R.	-	-	[illegible]
Latin America	Region West	Argentina	7·0	7·0	[illegible]
	Region North	Mexico		-	[illegible]
	Region East	Brazil	11·0	15·0	[illegible]
Asia	Region South	Indonesia	-	-	[illegible]
	Region South East	India	-	15·0	[illegible]
	Region Far East	S. Korea	-	[illegible]	[illegible]
		Taiwan	-	[illegible]	[illegible]
		total	-	30·0	[illegible]
	Region Near East	Turkey	[illegible]	[illegible]	[illegible]
	Region Central	Iran	-	[illegible]	[illegible]
		Israel	-	-	[illegible]
		Pakistan	-	[illegible]	[illegible]
		total	-	30·0	[illegible]
Summary			30·5	112	[illegible]

Necessary p-xylene capacity [illegible]
[illegible] (polyester fibers) [illegible]

			in 1,000 t/y.		
			1971	1975	1980
Africa	Region North	U.A.R.	-	-	210
Latin America	Region West	Argentina	50	50	100
	Region North	Mexico	-	-	210
	Region East	Brazil	170	210	420
Asia	Region South	Indonesia	-	-	210
	Region South East	India	-	210	630
	Region Far East	S. Korea	-	210	420
		Taiwan	-	210	420
		total	-	420	840
	Region Near East	Turkey	170	210	210
	Region Central	Iran	-	210	210
		Israel	-	-	210
		Pakistan	-	210	210
		total	-	420	630
Summary			427	167	357

3. Summary of synthetic fibres

The complete data for the planned and expected production of the three synthetic fibres in the developing regions are as follows in 1,000 tons/year:

	1972	1975	1980
PAN	97	150	206
Polyamide	193	374	499
Polyester	176	317	557

and the necessary investment requirements in millions of US-Dollars.

	1972 to 1975	1975 to 1980	1972-1980
PAN	78	84	162
Polyamide	632	439	1,071
Polyester	324	547	871

The demand for the intermediates for this fibre production, i.e. acrylonitrile (AN), caprolactam, and DMT, is calculated on the basis of these dates in 1,000 tons/year.

	1972		1975		1980	
	necessary capacities	expect. extens.	necess. capac.	expect. extens.	necess. capac.	expect. extension
AN	101	62	158	132	227	192
caprolactam	361	162	515	337	668	455
DMT	207	61	364	224	657	510

The following investment costs are based on the investment requirements for the expected extensions, and not on the necessary capacities.

It must be understood that in 1980 still quite a lot of intermediates will have to be imported to maintenance the full fibre production.

	1972 to 1975	1975 to 1980	1972 to 1980
AN	26	20	46
caprolactam	123	83	206
DMT	52	91	143

As far as the primary products are concerned the demands are mostly too small for the erection of plants for its production (see above), and the investment requirements up to 1980 do not even reach 5 % of the total investment costs. They are therefore omitted from the following table.

Investment requirements for the expected complete synthetic fibre plants (from basic petrochemicals to end-products) in millions of US-Dollars.

	1972 to 1975	1975 to 1980
PAN	100	104
Polyamide	755	521
Polyester	376	638
Summary	1,231	1,263

These data give the necessary minimum investment requirements based on the minimum capacities for each country and on the domestic demand.

Here the Industrial Development Field Advisers could do very useful work in convincing the governments of the individual countries of the advantages of a regional economy. Not only would the number of plants be smaller in each region whilst the units (capacities) become bigger, but also it would be possible to produce a much higher rate of the necessary intermediates and primaries in the regions themselves and for example, the discrepancy between the caprolactam demand and the expected extension of the caprolactam production could be reduced to a

D. Other petrochemicals

Some other petrochemicals are mentioned here, but unfortunately for a very limited number of countries only. This comes from the fact that very few of the developing countries already have plants for primary petrochemicals running or under construction and that this situation will hardly be changed by 1980 because of the relatively small necessary capacities of these products.

The following tables deal with ethylene oxide,

- ethylene glycol
- phthalic anhydride
- vinyl acetate
- acetic acide
- 2-ethyl-hexanol
- phenol and
- acetone

and with the necessary capacities of ethylene, propylene, oxylene and benzene to provide full maintenance of these plants with the necessary petrochemical raw materials.

a) expected evolution of the consumption in the developing countries in 1,000 t/y
b) schedule for the expected progressive extension of the capacities in 1,000 t/y
c) investment requirements for this extension in millions of US-$
capacity : 7,300 t/y = investment 2,000,000 $
capacity : 29,000 t/y = investment 4,000,000 $

Table 46

			a)			b)			c)	
			1968	1975	1980	1968	1975	1980	up to 1975	1975 to 1980
Africa	Region North	U.A.R.	-	5'0	18'0		-	7'3	-	2'0
		other developing countries	3'3	13'0	36'0					
Latin America	Region East	Argentina	3'0	19'0	30'0		7'3	14'6	2'0	2'0
	Region West	Mexico	18'0	44'0	65'0		29'0	58'0	4'0	4'0
	Region East	Brazil	10'0	38'0	70'0		29'0	58'0	4'0	4'0
	other developing countries		4'0	26'0	45'0					
Asia	Region South East	India	1'0	30'0	70'0		14'6	43'6	4'0	4'0
	other developing countries		1'0	65'0	115'0					

a) expected evolution of the consumption in the developing countries in 1,000 t/y
b) schedule for the expected progressive extension of the capacities in 1,000 t/y
c) investment requirements for this extension in millions of US-$
capacity : 15,000 t/y = investment 4,000,000 $
capacity : 40 000 t/y = investment 10,000,000 $

Table 47

			a)			b)			c)	
			1968	1975	1980	1968	1975	1980	up to 1975	1975 to 1980
Africa	Region North	U.A.R.	-	3'0	12'0		-	[illegible]	-	[illegible]
		other developing countries	2'9	6'0	15'0					
Latin America	Region East	Argentina	3'6	9'0	15'0		10'0	[illegible]	[illegible]	[illegible]
	Region West	Mexico	5'6	14'0	25'0		10'0	30'0	2'0	4'0
	Region East	Brazil	4'8	18'0	30'0		20'0	40'0	4'0	4'0
		other developing countries	3'5	14'0	25'0					
Asia	Region South East	India	5'0	15'0	35'0		20'0	40'0	4'0	4'0
		other developing countries	20'0	60'0	100'0					

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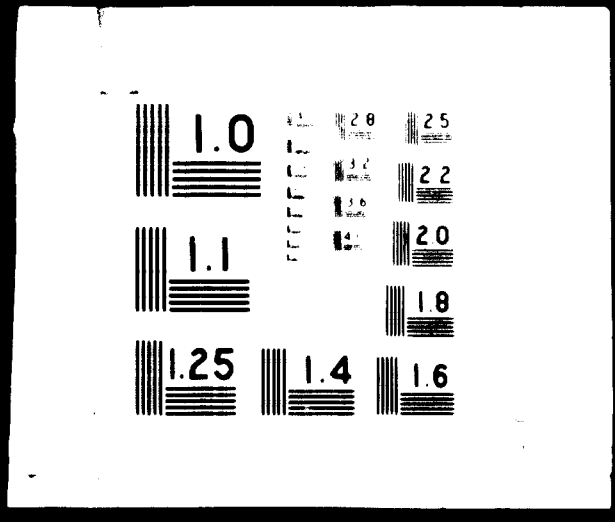

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[illegible] a) expected evolution of the [illegible] in the [illegible]

b) schedule for the expected progressive [illegible]

c) investment requirements for [illegible]

capacity 12,000 t [illegible] investment [illegible]

capacity 50,000 t [illegible]

Table 4[illegible]

			a)			b)			c)	
				[illegible]	[illegible]		[illegible]			
[illegible]		[illegible]		0.4	[illegible]					
		[illegible]		12.0	[illegible]					
		[illegible]	3.0	9.0	[illegible]					
		[illegible]	7.5	17.0	30.[illegible]					
		[illegible]	4.0	9.0	6.0					
		[illegible]	[illegible]6	[illegible]	[illegible]					
		[illegible]	3	3.0	[illegible]					
		[illegible]	4.5	[illegible]	[illegible]					

a) expected evolution of the [illegible] in 1,000 t/y

b) schedule for the expected progressive [illegible] in 1,000 t/y

c) investment requirements [illegible]

capacity [illegible] [illegible] 000

[illegible]

Table 49

			a)			b)			c)	
			1968	1975	1980	[illegible]	1975	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	1.3	[illegible]					
		[illegible] countries	1.0	12.0	[illegible]					
[illegible]	[illegible]	[illegible]	7.8	15.0	[illegible]		[illegible]	[illegible]		
	[illegible]	Mexico	6.9	15.0	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	Brazil	14.3	28.0	70.0		50.0	80.0	[illegible]	
		[illegible] countries	11.0	24.0	[illegible]					
Asia	Region South East	India	12.0	70.0	140.0		[illegible]	[illegible]	[illegible]	[illegible]
		[illegible] countries	12.0	30.0	[illegible]5.0					

a) [illegible]

b) [illegible]

c) [illegible]

capacity [illegible]

Table [illegible]

			a)			b)			c)	
			1968	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	2'4	[illegible]	[illegible]					
		[illegible]	3'1	[illegible]	30'0					
[illegible]	[illegible]	[illegible]	5'0	30	25'0		[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	Mexico	5'0	15'0	35'0		[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	Brazil	9'1	20 0	40'0		25'0	[illegible]	[illegible]	[illegible]
		[illegible]	6'5	23'0	45 0					
[illegible]	[illegible] Steel Sect	[illegible]	3 6	12'0	22'0		[illegible]	[illegible]	[illegible]	[illegible]
		[illegible]	22'0	60 0	125 0					

