THE GEOGRAPHY OF PETRO-CHEMICAL INDUSTRY IN TURKEY

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THE GEOGRAPHY OF THE PETRO-CHEMICAL INDUSTRY IN TURKEY

Thesis

for the degree of Doctor of Philosophy

presented by

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University of St. Andrews

1974

Candidate's Statement and Declaration

I state that this thesis "The Geography of the Petro-Chemical Industry in Turkey" is the result of research undertaken by me. I was admitted as a research student under Ordinance General No. 12 of the University Court, St. Andrews, in October 1970 as a candidate for the degree of Ph.D.

I further declare that this thesis has been composed by me, that the work of which it is a record has been done by myself, and that it has not been accepted in any previous application for a higher degree.

N. Engin

Supervisor's Certificate

I certify that Naci Engin has fulfilled the conditions of ~~the Ordinance and Regulations, St. Andrews, No. 16~~ RESOLUTION, 1967, No. 1, laid down by the University Court, St. Andrews, and is accordingly qualified to submit this thesis for the degree of Ph.D.

Dr. A. H. Dawson

ABSTRACT

The subject of the thesis is the geography of the petro-chemical industry in Turkey. The geography of the industry is divided into three sections and seven chapters.

The first section, which covers the first two chapters, is an introduction to the industry in Turkey. The geographical and the industrial background of Turkey is described together with the major theories of industrial location and the history of industrial location in Turkey, from the foundation of the Republic to the present day. The function and creation of the petro-chemical industry in the world in general and in Turkey are described.

The second section, which contains five chapters, studies the location factors of the first Turkish petro-chemical complex, its products, the domestic and external market for petro-chemical products, the socio-economic problems which have been created in the areas surrounding the complex, and a suggestion as to where the planned second petro-chemical complex of Turkey should be located.

The third section summarises the findings of the study.

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PREFACE

The author became interested in the petro-chemical industry when he was a student in İstanbul University mainly because the subject was very new for Turkey and almost no work has been done on it.

His interest can be summarised as follows: the feature of the petro-chemical industry, the factors that affect the choice of location of this industry, the effect of the Government in this choice of location, the relations of the petro-chemical industry to other industries and geographical environment.

This research has been the beneficiary of many discussions in St. Andrews and in Turkey, and a product of extensive reading.

The conducive atmosphere of the Department of Geography at the University of St. Andrews and the University Library contributed in many ways to the construction of this study.

I would like to thank Dr. A. H. Dawson, who supervised me throughout my research and who made many valuable comments and suggestions on this subject.

I would also like to thank Mr. J. H. Paterson for the interesting discussions we have had and for the many suggestions he has made concerning this work, and for the encouragement he has given me, and Dr. K. MacIver and Professor B. Proudfoot for providing me with the facilities of the Department of Geography, University of St. Andrews, and Mrs. S. Weaver who patiently typed this thesis.

I would like to thank Prof. A. Tanoğlu and Prof. E. Tümertekin of İstanbul University for attracting my interest to the subject when I was an undergraduate student, and Mr. H. Batuk who is General Director of PETKIM and who made available the facilities of PETKIM, and Mr. F. Karakaş who kindly provided me with the vital information and most up to date statistics, and Dr. M. İçel with whom I had many valuable discussions.

St. Andrews 1974 N. Engin

The Pronounciation of Turkish Words and Place Names

In this text there are many words and place names which readers may find difficult to pronounce and difficult to remember. A brief note is included here which I hope will give every reader the necessary equipment with which to become acquainted with the correct pronounciation of Turkish words and place names.

First of all, I would like to point out that the Turkish language is a very phonetic language and there are no exceptions. The Turkish alphabet contains 29 letters and some of these are different from the English letters:

Ç	ç	as "ch" in church
Ğ	ğ	soft "g"
I	ı	"i" without dot
Ö	ö	as in "bird"
Ş	ş	as "sh" in she
Ü	ü	as in "tune"

The Turkish alphabet does not contain:

Q

W

X

Notes About Measures and Turkish Currency

Throughout this research the metric system has been used.

The units of the Turkish money system are Lira and Kuruş.

1 T.L. (Turkish Lira) = 100 Kuruş

According to the statement of the Central Bank of Turkey (26.7.1973)

£1 = 35.98 T.L.

According to The Financial Times (30.8.1974)

£1 = 32.3 T.L.

According to The Financial Times (20.11.1974)

£1 = 31.8 T.L.

INTRODUCTION

The amount of research done up to now in the study of the petro-chemical industry from an economic point of view is very little. One such work is the study by Walter Isard with E. W. Schoolar of Location Factors in the Petro-Chemical Industry published in the U.S.A. (1955) and another is again by the same author with Schoolar - Vietorisz on Industrial Complex Analysis and Regional Development published in the U.S.A. (1964). The reason why so little work has been done on the subject is first of all the recent development of the petro-chemical industry compared to some other industries. Although this industry started in the 1920's, it has only become an important branch of industry in the last 25 - 30 years. Another reason for the lack of detailed studies on this subject is the very advanced technology used, which has made the study difficult for economists and geographers and therefore less attractive to them. In fact, in our insistent attempts to obtain information from firms bigger and older than PETKIM (Turkish State Petro-Chemical Company), the actual information we have obtained is only a very small percentage of the help given by the latter.

The reason for this may be the fierce competition existing between various firms in the rapidly developing technology of this field. In most of this work we have interpreted and compared the data obtained principally from PETKIM. We could not give many references in this subject since our main concern was the petro-chemical industry in Turkey, and this is the first work of this nature. As we have mentioned above, there are only a couple of studies made relative to our subject and they are out of date already since there has been rapid development recently in this subject. All our attempts to obtain the first work of Walter Isard in the United Kingdom have been unsuccessful. In fact, there is little in common between the work carried out by Walter Isard and our work; perhaps only a resemblence of titles.

Walter Isard investigated the choice of location and economic feasibility of the petro-chemical works established in Puerto Rico by the U.S.A., which was the homeland of petro-chemical industry and which already had many more establishments of this nature. He showed how the low transportation costs (because of proximity of Puerto Rico to the lands that produce raw material for the petro-chemical industry), the cheap labour costs (low wages in Puerto Rico) and the transportation facilities to the U.S.A. markets could be exploited. However, the nature of our work is quite different from the above consideration. First of all, unlike the U.S.A., Yarimca petro-chemical complex was the first complex in Turkey. Again, unlike the Puerto Rico complex which made use of cheap labour and had low transportation costs due to proximity to raw material-producing lands, the Turkish complex was established in an area where the labour costs were the highest in the country and where the complex is right in the middle of the biggest market of the country, which was up to then satisfied only through importation of such products. The transportation costs in the Turkish complex were very low due to the close proximity of the complex to the major market, but the cost of land where the complex was built was one of the highest in the country and so were the labour costs. The case of Puerto Rico complex is different as Puerto Rico itself was not a major market for petro-chemical products in the U.S.A. Again, unlike the Turkish complex, the cost of land for the complex to be built on is relatively cheaper in Puerto Rico than in other places in the U.S.A. nearer to the major markets consuming petro-chemical products. So, the choice of location for various industrial establishments faces us with different conditions to be dealt with.

The birth of an industry anywhere and its improvement largely depends on its type, and various conditions. These conditions may be vital in a particular place and of no importance somewhere else. So, one place can be very profitable for a certain industry but may not be the best location for another industry.

The choice of locations for industries in a country with a central administration is different from a country with a federal administration. In a country with a federal administration like the U.S.A., different tax systems can be used for different energy sources and basic materials. In a country with a central administration like Turkey, however, a single system of taxation is used for all energy sources and basic materials. Naturally, the choice of location for industry in the two systems mentioned above is different. In a country with a federal government, some states may impose lower taxes on petrol and basic materials than others. The transportation and production costs will therefore be lower in that state, and as a result it will be more favourable for industry. So, we should investigate the local factors in the choice of location of industry, and at the same time we should take into account that these factors may change with time, like different forms of energy and raw materials replacing a more conventional form of energy, because of economic or even political considerations.

In this research the author investigates the choice of location and relationship with the geographical environment of the petro-chemical industry in Turkey. In this work the author tries to explain the facts in the choice of a location for the petro-chemical industry, and also attempts to make forecasts about the future of the industry. Instead of building his forecast on purely theoretical considerations he tries to stay with the facts as far as possible. The author tried to use the most up to date statistics that were available to him.

A Note on Sources

This research is based mostly on field work by the author in 1971 and 1972, but for the purpose of calculations, the following statistical sources were mainly used:

1. D.P.T. (Devlet Planlama Teşkilati - State Planning Organisation). This organisation was set up in 1960 and was to be an advisory body under

the authority of the Prime Minister. It publishes Five Year and Annual Plans, and magazines. So far, it has published three Five Year Plans as follows:

A. Birinci Beş Yillik Kalkinma Plani 1963 - 1967
(First Five Year Development Plan)

B. İkinci Beş Yillik Kalkinma Plani 1968 - 1972
(Second Five Year Development Plan)

C. Üçüncü Beş Yillik Kalkinma Plani 1973 - 1977
(Third Five Year Development Plan)

2. D.I.E. (Devlet İstatistik Enstitüsü - State Statistical Institute)
It publishes annual statistics and magazines.

3. Images Economiques du Monde 1973. Published annually in Paris.

4. PETKIM (Turkish State Petro-Chemical Company).
PETKIM publishes magazines periodically and brochures from time to time. Up to date statistics have been sent officially by the courtesy of PETKIM.

5. Petrol Ofisi (Turkish State Petroleum Marketing Company).
This company publishes statistical data annually and magazines periodically.

6. Resmi Gazete (Official Gazette).
First published in 1920. This Official Gazette is published by the Prime Minister's office daily, and contains all the Government decisions and plans. All plans and decisions of the Government take effect after they are published in this Official Gazette.

7. United Nations (1971) Statistical Yearbook 1970, published in New York.

Plan of the Research

This thesis is divided into three sections and seven chapters. From the content of the research and from the sources of material noted in the bibliography it will be appreciated that field work in Turkey played a key role in the collection, interpretation and analysis of facts and ideas. As we pointed out before, these were obtained chiefly in 1971 and 1972 in Turkey

and most recent statistical data has been provided with official letters kindly sent by PETKIM.

In the first section, which covers the first two chapters we have studied an introduction to the petro-chemical industry in Turkey.

In the geographical environment, as for other industrial plants, the petro-chemical complex occupies an area and its location is affected by certain factors. These factors can be different in different periods and in different circumstances. So, in the first chapter, the geographical background of Turkey, and well-known theoreticians' location theories have been studied. In the same chapter we try to show how the decision over location of industry is also affected by the Government in Turkey.

Like every industrial establishment, the petro-chemical industry occupies a geographical area and has a reciprocal relationship with it. In order to understand how much the zone of influence of a petro-chemical complex can be extended from its surrounding areas it should be studied as a function of this industry. Because of this we studied, in the second chapter, the general development of this industry, how it was created, and how it was extended throughout the world, and in particular, the background of this industry in Turkey.

In the second section, which contains five chapters, we have studied the location factors of the first Turkish petro-chemical complex, its products, the domestic and external market for petro-chemical products, the socio-economic problems which have been created in the areas surrounding the complex, and a suggestion as to where the planned second petro-chemical complex of Turkey should be located.

In the light of the first and second chapters we have studied in the third chapter why the Istanbul area was chosen as the location of the first petro-chemical industry in Turkey. We have established that if it had been located at either one of the raw material sources or at the Batman refinery the transportation costs (for both raw material and products) would be different.

In the fourth chapter, the aim of the establishment of PETKIM is studied. In the light of the aim of PETKIM, those products which most satisfy the domestic demand have been discussed.

In the light of the fourth chapter, the fifth chapter studies the situation regarding internal demand. It also shows the situation of demand amongst the important industrial areas. Besides this, the needs of the domestic market are calculated until 1995[1], so, to throw light on the situation of the external market subheading the export possibilities of the Turkish petro-chemical industry are examined. The situation and agreement of Turkey with her RCD (Regional Cooperation for Development) partners is studied. Her trade relations with other, neighbouring countries are also considered.

In the sixth chapter, the socio-economic problems which are created in the areas surrounding the Yarimca complex are examined. As an individual industry the erection of the Yarimca complex meant the loss of some of the most fertile agricultural land in Turkey. It also, however, attracted other branches of industry for which the Yarimca complex was a source of raw material. So, with the decreasing agricultural lands in the areas surrounding the Yarimca complex, it created some socio-economic problems, which are studied in this chapter. However, the Yarimca complex has not been completely disadvantageous in all respects for the surrounding area; there were some positive advantages. One of the positive aspects was the help given to the agrarian population and land by increasing agricultural products and creating additional jobs. The relationship therefore of the Yarimca complex with the surrounding area is worthy of discussion and is examined in this chapter.