Exercise — a) expected evolution of the consumption of the product in the country
b) [illegible] capacity [illegible]
c) investment required [illegible]

Capacity : 25,000 t/y phenol and [illegible] investment 5,000,000 £

Table 2

		0·4	0·5							
		0·3	7·6	0·4						
		7·4	3·0	20·0						
		3	5·0	30·0						
		8·7	26·0	44·0						
		7·4	10	16·0						
		12·0	30·0	40·0						
		1·0	3·0	5·0						

Exercise — a) expected evolution of the consumption of the [illegible] in 1,000 t/y
b) Schedule of the capacities/progressive extensions [illegible] in 1,000 t/y
c) investment required [illegible] capacity (see [illegible])

Table 3

			a)			b)			c)	
			1968	19[illegible]	19[illegible]0	19[illegible]	1975	19[illegible]0	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	0·5	3·0	[illegible]					
		[illegible]	0·3	0·5	[illegible]					
[illegible]	[illegible]	[illegible]	5·0	10·0	[illegible]			[illegible]		
		Mexico	4·8	9·0	[illegible]					
		Brazil	9·4	23·0	40·0		[illegible]	[illegible]		
		[illegible] countries	5·0	15·0	20·0					
[illegible]	[illegible]	[illegible]	6·0	18·0	[illegible]		[illegible]	[illegible]		
		[illegible] countries	6·0	20·0	28·0					

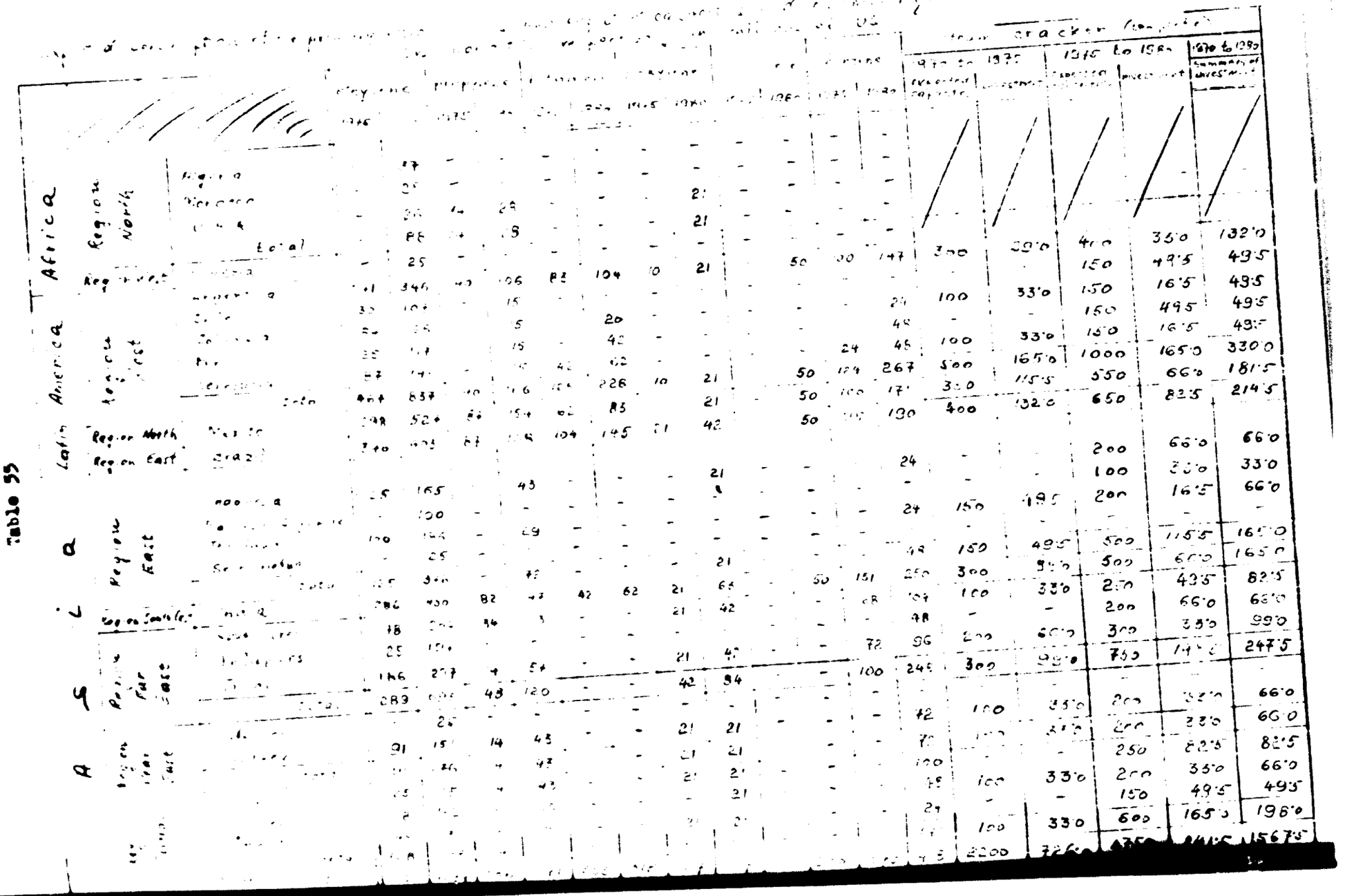
Table 54

...ry ethylene, propylene, ...-xylene ... capacities for the previous petrochemical ... [illegible].

countries		U.A.R		Argentina		Mexico		Brazil		India	
years		1975	1980	1975	1980	1975	1980	1975	1980	1975	1980
ethylene	for ethylene oxide	-	70	70	70	28.0	28.0	28°	28°	14°	23°
	for ethylene glycole	-	70	70	70	7.0	14.0	14°	14°	14°	14°
	for vinyl acetate	-	-	4.8	4.8	4.8	12.0	4.8	4.8	-	-
	for acetic acid	-	-	6.4	12.8	6.4	12.8	26.1	26.1	26.1	78.3
	total	-	140	25.2	31.6	46.2	66.8	72.9	72.9	54.1	120.3
propylene	for phenol/acetone	-	-	-	13.3	-	13.3	13.3	26.6	13.3	39.9
	for 2-ethylhexanol	-	-	11.8	35.4	23.6	47.2	23.6	47.2	11.8	35.4
	total	-	-	11.8	48.7	28.6	60.5	36.9	73.8	25.1	75.3
p-xylene	for phthalic anhydr.	-	-	-	50	-	50	-	50	-	50
benzene	for phenol/acetone	-	-	-	22.9	-	22.9	22.9	45.8	22.9	68.5

The following table shows the consumption of primary petrochemicals necessary tp provide a full maintenance for the expected demand in 1975 and 1980 for all the previous petrochemical products, considering the economic minimum capacity of a steam cracker of 80,000 tons/year ethylene. The expected investment costs are given for those countries whose ethylene consumption in 1975 respectively 1980 will reach the minimum or a multiple of it.

Table 55



c) Remark of the Roenits report

As already pointed out at the beginning, the Roenits report has been made following a special request of the UNIDO, and is therefore the best and most complete document used for this study; it has already been mentioned and explained as well that this report was very valuable and useful and was therefore the background for this study.

Nevertheless, the Roenits Report cannot be accepted without some critical comments which are then, of course, the basis of the final forecast for the second development Decade.

The most important criticism is, certainly, that the whole report refers to the business interest of Farbwerke Hoechst. It had to be and was expected, when the order was placed with Mr. Roenits, that this report would not be an objective one, but it is necessary to mention it here. All the data, even the selection of the petrochemicals that were dealt with, are figures where Farbwerke Hoechst illustrated their own experiences and feelings. This, to say "unobjectivity" , could only have been eliminated, if similar orders had been placed with at least two others of the very big chemical companies in countries other than in Germany, e.g., Dupont and ICI; since this was not done it is necessary to bear in mind that the data are the figures of one producer only.

Another important point is the arrangement of the report. It has not been done regionwise following the UN-regions, but continentwise, showing therefore often figures for all the developing countries of one continent and no data for individual countries. This makes the comparison much more difficult, although the author of this study broke the Roenits Report down into the UN-regions as much as he could. The figures for "other developing countries" of one continent could not be broken down and this makes some of the total figures for the regions rather uncertain. Unfortunately, the author did not have enough time to discuss this matter with Mr. Roenits and the contributors to his report.

Furthermore, very often - particularly in the case of African - only one or two countries of one region were mentioned; these figures could therefore hardly be compared with other data. Also the figures given were not always for the same countries; the three region of Latin America are a convenient exception since, on the whole, here a much more complete list of countries (except for the region North.) were given. There are also some mistakes and illogical results in the tables of the Roenitz Report, but this is probably because of the short time available. It was, unfortunately, also impossible for the author to discuss these errors with Mr. Roenitz, and they were therefore corrected without the right to do so, but by drawing the logical conclusions and assuming that the errors were "typing mistakes".

Finally, the report is based - as far as the forecast of the production and the investment are concerned - on the European situation regarding the size of the plants, particularly for the intermediates, basic products and other petrochemicals. It also has not been taken sufficiently into consideration that there are sometimes special production situations for countries or even regions - e.g. for the Near East Asia Region - and the political position has not always been taken into account either.

Under these circumstances the Roenitz Report had to be examined. It will be compared with the other sources in the last chapter.

2) The Inter-regional Petrochemical Symposium (Baku 20 - 30 Oct.1969)

The Inter-regional Petrochemical Symposium was held in Baku at the end of October 1969. Reports of all developing regions were discussed and compared with other data. As far as the papers were available, the most important tables and lectures have been used for this study.

a) Prospects for the development of the petrochemical industry in Africa by the ECA.

As far as the ECA report is concerned, at first glance it looks so good and exact with all the data for lots of petrochemicals for the individual regions that the reader must feel that here an excellent, much better work has been done than for any other part of the world or any other report. But only at first glance. On going into the details the reader will immediately find that most of the figures given are estimated ones only and are therefore of no great value; they fill the gaps, but that is all.

To start the critical comments with the petrochemical end products, most of the figures for the demand were available only for the Region North Africa and are estimated for the other regions. Unfortunately, it is not mentioned whether the data used even for the Region North Africa are based on actual figures, and if they are, on what sort of figures (consumption, import or demand of the industry or ?); are they based on the existing figures for the demand ? (does this mean consumption or import or ?) for each country ? (the tables says only "proposed capacities" but not consumptions !). Therefore it is difficult or even impossible to judge them. Furthermore, there is no explanation as to how the data for 1975 and 1980 were estimated: in form of a linear or exponential function ? in connexion with the growth of population ? or of the income per capita ? by copying diagramms from other years ? for the product itself or not even similar products ? All this not only makes the judgement rather difficult, it makes the figures themselves unreliable. For that reason, the data are not given separately, but in connexion with the Roenits ones and with the figures of the Verband der Chemischen Industrie in the tables after point number 3).

b) The basic petrochemical industry in Latin America by the ECLA.

The report of the ECLA is practically of no use at all for this study. It gives very poor forecast figures for some basic petrochemicals for the whole of Latin America, without any breakdown into regions; even the available data for the past decade are only for the whole continent and not for the individual countries or regions. It was considered first, to do all the forecasting ourselves in co-operation with a Full-General-Electric time sharing computer, but because of very poor results with the few figures it was discontinued.

Of the papers available on Latin American countries giving forecasts, the author of this study considers only the lecture given by C.C. Zarate, " The Development of the Petrochemical Industry in Argentina " , to be useful. Unfortunately, the only available data from this lecture is from Argentina, and therefore, with regard to the worldwide purpose of this study, the author could not use that lecture for one single country.

The comparable figures are in the tables for the comparison of the expected consumption of petrochemicals for the Second Development Decade after point number 3).

10. The development of the petrochemical industries in the Middle East region by Mr. Czeija

This table comes also from the Graz International Petrochemical Symposium and is based on Mr. K. Czeija's lecture "The Development of Petrochemical Industries in the Middle East Region" (i.e. the region Near East Asia in this study).

Mr. Czeija made his calculations for this region in co-operation with the UNIDO Industrial Development Field Adviser. He has been in each country, mentioned in the tables below and collected all the import data of the last ten years. A time sharing computer was fed with them and the forecasts made for each individual country. Mr. Czeija took the special situation of this region into consideration descending from the fact that approximately one quater of the world's crude oil production is covered by those countries. Considering this unique situation and that natural gas for approximately 600 million US $ per annum are blown into the air or flared in this area, he feels that the region Near East Asia is forced to go ahead with petrochemical plants and has practically no other choice. Therefore, the economical contemplations for these countries are not the usual ones: "is it economical to build a plant and can at least 60% of the output be sold on the domestic market?" The right considerations here are instead: "is it cheaper to produce something from natural gas and sell this product also under the world market price, if necessary, than continue to flare the gas?" There is no doubt that yearly 600 million US $ are of great importance.

Consumption figures for the region Near East Asia without Turkey for the Second Development Decade from 1970 to 1980 in 1,000 t/y

	1970 - 1975	1975 - 1980
Polyethylene without plasticisers	45	45
PVC	40	40
Polystyrene	20	50
PAN fibres	20	20
Polyamides fibres	-	20
Polyester fibres	-	10

Mr. Czoija also gives some data for the import and consumption of rubber [illegible]. Since about 60 % of the used materials are synthetic rubber the following table was produced to illustrate the import and consumption of styrene-butadiene-rubber and polybutadiene rubber in the UNECOH region:

SBR and Polybutadiene rubber import and consumption in 1,000 t/y. (based on tyres only).

	1970	1975	1980
Iran	3'5	4'4	5'4
Jordan	1'5	1'9	2'6
Kuwait	1'1	1'6	2'3
Lebanon	2'3	2'7	3'6
Saudi Arabia	4'3	5'4	6'5
Syria	2'6	3'3	4'2
T o t a l	15'3	19'3	24'6

As far as synthetic fibres are concerned Mr. Czoija's consumption figures are based on the import data for woven fabrics from man-made fibres. Following his calculation the growth of the consumption for the region Near East Asia excluding Turkey is likely to be:

Growth of consumption:

from 1965 to 1970 approx. 100 % from the consumption of 1965,
from 1970 to 1975 approx. 170 % from the consumption of 1965 and
from 1975 to 1980 approx. 240 % from the consumption of 1965.

Unfortunately, Mr. Czoija has not included Turkey in his research work, since it is not one the the UNECOH countries. This makes his figures not so comparable. Furthermore, not all the products are mentioned which would be of interest for the development of the petrochemical industries in this area, but because of his own calculations with the computer he produced the only really comparable figures to the Rochlis report and it is quite unfortunate that this region is not complete because of the exclusion of Turkey. Nevertheless, of all the available papers from the Second Interregional Symposium it is the best and most useful report for this study and of much assistance for the elaboration of the final forecast.

d) [illegible] of the [illegible] in the [illegible] to the [illegible] figures 10/a

The report for Asia of the [illegible] is rather detailed and given some data for some countries which are unsold for this study. Again, unfortunately, only a small part could be used here since the arrangement of this report is completely different and there was neither time to clear the doubtful points nor to change the arrangement. For example: there are figures for the projected demand of chemicals for quite a lot of countries, but for all the plastics and synthetic resins together, which does not help here.

However, a few tables for the expected consumption of various petrochemicals could be used and put into the table for comparison with the other figures (see after point number 3).

Another unfortunate point is that the figures in this report are for the year 1980 only, and the data for the monomers and primary products are all given as totals and not split up following the use by the industry or the market.

Nevertheless, the used data for 1980 illustrates mostly a different opinion as Mr. Roenits has shown, but in the few cases where they are equal they make the Roenits data more secure.

(3) The Report of the Verband der Chemischen Industrie.

It has been already mentioned in the preface that the data given in the report of the Verband der Chemischen Industrie are not very useful either. The report deals with the development of the whole chemical industry and concentrates therefore mostly on figures for groupes of chemicals and not on single products.

Furthermore, the report does not contain the data for all of the developing countries separately, but shows the figures for a few countries only and for the whole continents; these also are reasons why it does not fit in this study.

Unfortunately, the useful data cannot be accepted without critical comments and this means another depreciation of the report.

The main criticisms are directed at the way in which the calculations were done. The authors of the report assumed that the growth of the chemical production in the developing countries between 1970 and 1980 would be 4 % ; this is based on the growth of the world production of chemicals between 1960 and 1967 . To have the data more flexible, they assumed for the period from 1970 to 1975 two figures for the groth of the production :

low figures for a low projection target, which is 4 %, and
high figures for a high projection target, which is 5'0 %.

Both assumptions could be right in some cases, but with regard to the wide range of chemical products it is certainly impossible to use these figures for a particular product, and therefore even the few data are rather dubious for this study.

The report is based - as already explained - on the production and not on the consumption. This for the developing countries does not seem to be the right basis. Mr. Roenitz in his report described how to go ahead with chemical plants in the developing countries and explained logically and understandably that the construction of chemical plants in the developing could and should be started reasonably not before the domestic demand (= the consumption) has

reached 70 to 80 % of the presumed production capacity. This seems sensible and it is therefore difficult to understand on what assumption the growth of the chemical production in the developing countries is based : on other products ? on the growth of population ? on European countries or on the world's growth of chemicals ?

Finally, the report gives an average yearly growth rate up to 1980, but the authors forgot to explain where the data come from : are they theoretical ones ? or are they given by other editors ? are they calculated and, if yes, what basis data have been used ? Lots of questions, and they all make the produced data suspect.

With all these reservations the report was used for this study. The following tables give some data from this report and although they are mostly for all chemicals they may give some interesting illustrations.

Projection of Per Capita Production of Chemical Products in Developing Countries 1960 - 1980, in US $

	1960	1965	1970	1975 L	1975 H	1980 L	1980 H
World	31.32	44.19	61.3	62.2	66.2	87.6	93.7
Developing Countries	2.57	4.01	4.8	5.1	6.1	6.1	7.0
Africa	1.27	1.99	2.4	3.0	3.1	3.7	3.9
UAR (Egypt)	8.91	13.13	15.6	17.1	17.7	19.3	20.0
Rest	0.43	0.61	0.85	1.36	1.46	1.80	1.94
Asia	1.08	1.85	2.10	2.60	2.70	3.10	3.20
Burma	0.45	0.5	0.56	0.71	0.71	0.85	0.90
China (Taiwan)	6.89	16.61	26.42	33.95	40.89	46.70	48.00
India	1.34	2.16	2.36	2.65	2.71	3.16	3.21
Indonesia	0.46	0.57	0.60	0.64	0.65	0.70	0.83
Iran	0.93	1.51	1.62	1.75	1.85	2.05	2.38
Korea, Republic of	0.37	1.94	2.10	2.60	2.15	2.51	2.82
Pakistan	0.22	0.68	1.00	1.33	1.51	1.70	1.87
Philippines	4.01	5.57	5.94	6.53	6.91	7.20	7.56
Thailand	0.53	0.65	0.70	0.85	0.87	0.95	1.08
Vietnam, Republic of	1.77	2.17	2.27	2.36	2.46	2.55	2.70
Rest	0.14	0.58	0.70	0.73	0.79	0.90	0.95
Latin America	10.46	15.64	19.1	21.0	22.6	22.2	25.4
Argentina	18.36	30.00	35.7	42.4	45.7	48.5	55.4
Brazil	11.19	14.18	16.0	17.5	18.9	18.6	21.3
Chile	9.22	9.63	11.9	14.4	15.4	14.3	17.0
Colombia	6.17	7.78	9.7	11.3*	12.3	11.3*	12.9
Mexico	14.72	25.15	33.4	35.0	37.6	36.2	41.4
Peru	7.00	11.37	15.7	17.3	18.6	18.0	20.6
Uruguay	7.20	8.89	10.0	11.0*	11.7	10.0*	11.9
Venezuela	16.44	28.74	36.1	40.5	43.9	43.6	49.6
Rest	1.42	2.81	3.4	3.9*	4.2	3.6*	4.2

* 1960, 1965 in current prices,
1970 - 1980 in current prices of 1965/1967;
L = Low projection, H = High projection.