After having studied the development of the petro-chemical industry as a whole and the background of this industry in Turkey; the industrial location decision factors in general and in Turkey; the location factors of the first petro-chemical industry in Turkey; its products; the domestic and external markets for petro-chemical products; and the relationship

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(1) Since forecast figures of the National Income of Turkey are available until 1995, all our calculations have been made according to that year.

between the Yarimca complex and its geographical environment; it is now time to turn to the study of the location of the other petro-chemical complex in Turkey. In the light of the above six chapters, therefore, in the final and seventh chapter we predict the location of the other petro-chemical complex. We also discuss the suitability of the three possible sites for the location of a second petro-chemical complex in Turkey.

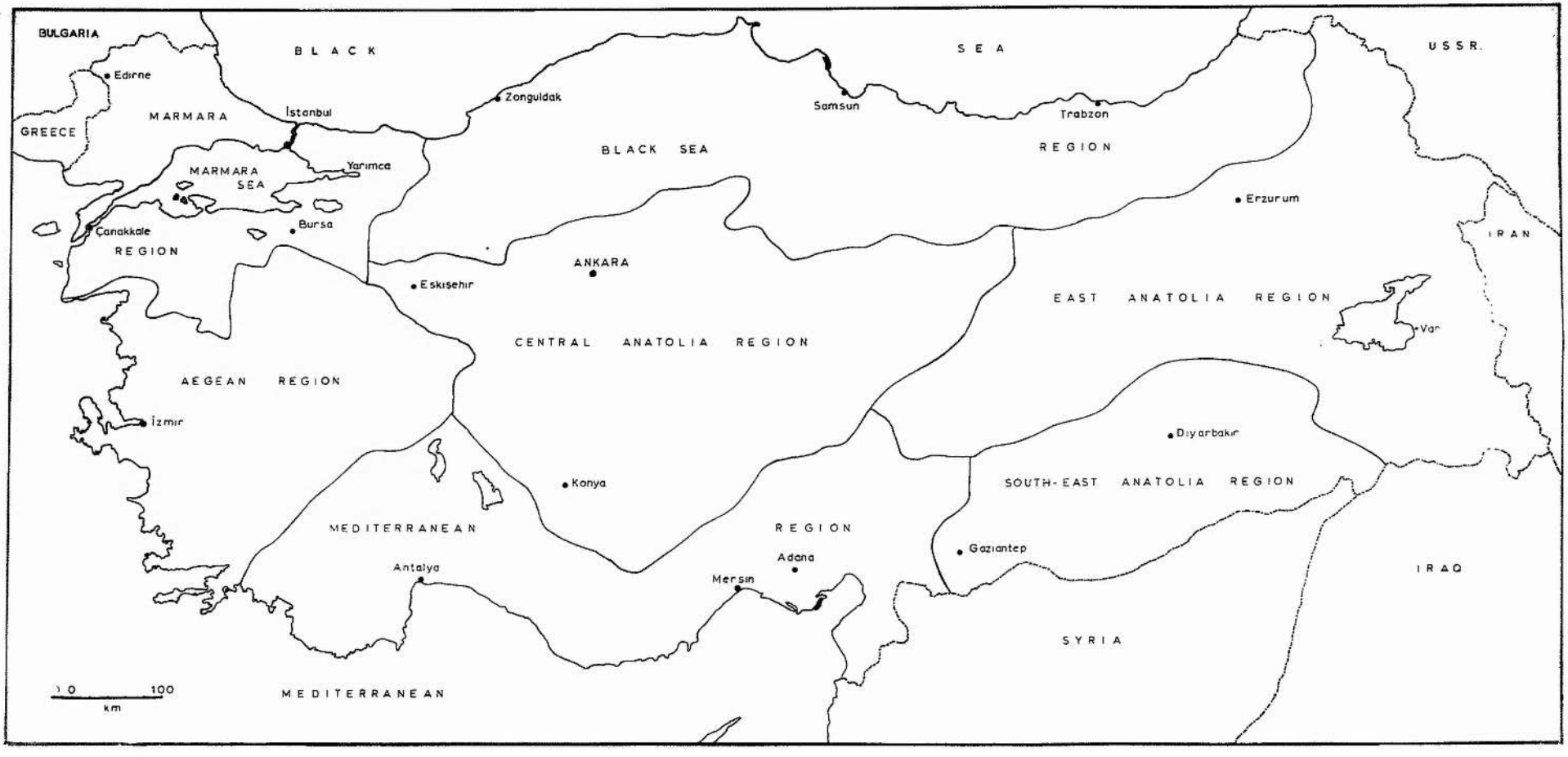
In the third section we made conclusions from the study of the first and second sections.

SECTION I

AN INTRODUCTION TO THE PETRO-CHEMICAL INDUSTRY IN TURKEY

CHAPTER I

GEOGRAPHY, INDUSTRY AND TURKEY



THE GEOGRAPHICAL REGIONS AND THE MAIN CITY CENTERS OF TURKEY

1. GEOGRAPHICAL BACKGROUND

A. EXISTING KNOWLEDGE OF INDUSTRIAL GEOGRAPHY

I) Relationship between Geography and Society

Geography is a science of the earth's surface which investigates its physical features, climates, vegetation, soils, products, peoples; their distributions and their relations.

One of the main branches of geography is human and economic geography which is concerned with population, settlement, transportation, industry and farms.

The subjects of human and economic geography are action and reaction between mankind and natural events. First of all human and economic geography is mainly concerned with the natural environment which mankind lives in and it investigates the influence of the natural environment upon mankind's lives, actions and activities.

Unlike plants and animals, however, men attempt to change their environment, and to adapt it to suit their desires. So to a certain extent they succeed; for example they may change the natural environment by building roads, factories and cities.

We may call this changed environment a geographic environment. Thus human and economic geography is concerned not only with the influence of natural events on mankind, but also with mankind's influence on natural events.

Industrial geography is one of the branches of economic geography whose subject matter is industrial activities in general. Industry is one of the major activities of human beings. As in the other fields of economic geography, the researches in industrial geography are being made in two separate areas:

(i) The study of a single industrial institution or of a specific branch of industry.

(ii) The study of regions where industry is the main economic feature (industrial areas).

In both of these areas geographers examine the regional relations, populations, and the factors which affect the industrial growth in certain places.

II) The Principles of Industrial Geography

Manufacturing is one of the main functions of man. The feeding, dressing, living of millions of people, the production of various tools and satisfaction of all other needs is possible as the result of this function. The manufacturing activities are not only important in the countries with high living standards but they are also vital for the men living in equatorial jungles, deserts and in other sparsely-populated parts of the world.

One of the most important factors which differentiates modern manufacturing activities from simple manufacturing activities is that certain pre-activities take place before the actual manufacture of goods, such as the foundation of energy or power sources and means of transportation. In other words, manufacturing activities are based on some pre-manufacture achievements. It is in this way that modern manufacture has become the occupation of a whole country or of a considerable part of its population. The major purpose of manufacturing activities is to convert certain goods to more useful, valuable and practical forms. For example; crude-oil which comes from the oil-field becomes more valuable and useful after it is refined in the refinery and is used as a raw material in a petro-chemical plant to produce various chemical products.

III) The Types of Manufacturing

The manufacturing activities in the world may be classified under three headings:

(i) Home manufacture or primitive manufacture.

(ii) Work-shop manufacture.

(iii) Modern manufacture.

Home in home manufacture and work-shop in work-shop manufacture are the places where manufacture takes place. Industrial institutions or factories, which are the main features of modern industry, are places where the capital, workers, and raw materials are gathered and directed for the production of certain goods. Production in very big quantities is the most important characteristic of modern industry.

The effects of modern industrial activities on the geographical landscape of the world are not only the industrial institutions of these places but also the social and transport institutions connected with them.

B. REQUIREMENTS OF MODERN INDUSTRY AND TURKEY

I) Transportation

The consumption of energy sources and raw materials in large quantities by modern industry is known to all. To bring these to the factory and then to transport them to the consumption markets can only be made possible by a regular and extensive system of transportation. The development of means of transport has made new regions convenient for industrial activities. The importance of transport to industries is most apparent in the iron industry and petroleum industry.

Since Turkey is a mountainous country it was a serious problem to build a sufficient transport network within the country. Only in the last two decades has anything been achieved significantly in this matter.

The average altitude of Turkey is 1131 m. The altitude of the country increases in the eastern parts where Turkey's highest point, Mount Ağri (5165 m.) is located.

The most apparent features of Turkey are:

(i) A narrow coastal plain encircling Turkey; at the centre of the country there is a plateau.

(ii) A high mountainous girdle encircling the plateau on the north, west and south.

(iii) An almost entirely mountainous eastern region.

As a matter of fact, if we are speaking generally of building roads in Turkey, their density is higher around the coast than inland. There seem two likely reasons for this:

(i) The harsh physical conditions of the country, high mountains (3000- 4000 m.) give few passes from the central plateau to the north such as Zigana Pass, Soğanli Pass, Kopdağ Pass and to the south such as Sertuval Pass, Gülek Pass, Çaykavak Pass.

(ii) There is relatively low land around the coast, unlike central and especially east Anatolia.

For this reason, at the beginning of the Republican Era all the attention of the Government was concentrated on the railway rather than roads, as a transport network within the country. Otherwise the Government needed more money to build and to maintain roads in the harsh physical conditions of the country.

II) Raw Material

The most important characteristic of modern industry is the usage of raw materials in large quantities. The iron industry may be taken as an example which shows the effect of raw material on the establishment of industrial institutions. Although the means of transport and technological facilities have developed tremendously, with some exceptions the iron-ore mines have

still remained the most attractive areas for heavy iron industry establishments. This fact remains the same as far as the forest industry is concerned. The beet sugar industry in Turkey can be shown as another typical example of a raw material orientated towards industry. As E.M. Hoover (Hoover, 1963, p. 32) says, "beet sugar factories are located near the beet field in order to economise on transportation of a bulky raw material".

III) Population and Market

Market is one of the vital factors which affect the localisation of any industry as it is necessary for the sale of its products. Since a plant is obliged to sell its product, market attracts industries in order to economise on transportation costs of its products. As Weber (Alexander, 1963, p. 621) says, "if both raw materials are fixed and pure the factory will be at the market in order to give the lowest aggregate transportation costs".

The consumption factor of the total population is vital for the industry. It is obviously valuable to have an internal market for the goods manufactured within the country. This of course depends on the density of the population and distribution of the population within the country.

At first glance it may be seen that features of the distribution of Turkey's population are:

(i) Sparse population.

(ii) Distribution not uniform.

(iii) Big differences of density among regions.

It is interesting to note that a map of population distribution shows very obviously the main line of Turkey's relief. The coastal part of the country is more attractive for population and has more important economic activity than the inland part. The commercial, industrial centres of the country are mostly situated there, so the coastal part of Turkey has a wider market for industrial products than the inland part of the country.

On the other hand, where certain goods and valuables are concerned, the purchasing power is as important as the size of population, and the purchasing power depends on the national income for every individual. If the strength of purchase does not increase parallel to the population increase, the national income per head obviously decreases. This means that although the internal market becomes large because of the population increase, in fact the people become much poorer. New industrial institutions which provide new jobs can be established by the income obtained from agriculture and it helps to build new industrial branches. As a matter of fact, it is observed that the national income in Turkey is increasing by new industrial and commercial activities and also by improving and encouraging agriculture, and protecting the prices of agricultural products. For example, the national income in 1938 was 96 T.L. (Turkish Lira), increasing to 440 T.L. in 1948, 645 T.L. in 1953, 1291 T.L. in 1958, 1546 T.L. in 1959, 2153 T.L. in 1965, 3200 T.L. in 1972, and 6930 T.L. in 1974 (The Financial Times, 30.8.1974, 9).

In this way the market factor in Turkey's industrialisation has improved. This situation also helps her future industrial activities in providing enough markets for the production of new industrial establishments.

IV Power Supply

Machinery is doubtless the most important characteristic of modern industry. The production and running of the machines is only possible by means of having energy sources which are much stronger than man power. The aluminium industry can be taken as a good example of power orientated industries (Paterson, 1972, p. 215), because it requires 8 - 10 $kw/_h$ of electricity to convert one pound of alumina into aluminium.

In every country the industrial activities are closely related to the consumption of energy. The energy capacity of a country or region depends on the power sources it has and also the ability of making use of these sources.

In Turkey the total energy consumption, as the equivalent of coal consumption rose from 22,000,000 tons at the beginning of the First Plan Period (1962) to 30,000,000 tons at the end of the period. During the Second Plan Period (1968 - 1972) the absolute value of the utilisation amounts of non-commercial fuel, such as wood and things like that, would be decreased and the amount of commercial fuel consumed would be increased. Thus, a more balanced utilisation of both would be obtained.

Turkey : Consumption of Various Energy Sources

(Resmi Gazete, 11.1.1971, p. 149; Petrol Ofisi Dergisi, 1969, p. 30; D.P.T., 1972, p. 185)

Year	Coal	Lignite	Crude Oil	H.Electric	Wood	Others
	T	T	T	GWT	T	T
1968	4,312,000	5,277,900	6,517,306	3,169,800	12,950,000	16,570,000
1969	4,606,000	5,511,400	6,469,675	3,439,600	12,500,000	16,000,000
1970	4,476,200	5,747,000	8,200,000	3,028,600	12,500,000	16,000,000
1971	4,500,000	6,400,000	9,334,000	3,000,000	12,500,000	16,000,000
1972	4,500,000	6,500,000	10,000,000	3,600,000	12,500,000	16,000,000

Natural gas has an important place next to coal, oil and hydro-electric power in other countries. In Turkey natural gas reserves of production value have not been found to date. Extensive exploration in this field should be done according to the Second Plan target. Natural gas during the Second Plan Period would be imported from neighbouring countries and the price of energy resources would be adjusted according to the general energy balance.