Projection of Per Capita Consumption of Chemical Products in Developing Countries [illegible] - 1980, in US $

	1960	1965	1970	1975 L	1975 H	1980 L	1980 H
Developing Countries	3.9	5.7	6.8	7.6	7.9	8.4	9.0
Africa	2.7	3.8	4.3	4.9	5.0	5.5	5.6
UAR	11.7	18.0	20.0	21.2	21.8	23.9	24.4
Rest African	1.7	2.2	2.5	2.9	3.0	3.3	3.34
Asia	1.8	2.9	3.4	3.9	3.9	4.4	4.5
Burma	1.4	1.4	1.4	1.4	1.4	1.4	1.5
China (Taiwan)	10.6	21.4	31.1	45.2	46.1	52.0	53.4
India	1.7	2.5	3.0	3.5	3.4	3.9	3.9
Indonesia	0.5	0.7	0.7	0.75	0.75	0.8	0.9
Iran	3.1	5.6	6.3	6.6	6.7	6.9	7.2
Korea, Rep.of	4.3	5.9	6.7	7.2	7.2	7.2	7.5
Pakistan	0.9	1.6	2.2	2.4	2.4	2.8	2.9
Philippines	6.1	8.1	8.1	8.5	8.6	8.8	9.2
Thailand	2.3	3.2	3.9	4.1	4.1	4.5	4.6
Vietnam, Rep.of	3.9	5.2	5.1	5.5	5.6	5.9	6.0
Rest Asia	1.2	2.2	2.9	3.0	3.0	3.1	3.2
Latin America	13.9	19.8	23.7	25.6	27.2	27.1	30.3
Argentina	19.8	34.0	41.9	43.5	51.3	55.0	61.0
Brazil	13.1	16.2	17.9	19.4	20.6	20.8	23.4
Chile	8.8	13.4	17.0	18.9	19.9	20.4	22.6
Colombia	11.3	11.5	14.3	15.8	16.8	16.8	18.3
Mexico	19.4	30.0	39.2	40.5	43.1	41.1	46.2
Peru	11.3	16.6	20.7	22.2	23.5	23.5	26.1
Uruguay	8.6	11.0	12.6	14.3	15.0	15.8	16.5
Venezuela	30.9	43.8	47.6	52.0	55.1	56.2	62.2
Rest Latin America	6.0	8.7	10.6	10.9	11.2	11.0	11.5

L = Low projection
H = High projection

Projection of Chemical Consumption in Developing Countries 1960 - 1980, in Mill US $

	1960	1965	1970	1975 Low	1975 High	1980 Low	1980 High
Developing Countries	5 095.6	8 473.5	11 420.2	14 362.4	14 960.4	17 676.2	18 983.1
Africa	699.1	1 114.1	1 442.0	1 825.0	1 862.0	2 325.0	2 376.0
UAR	302.4	533.5	690.0	850.0	872.0	1 080.0	1 108.0
Rest Africa	396.7	571.6	752.0	975.0	990.0	1 245.0	1 268.0
Asia	1 591.4	2 771.8	3 653.2	4 658.4	4 733.4	5 898.2	6 057.1
Burma	30.6	33.6	38.6	43.4	43.4	46.9	51.9
China (Taiwan)	111.7	265.2	436.0	714.0	729.0	973.0	998.0
India	738.5	1 231.6	1 615.0	2 014.0	2 052.0	2 620.0	2 654.0
Indonesia	49.5	68.3	82.5	100.0	102.0	120.0	140.0
Iran	87.1	133.2	167.0	200.0	203.0	231.0	242.0
Korea, Rep.of	105.7	168.4	220.0	270.0	273.0	307.0	320.0
Pakistan	81.2	165.3	232.6	301.0	304.0	391.3	406.2
Philippines	166.0	261.9	310.0	390.0	396.0	486.0	506.0
Thailand	59.7	94.5	149.2	168.0	169.0	207.0	213.0
Vietnam, Rep.of	55.3	85.2	98.9	110.0	112.0	127.0	130.0
Rest Asia	118.1	235.1	300.0	348.0	350.0	389.0	396.0
Latin America	2 815.1	4 587.6	6 325.0	7 879.0	8 365.0	9 453.0	10 550.0
Argentina	410.4	720.0	1 018.0	1 275.0	1 362.0	1 529.0	1 720.0
Brazil	912.2	1 311.9	1 680.0	2 090.0	2 229.0	2 515.0	2 836.0
Chile	68.1	116.6	165.0	206.0	217.0	245.0	271.0
Colombia	174.1	206.8	295.0	380.0	402.0	460.0	501.0
Mexico	697.1	1 282.2	1 904.0	2 350.0	2 502.0	2 800.0	3 153.0
Peru	112.7	194.4	275.0	340.0	360.0	405.0	449.0	
Uruguay	21.5	29.6	37.0	43.0	45.0	49.0	51.0
Venezuela	295.3	385.0	495.0	650.0	689.0	820.0	908.0
Rest Latin America	123.7	441.1	456.0	545.0	559.0	630.0	661.0

Share of Domestic Production on Consumption of Chemical Products 1960 - 1980, in %

	1960	1965	1970	1975 Low	1975 High	1980 Low	1980 High
Developing Countries	65.9	70.4	72.1	75.0	77.2	76.2	[illegible]
Africa	47.0	52.1	55.8	61.2	62.0	67.3	[illegible]
UAR	76.2	78.8	76.0	80.7	91.2	80.8	92.0
Rest Africa	25.3	27.7	34.0	[illegible]	46.7	57.0	[illegible]
Asia	60.0	63.8	61.8	66.7	69.2	70.5	[illegible]
Burma	32.1	37.9	41.4	50.7	50.7	53.6	[illegible]
China (Taiwan)	65.0	77.6	85.0	86.3	[illegible]	[illegible]	[illegible]
India	78.9	86.1	75.7	80.3	78.7	81.0	[illegible]
Indonesia	96.0	81.4	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Iran	30.0	27.0	25.7	24.5	27.6	[illegible]	[illegible]
Korea, Rep.of	22.6	32.1	21.9	20.0	21.[illegible]	38.[illegible]	[illegible]
Pakistan	24.4	42.5	45.5	61.7	62.9	62.[illegible]	[illegible]
Philippines	65.7	68.8	[illegible]	78.6	79.2	81.8	[illegible]
Thailand	23.0	20.3	17.[illegible]	20.[illegible]	[illegible]	[illegible]	[illegible]
Vietnam, Rep.of	45.4	41.7	44.5	42.[illegible]	43.9	43.2	[illegible]
Rest Asia	11.7	26.4	24.1	24.3	25.0	25.8	[illegible]
Latin America	75.3	79.0	80.0	82.0	83.[illegible]	[illegible]	[illegible]
Argentina	92.7	88.2	85.2	[illegible]	88.2	88.2	[illegible]
Brazil	85.4	87.5	[illegible]	90.2	[illegible]	[illegible]	[illegible]
Chile	104.8	72.0	70.[illegible]	[illegible]	[illegible]	72.[illegible]	[illegible]
Colombia	54.6	67.7	67.[illegible]	[illegible]	72.0	67.3	[illegible]
Mexico	75.9	83.8	85.2	[illegible]	87.2	88.1	[illegible]
Peru	61.9	68.5	75.3	[illegible]	79.1	76.6	[illegible]
Uruguay	83.7	80.8	79.4	[illegible]	78.6	83.3	[illegible]
Venezuela	53.2	65.6	75.3	[illegible]	[illegible]	77.6	[illegible]
Rest Latin America	23.7	32.3	32.1	35.3	37.5	32.7	[illegible]

Projection of Capital Expenditures and Production, Billion US $

			Africa	Asia	Latin-America	Developing Countries Total
1966/70	Production Value		3.5	10.3	25.9	39.7
	Investment Costs	13 %	0.50	1.35	3.40	5.25
		15 %	0.55	1.60	3.90	6.05
		17 %	0.60	1.80	4.40	6.80
1971/75 Low	Production Value		5.0	13.9	29.4	48.3
	Investment Costs	13 %	0.65	1.80	3.80	6.25
		15 %	0.75	2.10	4.40	7.25
		17 %	0.85	2.40	5.00	8.25
1976/80 Low	Production Value		7.0	18.6	36.1	61.7
	Investment Costs	13 %	0.90	2.40	4.70	8.00
		15 %	1.05	2.85	5.40	9.30
		17 %	1.20	3.20	6.10	10.50
1971/75 High	Production Value		5.1	14.1	30.8	50.0
	Investment Costs	13 %	0.70	1.85	4.00	6.55
		15 %	0.80	2.10	4.60	7.50
		17 %	0.90	2.40	5.70	8.50
1976/80 High	Production Value		7.2	19.2	40.2	66.6
	Investment Costs	13 %	0.95	2.50	5.20	8.65
		15 %	1.10	2.90	6.00	10.00
		17 %	1.25	3.30	6.80	11.35
1966/80 Low	Production Value		15.5	42.8	91.4	149.7
	Investment Costs	13 %	2.05	5.55	11.90	19.50
		15 %	2.35	6.55	13.70	22.60
		17 %	2.65	7.40	15.50	25.55
1966/80 High	Production Value		15.8	43.6	96.9	156.3
	Investment Costs	13 %	2.15	5.70	12.60	20.45
		15 %	2.45	6.60	14.50	23.55
		17 %	2.75	7.50	16.40	26.65

P[illegible]

[illegible]

	1960	[illegible]	[illegible]	1975 Low	1975 High	1980 Low	1980 High
[illegible]	7[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]68	5990	[illegible]	10[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	330	[illegible]	7[illegible]	1140	1177	1567	1638
[illegible]	[illegible]30	[illegible]	[illegible]	[illegible]	766	[illegible]	[illegible]
[illegible]	100	[illegible]	[illegible]	45[illegible]	471	[illegible]	737
[illegible]	928	1787	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	10	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	73	20[illegible]	[illegible]	631	[illegible]	[illegible]	[illegible]
[illegible] Taiwan	573	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible] Korea	[illegible]	60	[illegible]	[illegible]	56	[illegible]	[illegible]
[illegible]an	20	[illegible]	[illegible]	[illegible]	81	107	120
[illegible]orea,Rep.of	[illegible]	55	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]kistan	20	70	[illegible]	[illegible]	[illegible]	396	[illegible]
[illegible]hilippines	110	180	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Thailand	14	[illegible]	[illegible]	[illegible]	49	[illegible]	[illegible]
Vietnam,Rep.of	[illegible]	35	[illegible]	47	[illegible]	[illegible]	[illegible]
[illegible]st	[illegible]	61	[illegible]	[illegible]	87	[illegible]	[illegible]
[illegible] America	2110	[illegible]	[illegible]	[illegible]	[illegible]	7750	[illegible]
Argentina	380	672	868	1115	[illegible]	[illegible]	[illegible]
Brazil	780	1146	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Chile	71	83	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Colombia	[illegible]	[illegible]	[illegible]	270	[illegible]	[illegible]	[illegible]
Mexico	530	[illegible]074	[illegible]	[illegible]	2182	2488	[illegible]
Peru	70	133	[illegible]	[illegible]	[illegible]	310	354
Uruguay	18	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Venezuela	120	250	[illegible]	510	[illegible]	[illegible]	[illegible]
Rest	46	101	[illegible]	195	[illegible]	[illegible]	[illegible]

x) 1960, 1965 actual; 1970 to 1980 projected

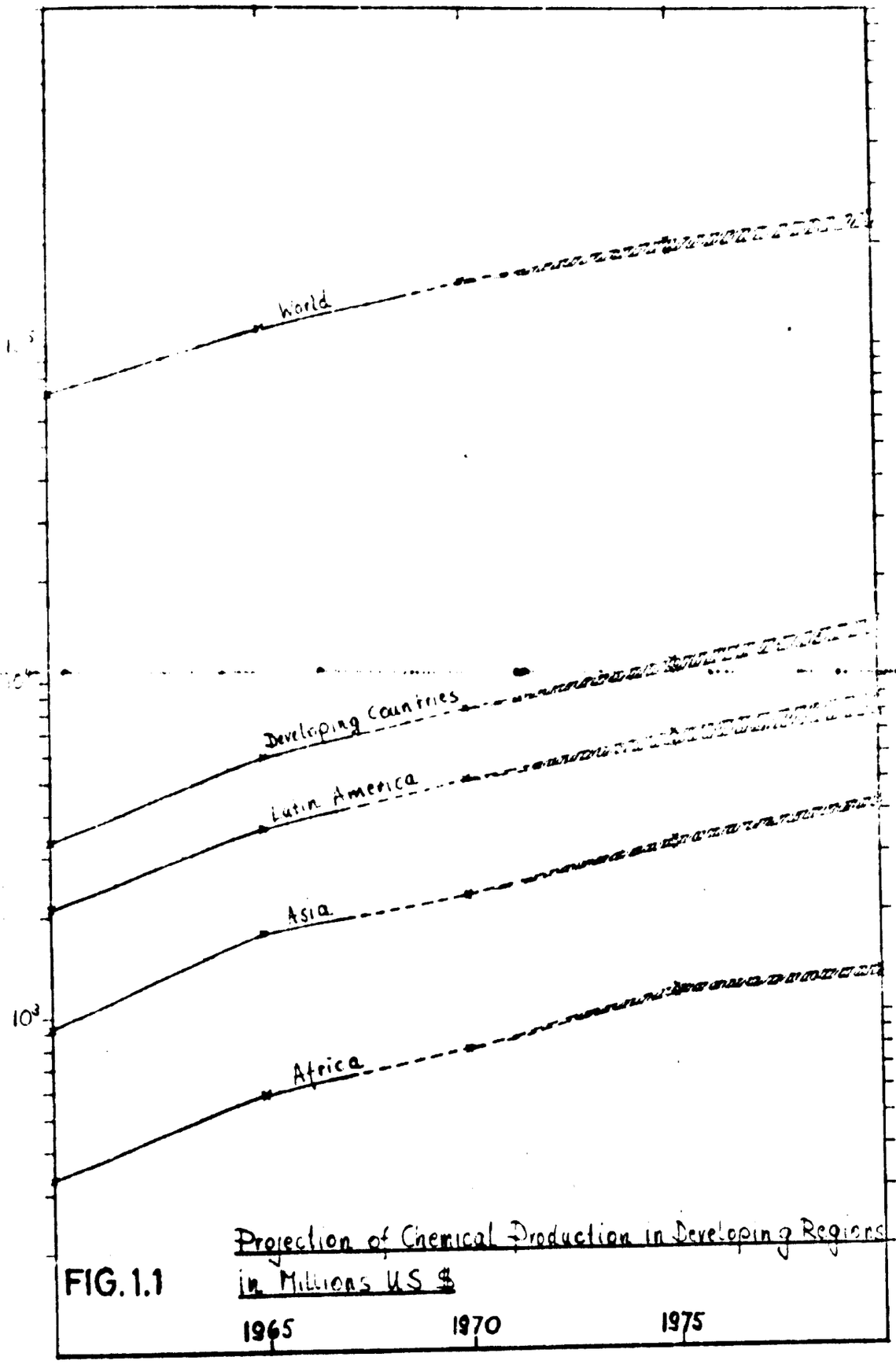


FIG. 1.1 Projection of Chemical Production in Developing Regions in Millions US $