The Percentage of Various Energy Sources in Commercial Energy Consumption in Turkey (D.P.T., 1972, p. 186)

Energy Sources	1968	1969	1970	1971	1972
Coal	25.3	24.6	23.2	22.0	21.0
Lignite	18.6	17.6	17.9	18.8	18.2
Crude Oil	49.5	51.2	53.3	53.9	54.8
Hydro-Electric	6.6	6.6	5.6	5.3	6.0

In the electrical power sector an investment of 5,000 million T.L. during the First Plan Period was forecast. According to the estimates, in the course of the same period the consumption capacity should have increased by an average of 13% per annum as a result of the increases in production, transportation and distribution of electrical power resulting from the anticipated investments. However, delays in investments, particularly for the installation of electrical power production centres, limited the amount of additional electrical energy provided to industry and other large-scale consumers and therefore increases did not go higher than 12 per cent.

During the beginning of the First Plan Period, due to the existing excess capacity and the favourable effect of rain within certain limits, it was possible to meet the increased demand for electrical energy without the need for a greatly enlarged production capacity.

Net power rose from 1,448 and 1,480 Mw in 1962 and in 1963 respectively, and to 2,186 Mw in 1967. For industry the average price of electric power produced by municipal power plants was 8.97 kuruş (1 T.L. = 100 kuruş) in 1951 per $kw/_h$, 9.88 kuruş in 1955, 18.48 kuruş in 1960, 20.29 kuruş in 1965, and 31.07 kuruş in 1969 (D.I.E., 1969, p. 118), but in 1965 for consumption from 1,500,000 to 2,500,000 $kw/_h$ rates averaged about 16 kuruş per $kw/_h$. Since average rate of per $kw/_h$ is fixed in Turkey, energy supply does not play an important role in plant location decision.

V) Climatic Conditions and Water Supply

The climatic conditions must also be mentioned as an important factor for the improvement of industrial activities. The climatic conditions affect industries in three important aspects. They are:

(i) To be able to get sufficient water for plant needs.

(ii) Being able to erect out-door plants.

(iii) From the air-pollution point of view.

(i) The climate affects the water supply of the plant via rainfall and evaporation. More or less every kind of industry requires water in either small or large quantity. Mostly rivers dry up or are smaller in summer in the Mediterranean climate because of insufficient rainfall plus the high degree of evaporation (this is also important for discharging waste water). Since Turkey is a Mediterranean country, water supply must be considered as an important factor for the location of industry. The water needs of the plant should be obtained from water-wells. But this does not mean that as soon as one digs a well one finds a sufficient quantity of water for its needs. Thus arises another important problem: to choose the right place and the right season in which to dig a water-well. As Turkey is a Mediterranean country a good time for this is autumn, because when the well is dug in autumn and 20 litres per second is obtained, it means this well produces generally at least 20 litres per second all the year round, since summer-time is the dry season of a Mediterranean climate. If the well is dug in winter or spring-time the well may be rich in water (say 20 litres per second) but it does not grant that the same quantity of water is obtainable for summer since the winter season is the humid season, and spring comes after the humid season (that is winter) in the same climate. As will be indicated later on, rain does not fall in most parts of Turkey in summer.

(ii) Yearly temperature, daily and yearly differences of temperature, the frequency of lowest temperature, days of frost undoubtedly affect most industrial locations. Some industries need out-door work (such as air-plane manufacturing) and some other industrial plants' out-door installations (such as petro-chemical plants)

may be affected by severe winters and big differences in daily and yearly temperatures. The climate enables substantial savings to be made in the costs of storage heating and assembly (airplane manufacturing).

(iii) The climate also plays an important role in air pollution. As will be indicated later on, during winter stable air masses cover all Central Anatolia. Since the atmospheric circulation is not sufficient to carry polluted air away from industrial plants, the percentage of pollution increases and creates an environment surrounding the industrial establishments which is harmful to people.

The degree of continentality of Turkey is important from the point of view of distribution of temperature, snow cover and days of frost. According to Johnson's formula (Erinç, 1962, p.305) in every part of inside Anatolia the degree of continentality is over 40. But this reaches 60, especially in north-east Turkey. The most notable feature is that the yearly differences of temperature are lowest at the coast, and nowhere are they more than 20°C. Even this is lower at East Black Sea where it is 15°C, but this figure rises to 30°C in East Anatolia.

It is also interesting to note the frequency of lowest temperature, because it affects most industrial locations. For instance, -5°C and lower than -5°C may be repeated at Mediterranean coast on average every five to ten years. This frequency is even less in some parts of the Mediterranean coast (Fethiye every thirty-five years and Iskenderun every twenty-seven years). This figure may be reached at East Black Sea coast every four to five years; West Black sea coast, Marmara and Aegean coast every one to four years. However, -5°C and lower has been recorded every year inland. If we consider -10°C, this temperature occurs every 100 years

THE CLIMATIC DIFFERENCES AMONGST REGIONS IN TURKEY

		Black Sea (Rize)	Marmara (İstanbul)	Aegean (İzmir)	Mediterranean (Adana)	Central (Konya)	East Anatolia (Kars)	South-East Anatolia (Diyarbakır)
Temperature (°C)	Yearly Average	14.3	13.9	17.5	18.6	11.5	4.1	15.7
	Warmest Month	22.6	23.4	27.6	28.0	23.1	17.5	31.0
	Coldest Month	6.9	5.5	8.6	9.1	-0.2	-12.0	1.5
	Highest	37.9	39.4	42.7	45.6	37.7	34.6	46.2
	Lowest	-6.6	-10.8	-8.2	-7.1	-28.2	-39.6	-24.2
Days of Frost	Yearly Average	12.1	24.2	8.1	8.1	104.3	182.4	67.7
	First Day of Frost	27.XII	13.XII	24.XII	21.XII	18.X	3.X	19.XI
	Last Day of Frost	10.III	24.III	22.II	21.I	15.IV	2.V	24.III
Rainfall (mm)	Yearly Average	2440.0	666.6	693.2	610.9	315.0	529.1	487.6
	Maximum	4045.0	870.8	1116.5	786.0	500.5	744.1	668.8
	Minimum	1757.0	475.0	488.0	248.0	143.0	420.0	206.2
Distribution of rainfall seasonally (%)	Winter	29	36	54	45	33	15	46
	Spring	15	21	21	26	34	31	30
	Summer	21	16	2	6	12	36	2
	Autumn	35	27	23	23	21	18	22
Evaporation (mm)	Yearly	620.1	763.4	1356.7 (Manisa)	1337.7	1188.8	957.0 (Erzurum)	2050.3

Source: Prof. S. Erinç (1962) Klimatoloji ve Metodlari, İstanbul, Baha Matbaasi, p. 443-449.

at the Mediterranean coast; fifty to sixty years at the East Black Sea; twenty to forty years at the West Black Sea and Aegean, and three to ten years at Marmara. But $-10^{o}C$ occurs every year in most inland parts of the country.

The longest periods of days with frost are reached in Eastern Anatolia and average 182 days, with a maximum of 199 days. Both numbers (182 - 199) are more than half of the year.

One more point to be discussed in this matter is rainfall. In terms of rainfall there are big differences amongst the regions in Turkey. One part of the country receives yearly 250 cm on average, while another part of the country receives only 30 cm or below, on average. The rainfall is affected by the situation of the mountains, and the altitude of the regions. As can be appreciated, rainfall also affects subterranean water. Of course the explanation of subterranean water is not as simple as this and it may be affected by other factors as well, such as structure of rocks and degree of evaporation and so on. But as can be appreciated again, subterranean water may be affected much more severely by low rainfall and a certain degree of evaporation, rather than high rainfall and the same degree of evaporation.

After these explanations and seeing the table from the point of view of water supply, to be able to erect out-door installations with air pollution makes the coastal part of the country become attractive to locate industrial plants.

VI) Labour Force

All industrial institutions big or small, require healthy, energetic and skilled labourers.

The total population points out the vital problem of provision of workers as well as market conditions. In Turkey the first reliable census

was taken after the declaration of the Republic in 1927. After this, another was taken in 1935 and then every following five years.

Population of Turkey

Year of Census	Population	Arithmetic density (per km^2)
1927	13,648,270	17
1935	16,158,018	20
1940	17,820,950	23
1945	18,790,174	24
1950	20,947,188	27
1955	24,064,763	31
1960	27,754,820	36
1965	31,391,000	41
1970	36,166,000	47

One of the main characteristics of the Turkish population is the low average age; for example, the 1960 census found that the 0 - 35 age group constituted 73.6 per cent of the total population. Another feature of the population of Turkey is the birth rate which is one of the highest in the world (3 per cent per annum). In Turkey the male population consistently exceeds the female population by 3 - 4 per cent.

In 1927 the proportion of female workers in the labour force was 24 per cent; this rose to 40 per cent in 1960. In the early 1960's it has been estimated that out of every 1000 people, 495 were potential manpower, 422 were in the child group (0 - 14) and 83 were in the old age group (over 65).

It should be noted that 95 per cent of female labour is employed in agriculture, 2 per cent in services and only 3 per cent in industry in 1960. On the other hand it has been estimated that 88 per cent of all woman labour is unpaid family labour.

According to the 1965 population census, the total labour force was 13,557,860, and 86,620 (0.6 per cent) were employed in mining; 960,950 (7.3 per cent) in manufacturing industries; 351.147 (2.5 per cent) in construction; 392,074 (2.7 per cent) in trade; 1,148,760 (8.6 per cent) in services and communications, 9,750,269 (71.1 per cent) in agriculture, forestry, hunting and fishing, and 868,040 (6.7 per cent) were miscellaneously employed (D.I.E., 1969, 80).

In the manufacturing sector, employment was 30.3 per cent for textiles and clothing; 23.1 per cent for metallurgy and engineering; 17.0 per cent for food, drink and tobacco; 10.9 per cent for wood products; 2.6 per cent for paper and printing; 3.3 per cent for chemicals and 12.8 per cent for others in 1965.

According to the 1963 Census of Manufacturing and Business, in Turkey in the chemical and chemical products sectors 15,622 employees were employed. 13,934 of them were employed in 166 large establishments, and 1,688 of them were employed in 766 small establishments. Their wages and salaries were 128,000,000 T.L. annually for large establishments and 8,000,000 T.L. annually for small establishment employees.

One more point to say in this matter is that the most mobile factor concerning the conditions of industrial establishments is the labour. As long as high salaries are made available, labourers can be attracted to every part of the country, and even to every part of the world.

VII) Capital

The need for large amounts of capital is one of the factors which differentiates simple (home) manufacture from modern manufacture. The capital was the most serious problem at the beginning of the Republican era in Turkey. The Government could not do much between 1923 and 1930 although it was very energetic, because it was short of capital in that time.

Apart from a private $10 million American loan in 1930, a Soviet Government loan in 1934, British Government loans of £3 million in 1938 and

£10 million in 1939, French and German loans in 1939, the financial resources utilised were Turkish public resources and those were generated domestically by the new banks.

In spite of their limited financial resources, the Government nationalised the foreign control of vital services and industries. At that period most of the country's financial resources had been spent on the nationalisation of services and industries. 52,000,000 T.L. was paid to one French company on nationalisation.

Since 1948, by accepting foreign aid, development has been very rapid. One of the objectives of planned development is to base development, to a large extent, on national resources and to relieve the dependence of the economy on foreign resources. To attain this objective, the Second Plan foresees as a target an average increase of 3.3 per cent per annum in foreign resources, against a rise of 12.2 per cent in domestic savings. In this way, every year a higher portion of the increasing income will be earmarked for savings, and consequently the relative share of domestic savings in GNP would rise from 17.9 per cent in 1967 to 22.6 per cent in 1972. This target foreseen in the plan requires additional efforts to be made in order to accelerate the increase in domestic savings. For this purpose due to the insufficient voluntary savings, a policy would be adopted to encourage the voluntary savings of the nation, on the one hand, and to increase public savings on the other.

As domestic savings depend on the level of income, an increase of 40.3 per cent in GNP during the period 1967 - 1972 would be conducive to the creation of an environment suitable for ensuring a rapid increase in domestic savings.

The basic long-term target extending beyond the second plan is to enable the economy to achieve the planned growth rate through its own resources. The realisation of this aim depends upon two basic conditions:

(i) The investments required for the attainment of this growth rate must be financed wholly through domestic savings.

(ii) Foreign exchange receipts must be increased.

To achieve the objective of reducing the dependence of Turkey on foreign resources the following should be done:

(a) All export opportunities should be thoroughly and rapidly appraised. In the distribution of investments among the various activities of the economy, priority should be given to export-orientated activities.

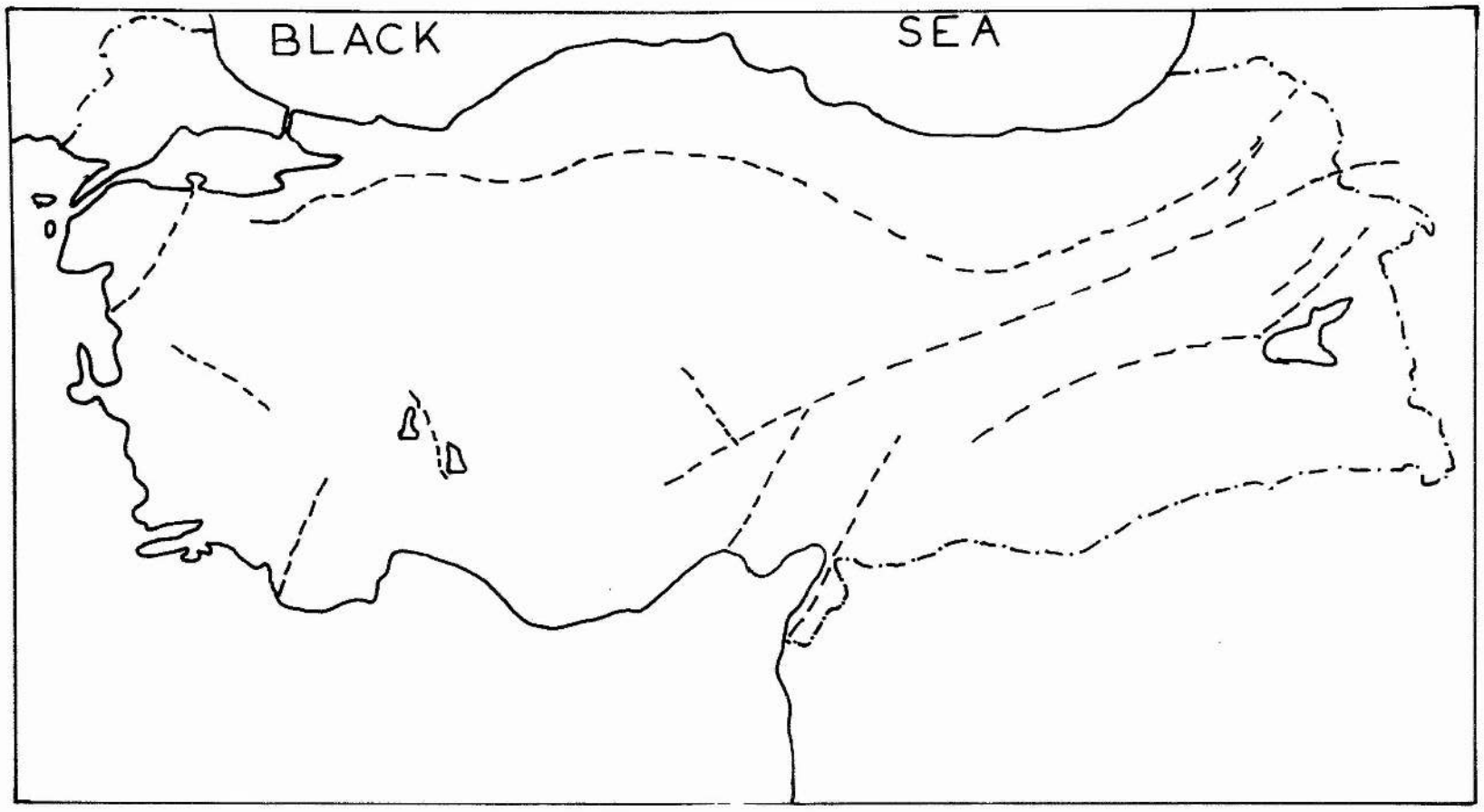
(b) The most effective utilisation of scarce foreign exchange resources should be ensured by placing emphasis on import substitution in the fields considered economically suitable and particularly in those fields based on natural resources.

(c) The scarce foreign exchange resources should be directed to the economic activities which are directly related to economic development.

However, Turkey's reserve of gold and foreign exchange was $402 millions in 1971, which rose to $2,040 million in 1973 and stood at $2,200 million by the end of July 1974 (Graham, "The Financial Times", 30.8.1974, 10). So, even six years ago an investment of a few hundred thousand dollars was an attractive proposition for Turkey, but today, with reserves of $2,200 million, she is herself able to finance projects involving the investment of several million dollars in foreign exchange.

VIII Earthquake

In Turkey, unlike some other countries, industrial plant location is affected significantly by earthquake. In modern times, two Turkish earthquakes have reached a magnitude of 8.0 on the Gutenberg-Richter scale. The highest magnitude ever observed in the world is 8.9. These shocks, at Mürefte



THE EARTHQUAKE LINES OF TURKEY
(After geological maps 1:100,000 and 1:500,000 of Turkey
Source: M.T.A.)

(Marmara region) in 1912 and at Erzincan (east Anatolia) in 1939 must be included in the twenty strongest earthquakes measured in the world since 1904. Since 1918, seven Turkish earthquakes have reached a magnitude of 7.0 to 7.5 and thirteen a magnitude of 6.0 to 6.9. The earthquake in Messina, Sicily in 1908 which resulted in the loss of 300,000 lives and which is generally regarded as the most destructive earthquake in Europe in the last seventy years, had only a magnitude of 7.0; that is 70 times less strong than those at Mürefte and Erzincan. This example shows the significance of Turkish earthquake figures.

According to an unpublished report of Professor Rothe (Secretary-General of the International Earthquake Bureau in Strasbourg), "the earthquakes with the greatest magnitude in the entire Mediterranean region occur in Turkey". (Ilhan, (Campbell - Editor) 1971, p.435).

IX Pollution Problems

Every industrial complex gives off residues which pollute atmosphere, water and soil. These are three very important factors in man's natural environment, and he uses them in his daily life. When human beings added to the natural environment by building roads, dwellings and factories they faced many different problems which they had not encountered in the past, such as air pollution, water pollution and soil pollution.

Air Pollution

An artificial climatic environment exists in industrial areas, especially where the natural climate is dry and warm and where lack of air circulation often results in stationery, polluted and toxic air. However, perfectly pure or sterile air does not exist: it is somewhat polluted, even in a natural state, but the quantity and quality of potentially harmful effects are considerably less than are found in industrial areas and the health hazard correspondingly reduced.

Sulphur dioxide is the main cause of this damage which is mostly produced by oil. Oil contains sulphur from 0.2 per cent to 3 per cent, but some oil contains even as much as 7 per cent. Sulphur dioxide will eat through cement,

concrete, limestone and iron. Architectural decorations and stone mouldings on buildings, monuments and statues suffer. Vegetation is almost completely destroyed in the areas surrounding certain factories emitting sulphur dioxide, because sulphur dioxide transforms to sulphur trioxide and later becomes sulphuric acid when it mixes with water particles. As a matter of fact, according to Hasan Asmas, President of The Society for the Preservation of Nature in Turkey, sulphur dioxide destroys all plants around Murgul Copper Plant in Turkey, and also damages the health of the inhabitants of that town (Asmas, Cumhuriyet, 18.12.1972, 5).

From the air pollution point of view, Ankara is one of the most polluted cities in the world. According to the same article, in 1969 Ankara had been polluted by sulphur dioxide as follows:

from solid fuel	41.1 per cent
from fuel oil	58.8 per cent

These artificial climatic conditions over Ankara are caused by the stable air-masses which cover Central Anatolia (Anadolu) in winter and are unable to carry industrial wastes and heating wastes from the city.

One further important point on this matter is carbon dioxide; since oil contains 85 - 90 per cent of carbon, it is one of the important factors in atmospheric pollution. As a matter of fact, something like half of the carbon dioxide which is produced by the burning fossil fuels remains in the atmosphere. In 2,000, it has been estimated that atmospheric carbon dioxide will be increased by approximately 25 per cent (Ward, 1970, p.10). This will cause important results from the geographical point of view in the long term, if the percentage of carbon dioxide increases in the atmosphere, because it absorbs long-wave radiation so it causes an increase of temperature.

In Turkey, air pollution has been ignored by the authorities until very recently, and so far sufficient work on this field has not been done.

Water Pollution

The major component of the human body is water, so it would not be out of place to briefly discuss the importance of water pollution in terms of human life.

The human organism is essentially an aqueous solution in which the processes of metabolism are carried out. To satisfy the requirements of this organism certain quantities and qualities of solvents must be introduced to maintain a given concentration. It is a process of self-intoxication against which the organism defends itself by trying to wash away useless substances from the tissues with the help of increasing quantities of water.

The significance of a good water supply, therefore, in terms of both quantity and quality, is obvious. The available reserve of fresh water in the world is insufficient as measured against demand. The available quantity of naturally fresh water barely reaches 3 per cent of the water found on earth.

Organic matter is one of the most important factors of water pollution. When the organic matter enters water it exhausts the oxygen resources of the water and creates unpleasant tastes, odours and generally septic conditions. The lack of oxygen stifles fish and most aquatic life in the water.

It is interesting to see the quantity of water needed to produce one ton of selected industrial products:

Products	Water Required (Lt)
Soap	2,000
Synthetic Silk Fibres	600,000
Synthetic Rubber	2,500,000

This table also explains the high quantity of waste in the water of the industrial areas.

Soil Pollution

Soil in industrial areas suffers a great deal from the infiltration of

untreated industrial wastes. It tends to lose its capacity to break down impurities which, in turn, threaten underground water supplies.

The synthetic products are especially harmful, such as chemicals that are used to increase crop production but which pose health hazards through their initial destruction of micro-organisms in the soil, and also through direct access to the human organism.

The purity of surface water has been affected by the general use of chemical agents in agriculture. The chemical agents penetrate the soil, rivers and lakes.

Since water pollution and soil pollution have not been considered a very important problem and have not been worked on for a long time in Turkey, a result of this is that Haliç (Golden Horn) has been more or less filled up by industrial wastes and other wastes. As a consequence of this, Haliç has now become a difficult place for fish and for navigation; it has a bad smell and is very dark and dirty in colour.

Water pollution and soil pollution are also important in some built-up areas of İstanbul, as the biggest industrial centre in the country. As will be indicated later on, industrial centres have been surrounded by gecekondus (squatters' houses, shanties), where there is a lack of sufficient sewage systems. A couple of years ago, as a result of the freely discharged industrial wastes and other wastes, there was enteric infection in the İstanbul area, resulting in the death of a number of people.

X Other Factors

Apart from the above-mentioned factors there are some other factors which play important roles upon location decision. One of them, as will be indicated later on, is the effects of Government, which is very important.

The human element can also play quite an important role in the location decision of an industrial plant, as L. Needleman (Needleman, 1968, 339) writes, "For instance, a study of the New England region found a manufacturing firm in

Worcester which would clearly have been better off in Boston. The reason for its location, it was discovered, was that the manufacturer's mother-in-law lived in Worcester, and his wife insisted on living in the same city. No amount of formal theory would have unearthed this reason, but formal theory could tell the manufacturer how much this cost him."

C. THE THEORIES OF INDUSTRIAL LOCATION

There are several important considerations which guide the choice of location of an industrial area:

(a) The industry may use several different raw materials originating in different locations.

(b) The industry may sell its products in several different markets.

(c) The product may change form, bulk and weight during manufacture.

In the light of these considerations, we can make two divisions:

I) Least Cost School.

II) Market Location School.

I) Least Cost School

One of the most distinguished advocates of the Least Cost School was Alfred Weber, the German Economist. His epochal treatise on the Location of Industries is widely recognised as the first attempt at a general formulation of laws governing industrial location. In his research for the basic factors governing plant location, Weber discusses two regional factors as (a) transport, and (b) labour and two secondary factors, agglomerative and deglomerative forces. Weber argues that the two regional factors are susceptible to deductive analysis, but that the secondary factors can only be treated inductively because they are largely accidental.

(a) He gives an important place to transport costs in his theory. His main concern is to minimise them. The materials which are used for manufacture vary according to their weight. Rather than speak of weight we should talk about Material Index (MI).

Material Index = Weight of localised material required per unit of product divided by weight of product. If Material Index is >1 it means loss of weight during process of manufacture. Material Index <1 means gain of weight during process of manufacture. Thus, if the Material Index is >1, the manufacturers will be drawn to locate near the source of raw materials, but if the Material Index is <1, the manufacture point will be located at the market.

Alfred Weber had noted that localised materials can be fixed and ubiquitous (which means material available almost anywhere, for example water). On the other hand, localised materials can either be gross or pure. If localised materials are ubiquitous, the Material Index will always be very small and the place of production will always be the place of consumption. If localised materials are pure, this means no loss of weight in manufacturing. Material Index equals 1 and location can can take place either at the location of raw materials or market.