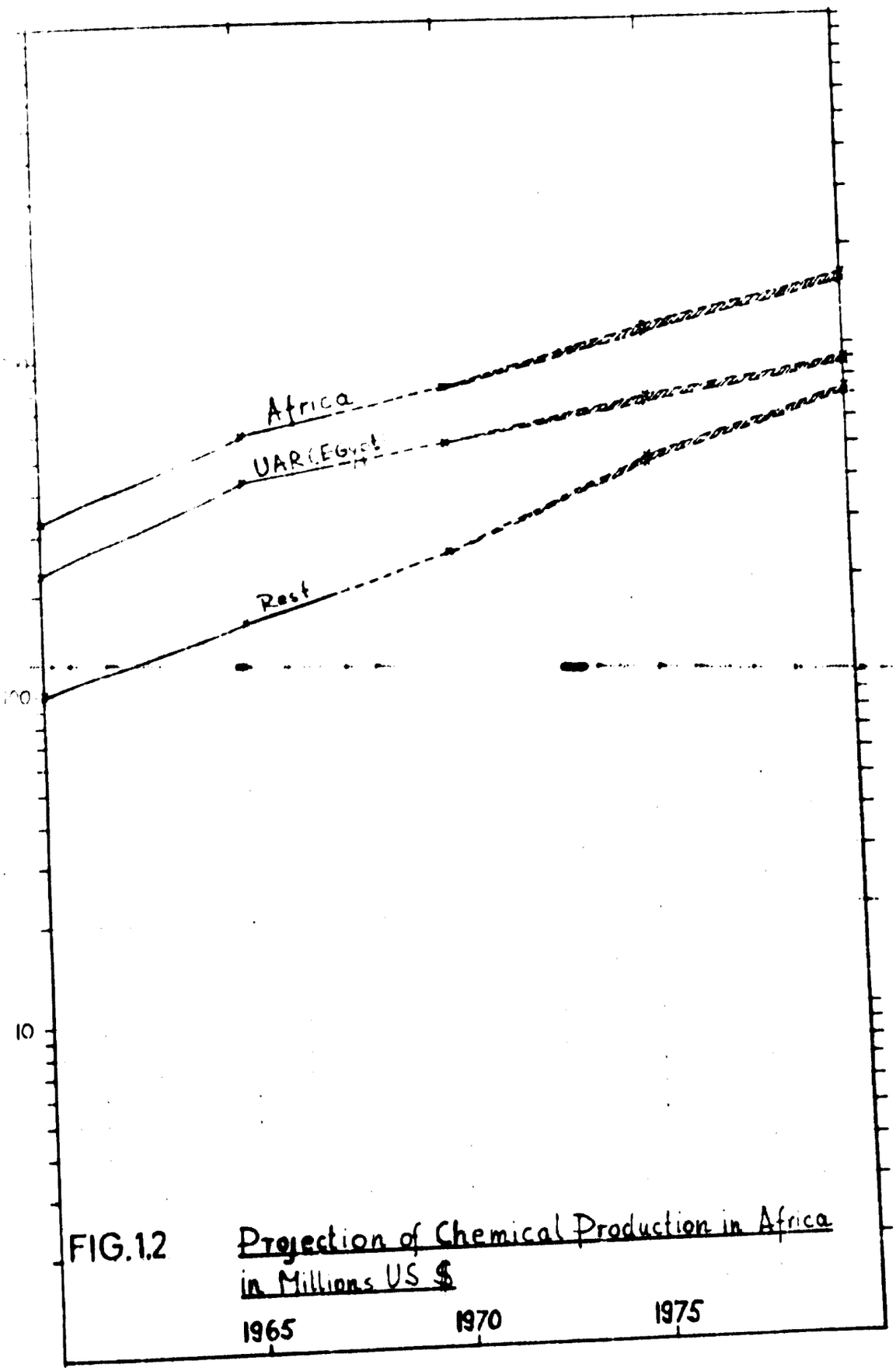


FIG. 1.2 Projection of Chemical Production in Africa in Millions US $

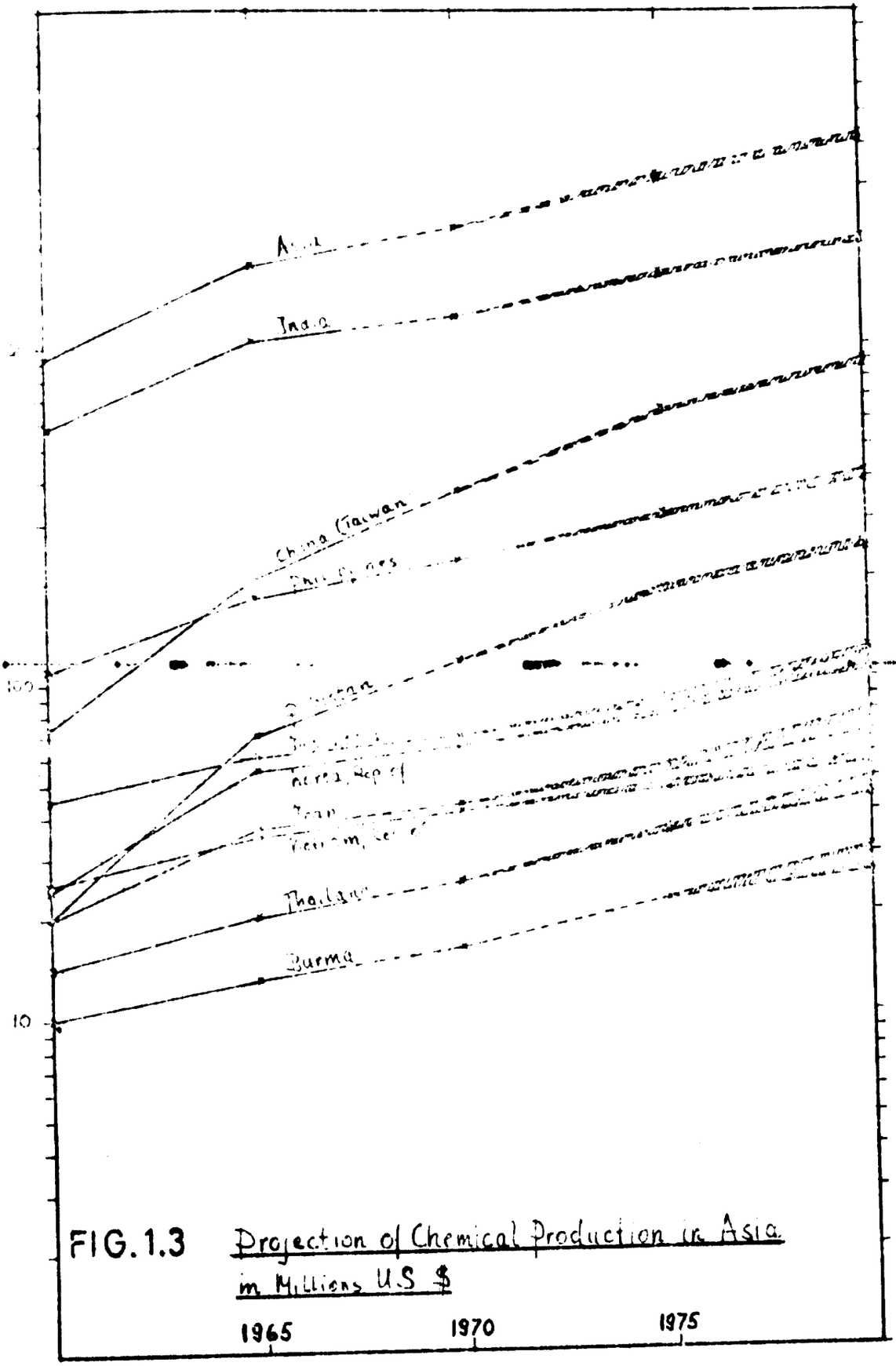


FIG. 1.3 Projection of Chemical Production in Asia in Millions U.S $

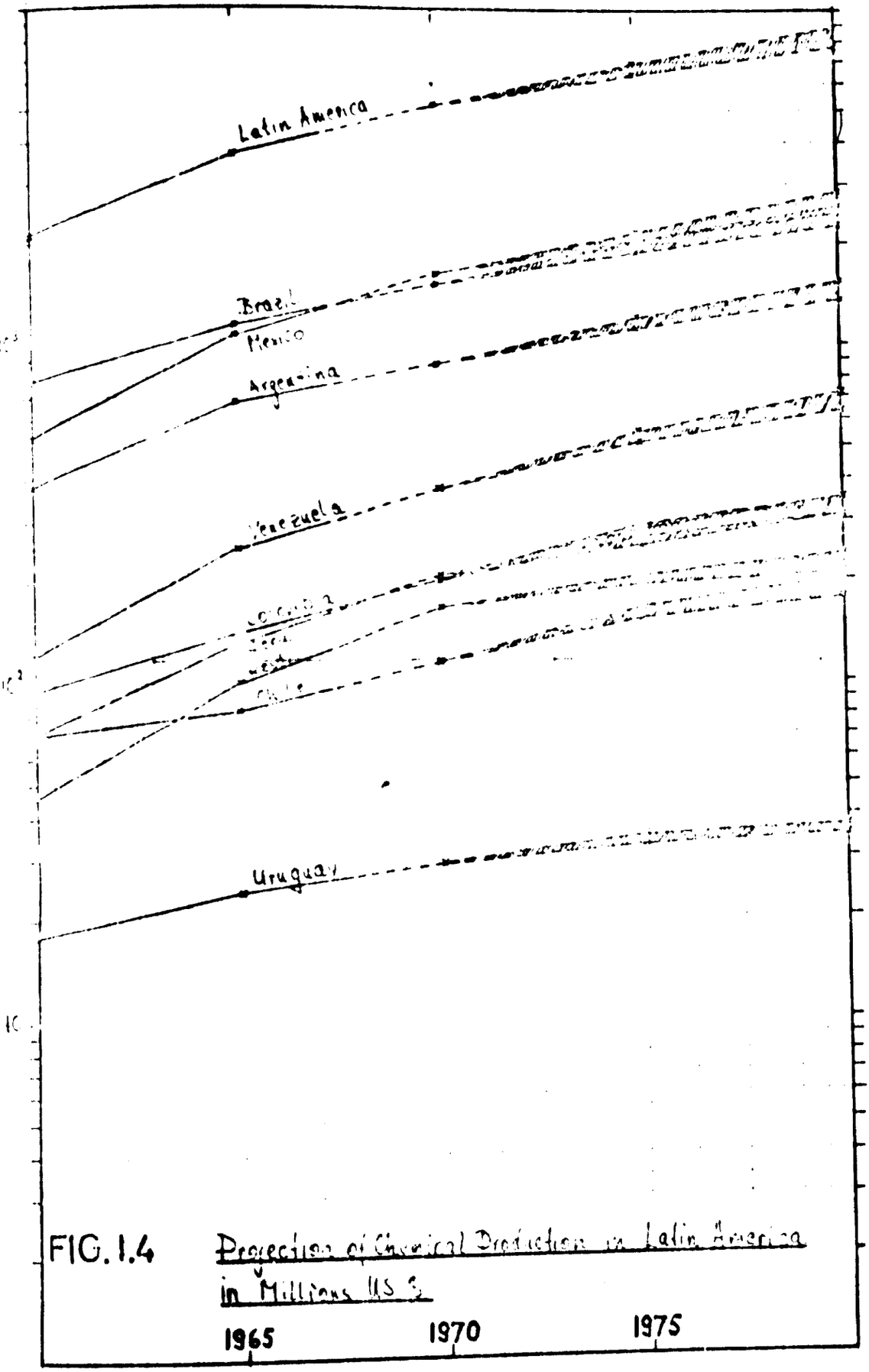


FIG. 1.4 Projection of Chemical Production in Latin America in Millions US $

Major Polymerization Plastics in Developing Regions, in 1000 Metric Tons; %

	1960	1965	1970	1975 L	1975 H	1980 L	1980 H
Africa							
Polystyrene	-	-	-	-	-	5	8
Polyvinylchloride	1	2	11	30	40	50	75
Polyolefins	-	1	5	10	20	60	92
Subtotal	1	3	16	40	60	115	165
Share in total plastics production in Africa	50.0 %	42.8 %	45.7 %	50.0 %	54.6 %	71.8 %	72.0 %
Asia							
Polystyrene	4	6	10	30	35	50	60
Polyvinylchloride	4	36	55	80	95	150	180
Polyolefins	3	18	80	150	170	250	280
Subtotal	11	60	145	260	300	450	520
Share in total plastics production in Asia	44.0 %	60.0 %	59.1 %	62.6 %	66.6 %	68.2 %	69.4 %
Latin America							
Polystyrene	9	25	50	80	95	120	135
Polyvinylchloride	13	53	84	117	135	190	210
Polyolefins	4	42	100	220	250	365	410
Subtotal	26	120	234	417	480	675	755
Share in total plastics production in Latin America	51 %	58 %	60.0 %	66.2 %	71.6 %	72 %	72%
Total major polymerization plastics in developing countries	38	183	395	717	840	1240	1440