(b) Alfred Weber had pointed out that labour cost may be important. Where industry has a high labour coefficient it will be attracted to locations of cheap labour but only if the savings in labour costs are greater than extra costs involved in deviating from the minimum transport costs.

$$\text{Labour Coefficient} = \frac{\text{Labour Cost}}{\text{Transport Cost}}$$

Dispersal will occur where costs rise, particularly with a high cost of land in the centre of the market. Predohl and others have pointed out that (Isard, 1968, p.36) Weber's industrial location theory is chiefly based on technical empirical knowledge. Transport costs are related to weight and distance, i.e., to technical factors. Varying raw material prices and other elements are reduced in similar fashion. Only under severe limitations is Weberian doctrine generally applicable.

II) Market Location School

(a) Lösch Industrial Location Theory:

One of the most distinguished advocates of the market location school is August Lösch. Lösch is a German economist who produced the first general theory of location with demand as the major spatial variable. Lösch does not accept the least-cost location approach of Weber and his followers. According to him the right approach is to find the place of maximum profits, where total revenue exceeds total cost by the greatest amount. Lösch's intention is not to explain the location of economic activity in the real world. He says (Lösch, 1964, 4), "The real duty of the economist is not to explain our sorry reality, but to improve it. The question of the best location is far more dignified than determination of the actual one".

According to Lösch the major factor affecting the cost of production is the variation of transport costs. If this is minimised, surely the cost of other essential things will be lowered. These alone almost show spatial regularity and their contribution toward determining location has therefore become the principal item in the ruling theory.

Usually, costs of production cannot be separated from the freight cost of rawmaterials, and often also the freigh cost of the finished products. The most favourable location depends upon both, and therefore upon total costs. In a free economy the correct location of an industrial enterprise lies where the net profit is greatest. A consideration of the variability of gross revenue should go beyond one-sided orientation by costs, i.e., should not, with Weber, regard gross revenue as constant by assuming a given demand and price.

Demand varies with price, in part directly and in part via the size of the market area. The connection between price, demand and location is such that for each possible factory price, e.g., the greatest total demand will be realised with a different location of the plant, therefore with change in price the market area assumes another form and therefore the demand of

individual markets changes in different populations.

Therefore, it is as meaningless to find the point of lowest cost as it is to consider the point of largest sales. We must rather search for the place of greatest profit. A geometrical solution becomes impossible as soon as price and quantity are added to the two spatial variables, for they can be applied to three variables at most. Algebraic treatment leads to equations of an insoluble degree. The greatest profit attainable at each point can be determined from cost and demand curves and from this the place of greatest money profit, the optimum location can be found. But this is trial and error, hence Weber's and all other attempts at systematic and valid location theory for the industrial firm were doomed to failure.

In comparison with a one-sided orientation, an orientation by profits could produce new special locations at favoured points where neither outlay is lowest nor proceeds highest but where the difference is greatest. There is however no industry in which this would necessarily be the case. It is clear that special locations are probably more numerous with one-sided than with complete orientation. In reality they are therefore more significant than they would be in a rational world. Thus special locations are more common in reality than they should rationally be.

The main drawback with Lösch's market area approach is that it cannot, as formulated at present, be made dynamic. Changes in transportation costs should initiate changes in the spacing and distribution of towns, yet towns are amongst the most conservative features in the economic landscape. To envisage a space economy with large towns disappearing in one place and new ones growing in others over the short-term periods during which major changes in the structure of transfer costs have come about is patently unrealistic. In consequence, it is argued that plant location dynamics need to be taken out of the normative framework devised by Lösch.

(b) Walter Isard:

Walter Isard's Location and Space Economy, published in 1956, represents

what is, to date, the most successful attempt at synthesising agricultural, manufacturing, and central place location theories. Although he presents many new insights, his work is essentially a synthesis rather than a new theory. In it he brings together various established theories in an equilibrium framework.

Agglomeration is of considerable interest to him. Some aspects of his discussion of agglomeration have immediate relevance to industrial location dynamics; other aspects are posed in a static framework, but can be extended to give a dynamic interpretation.

Isard criticises Lösch's work on several grounds. Firstly, he believes that optimal location for production does not necessarily coincide with optimal location for consumption. Isard also considers that Lösch's presentation would become exceedingly complex, if one were to relax the simple uniformity assumptions which are basic to his model. For example, if one were to introduce inequality in raw material, labour and capital resources, an uneven and discontinuous distribution of population and all other types of local differences, the task would become extraordinarily difficult.

Isard pays great attention to the transport factor. He (Isard, 1968, 90) considers transport inputs as vital as four other factors of production: land, labour, capital and the entrepreneur. He does not think of the transport function as another factor of production, but he emphasises that transport inputs play an important role in production and consumption processes. Isard believes we especially need to probe deeply into space preferences; i.e., into man's propensity for intricate forms and pattern of herd existence and into the socio-psychological and biological forces which together with economic and other forces govern the spatial patterns of population settlement. These forces have a strong bearing upon urban land use patterns and the mutual interdependence of the industrial, commercial and residential sectors.

2. THE GOVERNMENT AND INDUSTRY IN TURKEY

In any country, scientific research takes place in order to determine a favourable location for any specific industry. However important the results of the scientific research, the last word about execution may belong to the Government which can alter the location decision for various reasons.

According to Hamilton (Chorley & Haggett - Editors - 1968, p.364), "three kinds of entrepreneur decide location in the real world: the private capitalist, the corporate capitalist and the State Administration (local, republic, national or federal)". So, there are three different approaches to the location problem. Especially in the mixed and planned economy, the Government has a major role.

In this part we will try to determine how the industrial location decision is affected by the Government of Turkey.

A. THE GOVERNMENT AND INDUSTRIAL LOCATION IN TURKEY

Every Government is committed, in theory to protecting the individual, providing acceptable standards of living, and settling the quarrels among the people peacefully, on terms judged equitable, to hold the community together. These three main tasks emerge in every Constitution. The balances in policy, the demand of the people to carry forward that policy, and the way it distributes the limited resources are only available to the Government by means of these three main tasks.

Strictly speaking, the impulse of the people living in the society poses immediately an array of tasks which are essentially universal. They can be summarised under the headings of security, welfare and growth and the Constitutional order. It is clear that the pursuit by Government of these tasks raises immediately a kind of economic or even an "input-output" problem. The execution of these main tasks requires resources. Resources are inherently scarce and must be drawn away from the private consumption and private investment. Here, in this input-output problem, inputs are men, money and obedience, and outputs are the three main tasks of the Government. So, naturally, these three main tasks of the Government affect every kind of

economic activity within the country.

The Government's influence in the choice of industrial regions can be grouped in two cases:

(i) In regions where the private sector does not want to invest on considerations of profit, the Government invests on its own initiative to secure the employment and economic welfare of the region.

(ii) In regions which are not most profitable for the private sector the Government indirectly makes these regions more attractive to the private investors by passing special Laws, offering free lands or exemption from some taxes.

The Government of Turkey in the Republican period used one or the other or both of these alternatives to secure the development of certain regions of the country in attempts to industrialise Turkey. The efforts of the Government for industrialisation since 1921 ranked Turkey along with Israel as one of the two most highly industrialised countries of the Near and Middle East (Brice, 1966, 291). The Turkish economy made particularly rapid progress during the last decade. Indeed the Gross National Product doubled with an average annual growth rate of 6.8 per cent between 1963 and 1972. Over this period industry was the most rapidly growing sector of the economy. In fact industry's share of the Gross Domestic Product rose from 16.5 per cent in 1962 to 24.6 per cent in 1972. In 1972, Turkish industry supplied 93.5 per cent of the total domestic demand and exported 4.5 per cent of its total production. Exports of industrial goods have increased 3.5 times as compared to 1963 figures. (İstanbul Chamber of Industry and Chamber of Commerce (1973) Turkey Exports, İstanbul, Apa Ofset, 29).

We can analyse the influence of the Government in the Republican Era on determining the location of industrial projects in three different periods:-

I) From the Foundation of the Republic to World War II

II) World War II Period

III) 1946 to the Present Day

I) From the Foundation of the Republic to World War II

Although Turkish preconditions for take-off should be dated to the period of the rule of Selim III (1789 - 1807) (Rostow,B,1971, 74), it was not until the Young Turks that a group emerged in authority which took the view that economic modernisation was not only acceptable but an essential component of Turkish survival in a modern world. In 1909 they passed a Law for the Encouragement of Industry; and this Law was revised in 1915. According to the 1913 census in the area of the Ottoman Empire there were only 269 establishments working with machines, employing a total of 17,000 workers. 76 out of the 269 were in the food industry, 75 were in the textile industry, and the rest of them were in the pottery, tanning, furniture, painting, paper and chemical industries.

In 1909 and in 1915, two important steps were taken in order to encourage industry and stimulate investors by abolishing tax and customs duties on imported raw materials, machinery and fuel. In this period, the concepts and institutions of national planning and Government control were first developed, but the war between 1908 - 1921 destroyed most of the existing plants. After World War I and the War of Independence, some important principles of economic activity were laid down at the Economic Congress in İzmir in 1923. They were:

(i) Promotion of legislation for the encouragement of industry, and, in particular, changes in the customs tariff according to the development needs of national industry.

(ii) Favourable inland and sea transport rates for local products.

(iii) Technical instruction, education and training of engineers for industry.

In the field of industrial legislation some steps were taken in 1924 and in 1925. In 1924 raw materials for export industries were exempted from duties by Law. The Bank for Industry and Mining was established in 1925. In the same year (1925) the Government imposed by decree on State

institutions and those assisted by the State, the duty of buying local produce if its price did not exceed foreign products by more than 10 per cent. The industry was encouraged by the Law for the Encouragement of Industry in 1927.

The first article of this Law lays down the primary conditions of the eligibility of the enterprises concerned:

"For the purposes of the present Law, industrial enterprises are plants devised, permanently or periodically, for mass production with the assistance of machines, tools or mechanical equipment by the processing and appreciation of all or a part of goods, materials and energy". (Hershlag, 1968, 53).

In the second article of the Law the enterprises which would enjoy the benefits are defined more precisely. The enterprises were divided into four categories. However, only the first category would enjoy all the facilities and concessions granted by the Law, the rest of the categories being granted only some of them. The enterprises which were to profit by the law undertook to start production within three years after receiving their licences. Theemployment of the Turkish citizens and imposed restrictions on the admission of foreign labour to the encouraged enterprises was shown in another Article. The facilities granted by this Law, although resembling the previous partial laws were much more comprehensive, as summarised in the following cases:

(i) Establishments approved by the Government and recommended by the Ministry of Commerce will be granted land free of charge up to 10 hectares. If need be, land may be expropriated for this purpose by a special law or compulsorily purchased from another authority, e.g., a municipality.

(ii) Decrees may be issued to exempt enterprises from telegraph or telephone charges on lines between various buildings of the enterprise or between them and the outside world.

(iii) Installation of these lines as well as of motor power throughout State areas will be free of charge.

(iv) The enterprises, including buildings and land will be exempt from the following taxes:

(a) Land tax

(b) Immovable property tax

(c) Profit tax

(d) Surtaxes on all previous taxes due to provinces and municipalities

(e) Supplementary personal tax

(f) Licence fees due to municipalities for construction of steam engines, motors and stills.

(v) Bonds and securities of companies established for industrial entrepreneurship will be exempt from stamp duties.

(vi) Materials needed for the construction of the enterprises, and accordingly specified, will attract no custom duties in so far as they are unobtainable in the country, or cannot be produced locally on an adequate scale. Such machinery, equipment and building materials will also be applied to other products and raw materials by special Government decree.

(vii) By a special Government decision the industrial enterprise may be granted a subsidy of up to 10 per cent of the value of its annual output.

(viii) The Government may, upon the recommendation of the Ministry of Commerce, issue permits for reducing the prices of salt, alcohol and explosive materials, or may grant premiums.

(ix) Government institutions, municipalities, companies and enterprises benefitting from the Law are bound to purchase the products of the encouraged enterprises, if the local quality and quantity are adequate, rather than foreign products, even if the price of the local product is up to 10 per cent higher.

The Law for the Encouragement of Industry reflected the Government's wish to implement its own declarations and the resolutions of the Congress of İzmir concerning the encouragement of private initiative, Government intervention being restricted to those cases where private activity had ceased.

According to the 1927 Census, 155 plants employed more than 100 workers each. Only 2,822 out of 65,245 enterprises employed motor power which totalled only 163,548 h.p. To give an idea of the fast evolution of Turkish industry in a short period we may compare the following figures: During the Ottoman Empire there were 16,975 industrial workers, whereas in 1921 the number of industrial workers increased to 76,216 and in 1927 to 256,855, and this in Turkey alone.