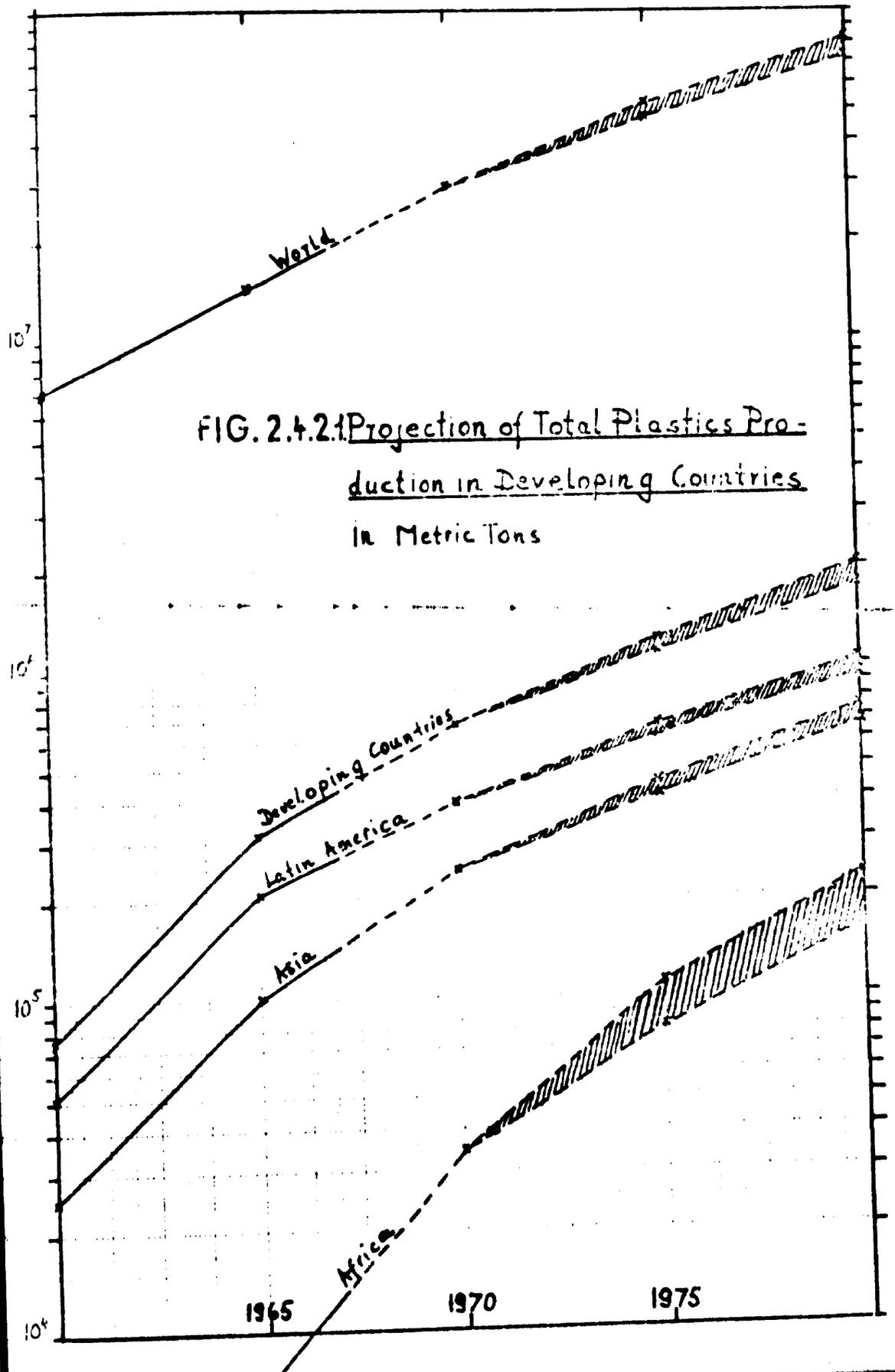


FIG. 2.4.2.1 Projection of Total Plastics Production in Developing Countries

In Metric Tons

The forecast for the Second Development Decade.

The following tables show the comparison of the expected consumption of petrochemicals of the various studies for the developing regions for the Second Development Decade. Since the figures of the Koenitz Report are the only complete ones, the other data could at the very best help to correct or to confirm them.

For that reason and since there were no other sources available than the data of the 3 studies, and particularly since the author of this study had no opportunity to correct or confirm any of these figures by personal experience, he decided not to draw any conclusions, but to show all the data in the above-mentioned tables. It will therefore be easy for any reader to use his own experience for the correction or confirmation of the figures shown.

Comparison of the expected consumption of petrochemicals for the Afro-Asian region as reported by various organizations in the years stated in col. 1, 2, 3.

Table 36

		Africa				Latin America			Asia				
		Region North	Region West										
polyethylene	Rentz report	1975		50	32	18	81	74	72	65	51	60	15	35
		1977	60	60	30	40	82	6	65	45	108	130	45	22
		1980	300	420	210	100	335	316	310	240	324	390	9	80
	Symposium	1970	0	10	4	2	?	?	?	?	?	?	?	?
		1975	15	20	12	8								
		1980	60	80	50	20				300	360	492	45	111
	Verband d. Chem. Industrie	1970	?	8	?	?		?	0		d	d	t	a
		1975		12										
		1980		23										
PVC	Rentz report	1970	10	4	2	25	81	41	66	28	52	22	13	33
		1975	30	18	10	50	46	23	23	14	19	45	5	29
		1980	65	42	18	100	344	253	244	194	258	405	105	78
	Symposium	1970	3	4	2	6	?	?		?	?	?		?
		1975		8		3								
		1980	24	40	20	10				142	203	333	90	70
	Verband d. Chem. Industrie	1970	?	3.6	?	?		√	0		?	t	a	t	a
		1975		6.4										
		1980		27										
polystyrene	Rentz report	1970	4	0.4			55		25	8	10	22	7	12
		1975	9	20	?	?	71	50	45	22	25	40	16	24
		1980	20	10			104	70	80	53	50	95	32	59
	Symposium	1970	5	3	4	2	?	?	?	?	?	?	2	?
		1975	8	6	5	3								
		1980	12	12	9	7				44	41	24	5	35
	Verband d. Chem. Industrie	1970			√	c			d		a	t	a	
		1975												
		1980												
polypropylene	Rentz report	1970					4	6	6	6	5	6	4	4
		1975	?	?	?	?	27	19	18	20	15	18	5	13
		1980					76	50	50	50	40	56		35
	Symposium	1970												
		1975	?	?	?	?	?	?	?	?	?	?		?
		1980								-	25	100		-
	Verband d. Chem. Industrie	1970												
		1975			√	a			d		a	t	a	
		1980												
styrene-butadiene rubber	Rentz report	1970					4	8	64		32			
		1975	?	?	?	?	96	48	80	?	32	?	?	?
		1980					176	64	112		48			
	Symposium	1970	16	12	10	16							5	
		1975	26	20	18	2	?	?	?	?	?	?	9	?
		1980	40	32	33	3				-	205*	120*	25	102*
	Verband d. Chem. Industrie	1970												
		1975			√	c			d	a	t	a		
		1980												

* Nigeria only.
or Turkey only.

+ all synthetic rubber

Comparison of the exports [illegible]
evelopment [illegible]

[illegible]

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			Africa				South America			Asia				
			[illegible]											
polybutadiene rubber	Bonitz report	1970												
		1975												
		1980												
	Interregional Symposium	1970												
		1975												
		1980												
	Verband d. chem. Industrie	1970												
		1975												
		1980												
PAN fibres	Bonitz report	1970												
		1975												
		1980												
	Interregional Symposium	1970												
		1975												
		1980												
	Verband d. chem. Industrie	1970												
		1975												
		1980												
polyamide fibres	Bonitz report	1970												
		1975												
		1980												
	Interregional Symposium	1970												
		1975												
		1980												
	Verband d. chem. Industrie	1970												
		1975												
		1980												
polyester fibres	Bonitz report	1970												
		1975												
		1980												
	Interregional Symposium	1970												
		1975												
		1980												
	Verband d. chem. Industrie	1970												
		1975												
		1980												
acrylonitrile for PAN	Bonitz report	1970	-				18	0	8	-	14	31	11	5
		1975	17				18	16	17	9	23	35	11	14
		1980	30				27	16	21	21	23	53	5	22
	Interregional Symposium	1970	1·8	1·2	0·2	0·2								
		1975	5	3	1·8	0·5					24	127		4
		1980	10	8	4	1·0								
	Verband d. chem. Industrie	1970												
		1975												
		1980												

+ see styrene butadiene rubber

[illegible] petrochemical [illegible] for the Second Development Decade for the various developing regions [illegible] the various [illegible]

in 1,000 t/y.