The structure of industry showed the characteristics of an early stage of industrialisation. In 1927 the enterprises were concentrated 44.3 per cent in food processing and 23.8 per cent in textiles. The crucial handicap of the emerging industry was the lack of adequate initial capital. The increasing output during the Republican Era was due partly to the Law's favourable impact on private industry and partly to a growing direct Governmental activity in certain industrial enterprises. Moreover, the Government intervention saved the silk industry, which in 1914 had been one of the four most important in the world, but was almost completely destroyed as a result of the wars. Thanks to the Governmental help this branch of industry began to recover in 1923. In Turkey, no sugar industry existed until the Government took action in this branch of industry in 1926. In accordance with production plans the area of sugar beet cultivation increased and the first sugar factory (in accordance with location theory) was erected near the sugar beet fields by the Government. A second sugar factory was established shortly afterwards by the Government in Thrace. Simultaneously, a Government

monopoly was created in sugar imports. Thus the Government acquired almost complete control over this industry. As a result of increasing local supply, sugar imports gradually decreased and completely disappeared in 1935.

During the Etatist period in the 1930's, the very structure of the Turkish Political system facilitated the assumption of the leading economic role by the State. The affairs of the country were being conducted by a strong and authoritative Government, its actions directed by the only party that relied on a widespread and centralised organisation. The regime still wanted to remain loyal to the capitalist system and to the principles of free enterprise and private property.

The leaders of Turkey, Atatürk and İnönü formulated the new policies to be later included in the Programme of the party and the Constitution of the Republic. İnönü in his speech[1], pointed out the need for greater State activity in the economic field in 1930. In 1931, Atatürk stated:

"Although considering individual enterprise and effort as a basic idea, we desire to have the Government take an active interest,especially in the economic field, and to operate as far as possible in matters that lend themselves to the safeguarding of vital and general interests, or in short, that the Government ensures the welfare of the nation and the prosperity of the State". (Hershlag, 1968, 69).

In 1931, with Atatürk's proposals, the Third Congress of the Republican Party accepted a programme dealing in three of its eight sections with the central economic problems of the country. This programme proclaimed that although the Party remained basically loyal to the principle of private enterprise and activity, the urgent needs of the country in the economic sphere called for the active intervention of the State.

The world depression of 1929 hit this set of developments hard and Turkey turned, to a degree, to the Soviet Union which was relatively stable, as a model and for assistance. In 1933, Turkey became one of the first countries which prepared a development plan, with the State itself as

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[1] Speech given in Sivas in 1930.

principal entrepreneur. The aim of this first plan was to overcome the difficulties of the international economic crises and to create a favourable climate for business.

The Government controlled the chemicals, ceramics, iron and steel, paper and cellulose, sulphur, copper mining, cotton, woollen industries and so on, through the two large Government Banks (Sümerbank, Etibank) as well as salt, tobacco, alcoholic products, matches and explosives. However, Atatürk consciously avoided locking the nation into a rigid system of permanent State ownership and management of industry. His intention was to leave the way open to a private entrepreneur for industrial activity. One of the most important considerations was the weakness of private capital.

Atatürk identified Etatism by his definition in 1935 at the opening of the İzmir Fair:

"Turkish Etatism is not a system which borrows ideas that have constantly been harped on by socialist theoreticians in the 19th century; it is a system peculiar to Turkey, which has evolved from the principle of the private activity of the individual, but places on the State responsibility for the national economy, with consideration of the needs of a great nation and a large country, and of many things that have not been done so far. The Turkish Republican State wanted to do quickly things which had not been done throughout the centuries in the Turkish motherland by individual or private activity; and as we realised, it succeeded in doing this in a short time. This road which we have followed is, as we have seen, a system different from liberalism". (Hershlag, 1968, 71).

The aims of the Second Five Year Industrial Plan were thus defined: In accordance with the Republican Regime, which acts and activates the principles based on etatism in economic policy as implemented by us are: to act and to activate. Private enterprise and capital are included within the framework of activation. The private economy continued to exist alongside the growing and expanding State economy chiefly through inertia and because

of a reluctance on the part of the State to decide between State capitalism or State Socialism. Turkey, with her Etatist regime, which handed over large branches of the economy to the State, but at the same time preserved spheres of economic activity for private capital and kept private ownership in town and country intact, has largely assumed State Capitalism. Establishment of a network of monopolies and State Banks, formation of industrial enterprises and marketing companies owned by the State, along with nationalisation of public services and mines proved the nearly complete abandonment of the non-intervention policy in industrial and commercial activities by the Government. As Atatürk emphasised at the Fourth Congress of the Republican Party in 1935, Turkish Etatism should be considered as follows:

"Although we consider private work and activity a basic idea, it is one of our main principles to invest the State actively in matters where the general and vital interests of the nation are in question, especially in the economic field, in order to lead the nation and the country to prosperity in as short a time as possible". (Hershlag, 1968, 72).

The inability of private enterprise alone to attain the rapid development taken as a target by the Republican Government of Turkey has created the necessity for the public sector to make direct investments in production activities (D.P.T., 1969, 111); so, Turkish Etatism should be different from that Etatism which begins where private enterprise leaves off.

As a matter of fact, Turkey was one of the first countries in the world to implement widely the mixed economy system. This system, however, was not created in Turkey under doctrinal considerations but came about as a result of the need for rapid development and of the necessity to reach quickly the level of contemporary civilisation by making use of all available resources. Nevertheless, in spite of the Encouragement given by the Law (1927), at the beginning of the 1930's the insufficiently available savings needed for development and the lack of entrepreneurs capable of directing these limited savings into productive investments forced the Government to

participate in economic life not only in the capacity of regulating economic activities but in the capacity of making direct investments in the basic production oriented industries. These means were to use modern methods of production and exploitation of domestic resources by local industry, and to encourage agriculture in order to increase the purchasing power of the largest class of the population. Basic industries in the fields of mining and metallurgy and the first installation of considerable size built to meet the basic food and clothing requirements of the prople were established by the State. However, conditions providing the possibility to transfer these installations to private enterprise in the course of time, were introduced under Law 3460 which was brought into force in 1938 (D.P.T. 1969).

So, the Turkish Etatism may be defined as Professor Bernard Lewis did in his book "Etatism means the emergence of the State as a pioneer and director of industrial activity, in the interests of national development and national defence, in a country where private enterprise and capital were too weak to do anything effective". (Hershlag, 1968, 73).

A gradual extension of enterprises, their dispersal throughout the country, and a central scheme covering both State and Private enterprise was shown as an aim for the industrial development at the Fourth Congress of the Republican People's Party in the 1930's. In the same decade when the First Five Year Plan came into effect, the two most important aims appeared to be:

(a) Preference for the industrialisation of the country over other areas of economic activity.

(b) State entrepreneurship in establishing the major part of new industries and controlling them through its financial institutions and agencies.

The acceleration of the process of industrialisation by channelling resources according to a preconceived development plan became entirely dependent on Government initiative and leadership. The Government aimed at the stimulation of an internal market for local raw materials by establishing new

industries because raw material prices had been affected by the fall in world prices following the World Depression. Military considerations were, on the other hand, an important additional factor, since considerable sums had to be set aside for security purposes; they also affected the lines of investment particularly with regard to the Second Five Year Plan.

The Laws of 1936 and 1937 granted the Government the right to examine the expenses of private establishments and to fix prices. The intention of these laws could be to prevent open competition with Government projects by private establishments.

In the light of the above explanations, the Government aimed at the establishment of the following industries at the following places:

(i) Chemical industry

(a) Artificial silk at Gemlik (Marmara region)

(b) Semicoke at Zonguldak

(c) Attar of Roses at İsparta

(d) Sulphuric acid at İzmit

(e) Superphosphates at İzmit

(f) Chlorine and caustic soda at İzmit

(ii) Iron and steel industry at Karabük (As a matter of fact, military considerations played an important role in the Government location decision of this project.)

(iii) Earthenware industry

(a) Ceramics at Kütahya

(b) Glass and bottles at Paşabahçe (İstanbul)

(iv) Paper and cellulose at İzmit

(v) Sulphur industry at Keçiborlu

(vi) Sponge industry at Bodrum

(vii) Cotton textiles industries at Bakirköy (İstanbul), Kayseri Ereğli (Konya), Nazilli and Malatya for yarn and cotton fabric, and Iğdir for yarn.

(viii) Worsted industry at Bursa

(ix) Hemp industry at Kastamonu

The important reasons for these locations of industries can be summarised as follows:

(a) To locate industry mainly on local raw materials.

(b) To disperse industrial centres, for strategic and economic reasons, by bringing industry to agricultural sectors, providing alternative employment for farmers, locating processing plants in the vicinity of raw materials.

(c) Extensive development of the textile industry in order to meet local demand, save foreign currency and eventually export.

(d) Particular emphasis on the production of consumer goods, without neglecting the necessary measures for the planned development of the sector of producer and capital goods. In 1936, the Second Five Year Plan was submitted to the Prime Minister which dealt with the development of several major sectors.

As Celal Bayar, who was minister of economy stressed in his introductory note, the implementation of this ambitious scheme did not seem compatible with the methods of a liberal regime. He also proposed to grant autonomy to State Enterprises in order to increase their efficiency through decentralisation. However, increased investments in industry by the Government during this period until World War II resulted in a significant growth in industrial output.

The Second Five Year Plan's main tasks were defined by the planners as follows:

"As in the First Plan, in this Plan, too, account has been taken of industry which is compatible with the economic structure and conditions (of the country). It calls for large capital outlay and techniques, and is based on local raw materials". (Hershlag, 1968, 82).

At a Government meeting in 1938 the following programme was accepted:

(i) Exploitation of the mines and natural resources of the country and the sea.

(ii) Establishment of heavy industry based on local raw materials, and accordingly the development of the Zonguldak-Karabük area on the following lines: improvements in the railway network and transportation in general, construction of a modern port for the export of steel and coal, erection of an electric power station near Zonguldak, and establishment of a cement factory in Karabük.

(iii) Industrialisation of Eastern Turkey by establishing a yarn factory in Erzurum, a cement factory in Sivas, two sugar factories and a meat packing industry, and improvement of the Port at Trabzon.

(iv) Establishment of an agricultural equipment factory at Ankara.

(v) Establishment of jute-works in Anatolia.

(vi) Construction of a power station and synthetic oil works in Kütahya.

(vii) Meat canning factory in Bursa.

(viii) Sugar refinery.

(ix) Aluminium factory.

(x) Housing projects.

There was a difference between the two Plans: the First Five Year Plan was chiefly concerned with the production of consumer goods whereas the Second Five Year Plan aimed mainly at the development of producer and capital goods.

On the eve of World War II, heavy industry, the dispersion of industry throughout various parts of the country, and the developments of ports and the navy were intended to serve security purposes of the country.

The Karabük iron and steel plant can be taken as a good example of Government influence upon location decision in the late 1930's. The location of Karabük plant has often been questioned; although the reserves of coking coal are nearby, the iron ore of Divrik is quite far and not of a high grade (Pounds, 1968, 115). The location of the iron and steel industry was to be determined by proximity to the coalfields, taking into account strategic

considerations as well; so, as the centre of the iron and steel industry, Karabük was chosen. If strategic considerations were not important some other place could have been chosen instead of Karabük[1]. Construction started in 1937 and was completed in 1939. During the 1940's several criticisms were made of the project which to Turkey symbolised economic independence on a high industrial level and to its critics the failure of planning, etatism and an excessive striving for industrialisation. Strategic considerations led to the location of the plant at a distance from Zonguldak itself which is the source of the coal supply and a shipment point on the Black Sea. There is a distance, therefore, of about 100 kms between Zonguldak and Karabük and about 1,000 kms between Divrik (iron ore sources) and Karabük. Apart from all this, the production of Karabük exceeded the actual needs of the country, but under these circumstances the plant suffered from inefficiency and loss.

It is evident from the above explanation that in this period the Government influence on the foundations of industry was overwhelming due to the weakness of the private sector, the lack of capital and the necessity to organise institutions for development, like Banks.

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(1) For more detail on this matter see:

(a) Pounds, N.J. (1968), The Geography of Iron and Steel, Hutchinson & Co. Ltd.

(b) Tümertekin, E. (1955), "Türkiye'nin Demir Çelik Sanayi, İstanbul, Baha Matbaasi.

(c) Tümertekin, E. (1960), Sanayi Coğrafyasi, İstanbul, Baha Matbaasi.

II) World War II Period

In Turkey, Etatism was always a sort of emergency regime, employed as the best means for achieving political and economic independence and military security. During World War II not only Turkey but other countries as well resorted to far-reaching Governmental intervention in all economic activities. The transition from a peace to a war economy in Turkey was much easier than in many other countries, owing to the existence of the emergency measures of Etatism already during the 1930's. Towards the end of the 1930's and the beginning of the 1940's, Turkey's contact with France and Britain resulted in economic agrements and western loans to her, and as a result of this, in more liberal international and domestic economic policies. In this period, the Ministry of National Economy's direct control of State industry increased, but this was meant to increase efficiency and promote reliance on competitive and commercial principles rather than to strengthen the Etatist regime. The chance was given to private capital for participation.

But this short period was soon followed by a period of new controls which was necessitated by the growing strain on financial resources and manpower caused by high military expenditure and the mobilisation of about one million people into military service.

In the Turkish economy, State monopolies, ownership in industry and services and substantial control in various fields of economic activity were established. The government took control either directly or via its economic agencies, over industrial plants and training centres, ports, large banks, communications and mines.