Table 9

			Africa				Latin America			Asia				
			Region [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	Benito's report	1970	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
		1975	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
		1980	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Interreg. Symp.	1970	[illegible]	[illegible]	[illegible]	[illegible]	?	?	?	?	?	?		?
		1975	[illegible]	[illegible]	[illegible]	[illegible]								
		1980	73	[illegible]	[illegible]	[illegible]				18	163	438		19
	Verband d. chem. Industrie	1970	No data											
		1975												
		1980												
[illegible]	Benito's report	1970	-	-	?	?	34	45	29	-	-	-	-	-
		1975	-	-			46	61	46	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
		1980	24	25			133	[illegible]	134	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	Interreg. Symp.	1970	[illegible]	[illegible]	[illegible]	[illegible]	?	?	?					
		1975	[illegible]											
		1980	[illegible]	[illegible]	[illegible]	[illegible]								
	Verband d. chem. Industrie	1970	No data											
		1975												
		1980												
[illegible] for polye[illegible]	Benito's report	1970	?	?	?	?	74	40	42	[illegible]	[illegible]	[illegible]	[illegible]	
		1975					261	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
		1980					494	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	
	Interreg. Symp.	1970	[illegible]	[illegible]	[illegible]	[illegible]	?	?	?					
		1975	43	38	73	9								
		1980	74	44	53	8								
	Verband d. chem. Industrie	1970	No data											
		1975												
		1980												
styrene for pol[illegible]	Benito's report	1970	-	-			22	[illegible]	15	-	-	[illegible]		
		1975	-	-	?	?	99	37	42	30	45	62		6
		1980	30	15			135	87	[illegible]	[illegible]	[illegible]	[illegible]	67	73
	Interreg. Symp.	1970	5	3	3	[illegible]	?	?	?	?	?	?		?
		1975	6	7	5	2								
		1980	12	13	9	4				31*	94*	49*		37*
	Verband d. chem. Industrie	1970	No data											
		1975												
		1980												
ethylene for styrene (for polystyrene)	Benito's report	1970	?	?	?	?	-	-	-	-	-	-	-	-
		1975					35	26	26	-	26	26		-
		1980					78	43	52	18	35	69	·6	52
	Interreg. Symp.	1970	1·8	1·1	0·9	0·4	?	?	?					
		1975	3	2	1·6	0·7								
		1980	4	4	3	1·3								
	Verband d. chem. Industrie	1970	No data											
		1975												
		1980												

* all styrene demand

...ort 11 ... of the ... on of ... ...
...velopment ... for the ... by ... of the ...

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			Africa				Latin America			Asia					
		Region North	Region ...												
copolactam 6 polyamide	Methanol d. chem. industrie	1970													
		1975													
		1980													
	Interreg. Symps.	1970	1		1	2	46	24	31	40	38	6	5	4	
		1975	14		4	2	63	25	31	65	7	16	32	79	
		1980	29	4			35	29	11	5	35	129	44	82	
	Remote report	1970					1/2	1/2	1/2	2	2	2			
		1975	14	4	4										
		1980	13							29	39	33		64	
benzene for styrene	Methanol d. chem. industrie	1970													
		1975				2									
		1980													
	Interreg. Symps.	1970	2	6	4	2	2	2	2						
		1975	3	8	4	12									
		1980	3	3	5	12									
	Remote report	1970					28	28	1/2	2					
		1975					28	28							
		1980													
DMT or adipester	Methanol d. chem. industrie	1970													
		1975													
		1980													
	Interreg. Symps.	1970					2	2	2	2	2	2		2	
		1975	3	8	55	16				7	85	111		11	
		1980	1		2	32									
	Remote report	1970					51	22	40	25	52	24	8	26	
		1975	12			2			20						
		1980	42	4	4	2	74	28	20	58	83	64	20	58	
ethyleneglycol for polyester	Methanol d. chem. industrie	1970													
		1975													
		1980													
	Interreg. Symps.	1970	-	-	-	2	6	7	11	3	5	9	0	3	
		1975	6				17	7	15	8	7	28	12	2	
		1980	5	14	14		25	10	21	30	-	42	29	30	
	Remote report	1970	11	14	08	02	2	2	2	2	2	2		2	
		1975	25	3	16	05									
		1980	5	5	05	03				-	30	41		4	
propene for DMT (or PE)	Methanol d. chem. industrie	1970													
		1975													
		1980													
	Remote report	1970					10	-	15	-	-	-	18	-	
		1975	-	2	2	2	10	-	21	-	21	42	21	42	
		1980	21				21	21	42	21	63	84	21	63	
	Interreg. Symps.	1970	3	4	2	05	2	2	2						
		1975	7	7	4	12									
		1980	12	14	9	05									

* see benzene for styrene

Comparison of the growth rate [illegible] development [illegible]

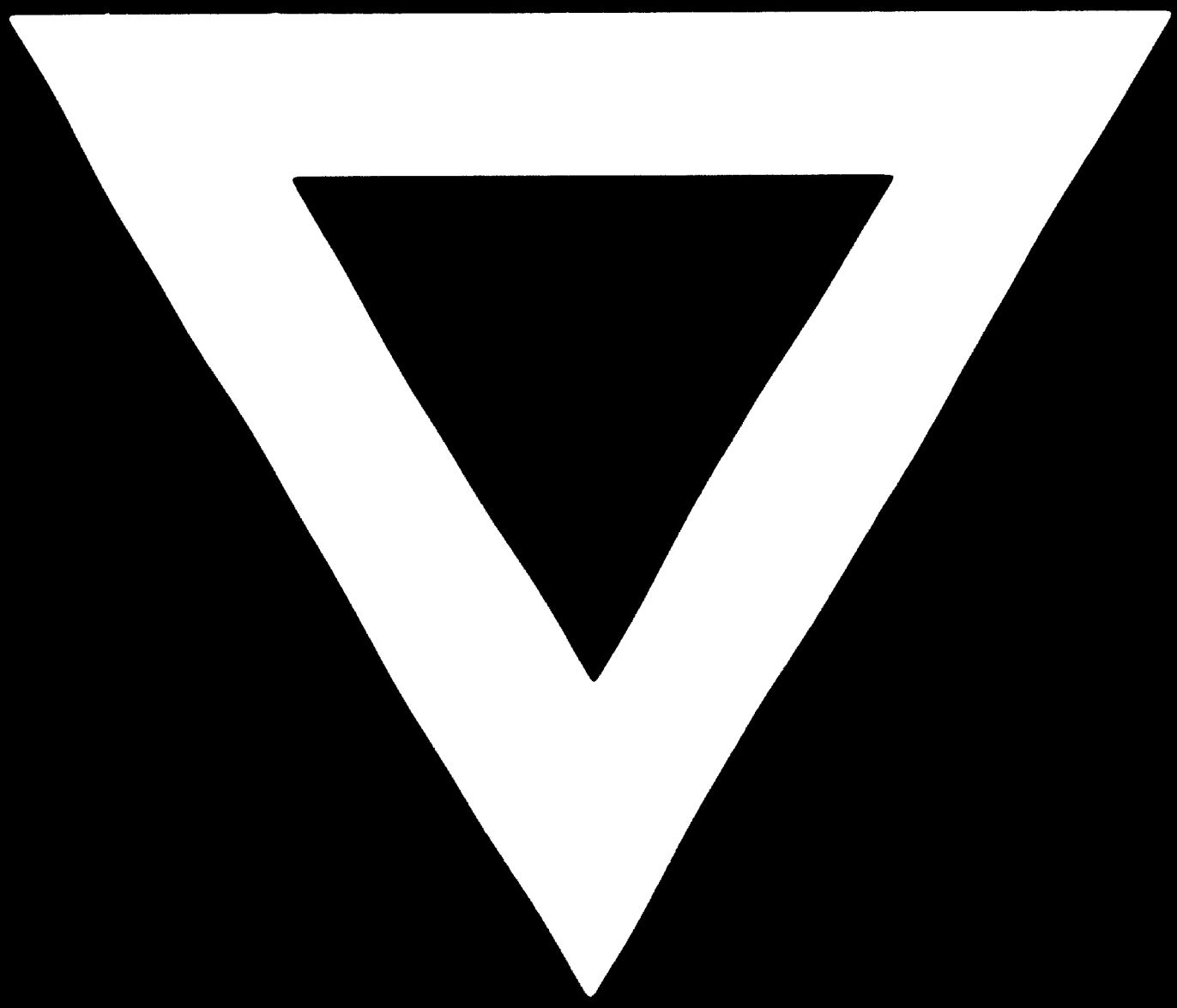
[illegible]

			Africa			Latin America			Asia					
		Region-wide												
benzene for styrene (for ethylbenzene)	Vorband d. chem. Industrie													
	Interreg. Symp. report													
	Forrest report													
ethylene for polyethylene, vinyl chloride, ethylene oxide	Vorband d. chem. Industrie													
	Interreg. Symp. report													
	Forrest report													
styrene for SBR	Vorband d. chem. Industrie													
	Interreg. Symp. report													
	Forrest report													
butadiene for SBR and polyurethane	Vorband d. chem. Industrie													
	Interreg. Symp. report													
	Forrest report													
propylene for AN (for PAN)	Vorband d. chem. Industrie													
	Interreg. Symp. report													
	Forrest report													

* all benzene demand

** see styrene for polystyrene

			Africa			Latin America			Asia					
		Region												
ethylene feedstock %	Roentz report	1970												
		1975												
		1980												
	Verband d. chem. Industrie	1970	No data											
		1975												
		1980												
ethylene feedstock %	Roentz report	1970												
		1975												
		1980												
	Verband d. chem. Industrie	1970	No data											
		1975												
		1980												
total ethylene	Roentz report	1970												
		1975												
		1980	88	26										
	Interregs. Synopsis	1970	39	26	22	8								
		1975	74	34	40	17								
		1980	125	40	60	63								
	Verband d. chem. Industry	1970	35	-	-	-	396	600	260	200	240	95		490
		1975	90	10	-	-	1050	750	600	200	400	310		600
		1980	130	30	30	10	1400	1000	800	300	900	620		760



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