The New National Protection Law (18.1.1940) empowered the Government to take over complete control of the national economy in case of war or general mobilisation. Additional to this, the new Law granted powers to the Government for the fixing of prices, the seizure of property and compulsory labour. Moreover, it was the Government's right to decide whether the time had come for total or partial application of the Law. Therefore, during World War II, the whole economy was run by the State because of the potential war danger.

III) 1946 to the Present Day

After World War II, the Third Five Year Plan prepared in 1946 differed in two important points from the two previous plans of the 1930's.

(i) This Plan implied a much greater measure of integration of agriculture within the general scheme.

(ii) The present Five Year Plan, unlike the former two plans, envisaged a large degree of foreign financial aid.

Towards the end of the 1940's several combined factors effected important changes in Turkey's attitude towards its economic system. Important changes also took place in the political structure of the country after assurances of forthcoming liberalisation measures were made by İnönü. In 1946 the Democratic Party emerged officially and gained some success in the Parliamentary elections, and eventually, in 1950, after amendments to the election law were issued, the Democratic Party won a large majority in the newly elected Parliament. They formed the new Government. A Law for the encouragement of Foreign investment was passed in 1947 and amendments to this Law were made in 1950 and 1951. In 1954 the new Government passed a Law which significantly increased Government support of foreign investments. The establishment of the Bank for Industrial Development (Türkiye Sanayi Kalkinma Bankasi) in 1950, explicitly and exclusively devised to aid private industry, was effected. Although its execution belongs to the Democratic Government, this scheme was prepared by the Republican Government. This shows the intention of the Republican Government to remove many restrictions, imposed by the Etatist regime in the first period and during World War II, on the economic life of the country and on private and foreign initiative, and to embark on policies leading to a more liberal national economy within a wider international framework. In this period, Marshall Aid influenced Turkish economic ideas and policies as well as it became an outstanding factor on account of its general economic and financial impact, apart from local measures.

One of the major targets of this period was to increase the share of the

private entrepreneur in economic activities, to reduce Government intervention and ownership in industry, and to rely on more market decision and price mechanism in both local and foreign markets.

The Democrats in their election campaign attacked the Etatist system liberally and stated in their programme:

"In order to accelerate the development of private enterprise and the increase of national wealth, it is necessary to put an end once and for all, to the policy which results in the freezing or wasting of national resources by the State in unproductive fields of activity". (Hershlag, 1968, 138).

The official economic policy of the Democratic Party was submitted by the Prime Minister on 29 May 1950. According to this programme, the State had become interventionist, capitalistic, bureaucratic and monopolistic, thus paralysing business and productive life. Although the Democrats criticised the Etatist regime before and after election, they did not propose to abolish State economic activity completely, they only wished to restrict it to certain fields in order to encourage private initiative in other sectors. The Democrats promised a gradual and extensive transfer of State enterprises to private hands. The Finance Minister of the Democratic Party explained the difference between the Etatist and the new period in his budget speech in 1955 (Ibid):

"Your Government has undertaken services of this country with a conviction that in a land where the economic resources have been so heavily neglected, the realisation of economic development, the increase of gross national product and expansion of the volume of employment and production can be best achieved by allocating a great portion of annual national income to production and capital investment and by encouraging and strengthening private enterprise on a large scale. It is for this reason that the barren Etatist policy practised with rigidity up to 1950 has been abandoned and in turn large capital investments that would eventually open the way to production of our rich natural resources have been undertaken one by one, the investments

of our citizens in different branches of production and into new enterprise have been encouraged and strengthened by taking advantage of every means and opportunity".

One of the important steps was taken to establish a Turkish Oil Company (T.P.A.O.), sponsored by the Government and private enterprise to manage the oilfields of Ramandag and Garzan and the refinery built at Batman with an initial capital of 150 million T.L.

Etatism has been considered by the Democratic Government as the central financing of development through the national budget combined with State control and ownership of vital economic resources, including large sectors of industry and the subordination of the private interests of producers and consumers to considerations of accelerating the pace of national economic development.

The Democratic Government period was different from the pre-war system in two important respects. They were:

(i) Private enterprise gained recognition side by side with State enterprise not only as a tolerated economic phenomenon, but as a supported and stimulated sector of the national economy, in contradiction to the period of Etatism.

(ii) More emphasis was placed on agricultural development, which offset the former hypertrophy of industrialisation.

One of the most important factors of the development of Turkish Industry was based, in addition to general national and security factors, on the relatively rapid increase of the urban population in Turkey which brought about a rise in the proportion of urban population from 25 per cent of the total population in 1950, to 35.9 per cent in 1970 (Resmi Gazete, 8.12.1972, 47). This change, of course, called for further efforts to create new and adequate jobs in secondary and tertiary occupations for a growing labour reserve, in particular in the large cities, such as Istanbul, Ankara, Adana, Izmit, and Adapazan, the population of which had increased twofold or even more since 1950.

As a matter of fact, according to official estimates, while total population increased annually by 2.8 per cent from 1950 to 1955, and by 2.9 per cent from 1955 to 1960, and rural population by 1.8 per cent and 2.0 per cent respectively, urban population grew by 5.7 per cent and 5.0 per cent during the respective period. (Hershlag, 1968, 170).

After the 1950's, the Government of 1960 reintroduced planning as a guiding principle of economic policies. In September 1960 the Law concerning the Establishment of the State Planning Organisation was issued. The new State Planning Organisation (Devlet Planlama Teşkilati, D.P.T.), was to be an advisory body under the authority of the Prime Minister.

In the objectives and the Strategy of the Plan, the High Planning Council (Yüksek Planlama Kurulu) laid down the general principles of planning, the outlines of 15 years perspective programming and 5 year plan targets and instruments. The target set for the annual rate of growth is 7.0 per cent. In 1963, 1964 and in 1965 the rates of industrial growth were 8.5 per cent, 8.8 per cent, and 8.9 per cent respectively. (Hershlag, 1968, 196). As a matter of fact, in 1963-1965 industrial production increased at a rapid rate with the maturation of previous investments and growing demands on the heels of rising real income; particular growth occurred in steel, oil and textiles.

In this period the private sector was encouraged by Laws. According to a Law passed on 19.2.1963 and Law number 202 the Government accepted that the entrepreneurs in general will pay no tax on 30 per cent of their profits, and for entrepreneurs in the agricultural sector this amount will be 40 percent, and for investors in less-developed regions it will be as high as 50 per cent. (D.P.T., 1970[B], 2).

The Law number 474, passed on 14.5.1964, granted, for certain goods that are imported and which the Government believes necessary for investment purposes within the long range plans, that the custom tax, and various other taxes, can be paid by the importer in five equal instalments (D.P.T., 1970[B], 2).

In the Second Five Year Plan Period (1968-1972) due to historical and

traditional causes, the Public sector in Turkey occupied a significant place in the economy. Although the relative share of public investments fell from 53.3 per cent in 1968 to 50.7 per cent in 1972 the important role of the public sector in the development of the economy was even to continue during the Third Five Year Plan Period (D.P.T., 1969, 82). During the Second Plan Period (1968-1972) public investments continued to retain their importance in the development of the economy. These investments registered an average rate of increase of 10.3 per cent per annum and rose from 9,000 million Turkish Lira in 1967 to 14,700 million Turkish Lira in 1972. In this period the relative share of public investment in total public expenditure increased from 38.6 per cent to 39.3 per cent (Ibid).

The investing agencies within the public sector are the General and Annexed Budget Administration, Local Administrations and Organisations operating under Revolving Funds, and the State enterprises. The Government realised infrastructural investments, in particular through appropriations made from the General and Annexed Budgets, while the investments of State Economic Enterprises and of organisations operating under Revolving Funds would be directed towards the production of goods and services. Local administrations on the other hand made investments directed towards the quantitative and qualitative improvement of local services. Achievement of the general development objectives depends upon the realisation of the Public sector expenditures. But there are organisational difficulties that greatly restrict development and efficiency in the industrial sector of public investments. The coordination and organisational difficulties of public enterprises producing industrial goods have not been eliminated. To increase the productivity of public industrial enterprises that were established through large investments, specialisation in production, development of technical services and efficiency in marketing activities are necessary.

In the Second Plan Period important steps were taken in order to encourage the Private Sector. The Government decided on 31.8.1970, and by the decision number 7/1198, to enforce selective credit system, which meant that although the investor had to pay 40 per cent of the amount of the money needed for

certain investments the rest is given by the Government as credits with a certain amount of interest; in less developed regions the percentage which must be provided by the investors would be 30 per cent and the credit given by the Government would have an interest rate of 2 per cent below the usual rate (D.P.T., 1970, 18).

After this application of the Law for the Encouragement of Private Enterprise by the Government, investments have been made by the private sector in several branches of industry. But in spite of all the Government's efforts to locate industries in less developed regions in the country, 64.6 per cent (42 out of 65 investments) of all investments have been made by the private investors in the Marmara Region where the most industrialised region in the country is. Second to Marmara comes Akdeniz (Mediterranean) Region with its 8 investments (12.4 per cent). Central Anatolia, Aegean, Black Sea and Eastern Anatolia follow with 9.2 per cent (6); 6.1 per cent (4); 4.6 per cent (3); 3.1 per cent (2) respectively(1).

However, there was no investment in the less developed south-eastern Anatolia by private investors. For this reason, according to the Third Five Year Plan (1973-1977), less developed regions will be given priority with respect to new industrial projects. The whole, or most of, the expenses for these projects will be financed by the State or by State agencies. At the same time encouragement will be given to private investors by the State to direct their investments to these regions (D.P.T., 1973, 902).

In the Third Plan Period, as the Prime Minister of Turkey quoted, if the private sector is interested in machine producing, metal producing and chemical industry, they will be benefitted by the new Law of Encouragement of Industry and the Government will turn for industrial investment to less developed regions of the country and some other industries for national defence which both will require huge investments (D.P.T., 1973, 6).

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(1) For our calculations data have been obtained from D.P.T. İkinci Beş Yillik Planda Türk Özel Sektörü, İstanbul, 1970.

Conclusion

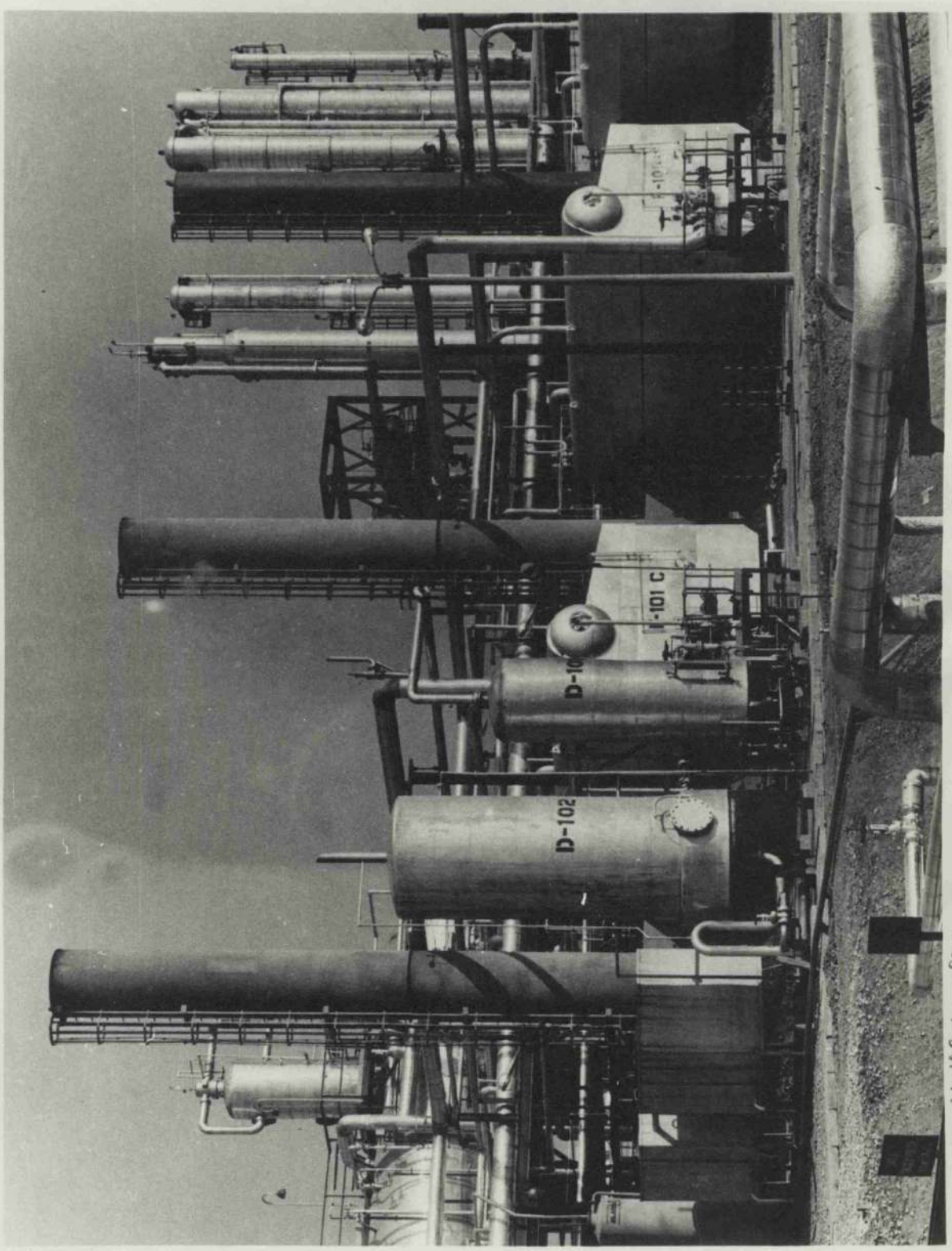
In this chapter, a picture has been drawn of the geographical and industrial background of Turkey. The theories of industrial location and the Government and industrial location in Turkey from the foundation of the Republic to the present day have also been explained.

As a result of climatic and physical conditions, the coastal part of the country is more attractive for population and has more important economic activity than the inland part.

The industry, like the population, may be concentrated or dispersed according to its circumstances. In Turkey, from the foundation of the Republic to the present day, industrial locations have been affected by the Government either directly or indirectly because of the weakness of private capital. The State emerged as a pioneer and director of industrial activity in the interests of national development and national defence. In the second chapter, the function of the petro-chemical industry and the background of this industry in Turkey will be explained.

CHAPTER II

THE PETRO-CHEMICAL INDUSTRY



A View of the Yarimca Petro-Chemical Complex

THE PETRO-CHEMICAL INDUSTRY

1. DEFINITION OF PETRO-CHEMISTRY

Petroleum chemical manufacture is one part of the chemical industry which produces chemical products from raw materials of petroleum origin. As the name implies, petro-chemicals embrace both the petroleum and the chemical industries.

A. PETROLEUM

I) Definition of Petroleum

The literal meaning of the word petroleum is oil from rock, which indicates that it is found in the earth's crust. Crude oil is found in the reservoir in association with salt water and gas. The oil and gas occupy the upper part of the reservoir and below there is a considerable volume of salt water. This water bearing section of the reservoir which is under pressure is known as the aquifer. The oil itself, when under pressure, contains an appreciable quantity of dissolved gas. The quantity of gas will depend upon the pressure and temperature in the reservoir. It is also possible to find accumulations of gas which are not associated with oil, as is the case in the North Sea (B.P., 1970, 108).

II) Features of Petroleum

The compounds in crude oils are essentially hydrocarbons or substituted hydrocarbons in which the major elements are carbon at 85 - 90 per cent and hydrogen at 10 - 14 per cent, allied with three minor elements: sulphur, from 0.2 per cent up to 2 - 3 per cent and, rarely, up to 7 per cent; nitrogen mostly below 0.1 per cent, but can be up to 2 per cent; and oxygen, up to 1.5 per cent. Crude oils also generally contain trace amounts of such elements as vanadium and nickel, and may also be contaminated with chlorine, arsenic, lead etc.

Crudes vary considerably in weight, but all are lighter than water. The American Petroleum Institute (API) system is confined mainly to two digit whole

numbers in which the larger number designates the lighter, and usually more valuable crudes. Crudes are also distinguished from one another in terms of the predominance of certain kinds of hydrocarbons or the nature of the base: paraffin, asphalt or mixed base. The latter accounts for about 75 per cent of world petroleum reserves. Petroleum and natural gas having the characteristic odour of hydrogen sulphide are referred to as sour: sour crude and sour gas.

III) History of Petroleum

For thousands of years man has known about petroleum. Before 3,000 B.C. the Sumerians were exploiting the asphalt seepages near Hit and mining the rock asphalt for use in building materials in treeless and rockless Mesopotamia. Mixed with sand and fibres it served as a cement for securing the walls of the hanging gardens of Babylon and Ziggurats, for paving the streets and temple roads, for paints, for water-proofing wickerware, for sharp weapons and as medicine for an amazing range of human ills. By the time the Persians invaded the Land of the Two Rivers about 600 B.C. the use of bitumen had declined but it was still in use for caulking ships. Later the Red Indians used it as war paint, and in the eighteenth century the French began using it as a lubricant.

The European oil industry is historically slightly older than the American. But not until 1857 was petroleum mined commercially. In 1857, in Ploesti (Rumania), 2,000 barrels of petroleum was yielded and marketed in the surrounding hinterland. Although petroleum was being exploited commercially in Rumania, Russia, Burma and Canada, its history may be dated from 1859 when Drake's well was drilled near Titusville, Pennsylvania. The techniques of drilling, pipelining and refining developed in Western Pennsylvania were soon utilised in Rumania and Russia and afterwards in the rest of the world.

Oil is found in many countries; some produce large quantities, others only very small amounts; in some countries no oil can be found. There are six main areas where oil is found in large quantities:

(i) The Middle East

(ii) North America (U.S.A., Canada)

(iii) The Caribbean (Venezuela, Colombia, Trinidad)

(iv) Russia

(v) Africa (Libya, Algeria, Nigeria)

(vi) The Far East (chiefly Indonesia)

At the present time nearly 62 percent of the world's oil reserves lie in the Middle East; 7.3 percent in North Africa; about 8.6 percent is believed to be within the Communist bloc; about 6.7 percent is in the South American sub-continent, the Caribbean and Mexico; 3 percent lies in the Far East and Oceania. The rest of the world reserves (about 10%) lie in the North American sub-continent, that is, in the U.S.A. and Canada. At the present time over 50 countries are producing petroleum.

OIL PRODUCING COUNTRIES IN THE WORLD (1972)

(Images Economiques du Monde, 1973, p. 55-56)

Country	Metric Ton
U.S.A.	467,448,000
U.S.S.R.	393,600,000
Saudi Arabia	285,913,000
Iran	248,277,000
Venezuela	169,008,000
Kuwait	151,152,000
Libya	106,272,000
Nigeria	89,777,000
Canada	87,500,000
Iraq	67,000,000
Indonesia	54,000,000

(cont'd.)

(Cont'd.)

Country	Metric Ton
Algeria	50,048,000
Abu Dhabi	50,000,000
China	42,000,000
Neutral Zone	30,300,000
Qatar	23,256,000
Mexico	22,600,000
Argentina	22,205,000
Rumania	14,128,000
Oman	14,100,000
Egypt	10,632,000
Colombia	10,143,000
Brazil	8,259,000
India	7,411,000
Trinidad	7,400,000
West Germany	7,104,000
Gabon	6,304,000
Bahrain	3,500,000
Turkey	3,408,000
Austria	2,472,000
France	1,484,000

The U.S.A. and Russia both have large indigenous resources of oil and a large domestic market. Except for the U.S.A. and Russia, most of the major producers are able to consume little of their own oil. On the other hand, the industrialised countries with a high demand, such as those of Europe, have comparatively few oil fields. Therefore most of the oil produced is consumed outside its country of origin and enters into international trade. About one-third of all the shipping afloat in terms of tonnage, though not in the number of hulls, consists of oil tankers.

OIL DEMAND IN SELECTED COUNTRIES (1969)

(B.P., 1970, p. 508)

	Country	Metric Ton
1.	U.S.A.	606,100,000
2.	Japan	141,080,000
3.	West Germany	104,280,000
4.	United Kingdom	83,270,000
5.	France	69,490,000
6.	Italy	63,150,000
7.	Canada	61,920,000
8.	Sweden	23,880,000
9.	Netherlands	21,420,000
10.	Spain	20,300,000
11.	Belgium - Luxembourg	19,690,000
12.	Australia	18,520,000
13.	India	17,150,000
14.	Switzerland	10,730,000
15.	Turkey (Resmi Gazete, 11.1.1971, p.149)	9,334,000 (1971)
16.	Finland	8,740,000
17.	Austria	7,910,000
18.	Norway	5,960,000
19.	Greece	5,450,000
20.	Yugoslavia	4,970,000

The oil industry is very highly capitalised. It is characteristic of industries requiring such high capital investment that unit costs decrease rapidly as the scale of operations rises and that plant and equipment must be fully employed. These factors have tended to encourage the growth of very large companies, or company groups. That is, they have their own resources of production, transport and refining, petro-chemical plant and their own marketing outlets.

Outside Soviet Russia and her sphere, 8 giant integrated oil companies are responsible for over 80 per cent of oil production, 71 per cent of refining capacity, 35 per cent of tanker ownership and about 70 per cent of the distribution and marketing of oil products.

The 8 giant integrated oil companies are:

1.	Standard Oil of New Jersey (Esso)	(American)
2.	The Royal Dutch/Shell Group	(Anglo-Dutch)
3.	Texas Oil (TEXACO)	(American)
4.	Gulf Oil	(American)
5.	Standard Oil of California	(American)
6.	Standard Oil of New York (Socony-Mobil)	(American)
7.	British Petroleum	(British)
8.	Compagne Francaise Des Petroles	(French)

The oil industry supplies petrol from the pump for cars, fuel oil for boilers, oils and greases for lubrications, bitumen for roads, and synthetic rubber and plastics in many forms, so many facets of our lives are dependent upon it, and over one third of the primary energy essential to modern civilisation is supplied by it. Its business is conducted by some of the largest industrial organisations in the world, as well as by thousands of very much smaller ones. And, yet, before the middle of the last century, it did not exist.

B. CHEMISTRY

I) Raw Material of Chemistry

The chemical industry is very ancient. It is based on a large variety of sources of raw materials. Some of them are fats, oils (of vegetable and animal origin), salt, metalliferous ores, water, atmosphere, coal and petroleum.

Chemistry can be divided into two main categories:

(a) Inorganic chemistry which is based on inorganic resources, such as minerals (iron, copper, silver etc.).

(b) Organic chemistry which is based on organic resources such as coal and petroleum which contain a mixture of carbon and hydrogen.

II) Coal and Petroleum: as a Raw Material of Chemistry

Recently petroleum has been used very widely as a raw material in the chemical industry. Petroleum seems to be more important than coal. In practice, coal contains about 75 per cent, by weight, of carbon; petroleum contains a higher percentage than coal, hence it gives a high combustion value. The appearance of petroleum as a significant source of chemicals dates back to the middle 1920's. The petro-chemical industry covers the production of chemicals derived from petroleum and the products produced in this manner are called petro-chemical products.

Petro-chemical products which are obtained by a variety of methods are consumed for the following products:

Plastics
Synthetic Rubbers
Synthetic Detergents
Synthetic Fibres
Insecticides
Paints
Various Industrial Alcohols
Carbon Black
Synthetic Fertilisers

and in other similar areas.

2. CREATION OF THE PETRO-CHEMICAL INDUSTRY

The history of petro-chemistry is divided into three main periods, characterised at the same time by the nature of the manufacture, the rhythm of the development and the geographical area of the latter.

A. THE PETRO-CHEMICAL INDUSTRY BETWEEN TWO WARS

In 1920, petro-chemistry was still represented in the world only by a production of carbon black of about 20,000 tons, located solely in the U.S.A. From this date the preparation of organic products taken from petroleum or natural gas started to progress slowly.

In 1920, Standard Oil of New Jersey erected in Bayway (New Jersey) the first industrial plant of isopropanol by hydrotation of propylene. Soon afterwards carbon and carbide began to get the classical derivatives especially glycol from petroleum ethylene. Towards 1928 the Cities Service directly obtained methanol by oxidation of natural gas. In 1930 Shell began using hydrogen of natural gas for the synthesis of ammoniac in Pittsburg (California). Polyethylene was prepared in the laboratory in 1935, and three years later semi-industrial production was begun. At the same time the chemistry of butylene enters the scene with the manufacture of methylethyl-cetone and above all, with that of butadiene, which was associated with the first attempts at obtaining synthetic rubber from a petroleum origin. Butyl was discovered in 1937 in the Standard Oil of New Jersey laboratories; two years later it was prepared in a pilot factory.

The bases have therefore been established in this period for the wide development which petro-chemistry soon exploited. But everywhere in the world it was, on the contrary, the chemistry of carbon which between 1920 and 1940 grew the most in answer to the demand for organic products and ammoniac. On the eve of the war, German carbo-chemistry made an important breakthrough into most of the sections of that which American chemistry was to develop after 1940, starting from petroleum and natural gas. Synthetic rubber was already produced in large tonnages in Germany and the U.S.S.R.

However, petro-chemistry remains located chiefly in the U.S.A. where its production only reached 600,000 tons in 1940. The only products it released on to the market in important quantities were carbon black (260,000 tons) and glycol. It's progress is related to the development of

the car. The first attempts at manufacturing synthetic rubber just before the war reinforced again this orientation of American petro-chemistry.

B. THE PETRO-CHEMICAL INDUSTRY DURING WORLD WAR II

The war provoked the U.S.A. to a vigorous acceleration in the rhythm of the development of petro-chemistry, especially after 1942. The production passed from 230,000 tons (not counting inorganic products and aromatics) to 1,270,000 tons in 1944 and 1,400,000 tons in 1945. This remarkable growth originated at first from the rapid increase in the demand for numerous necessary products for the war effort (rubber, explosives, solvants, etc.). Now the petroleum and natural gas industries were offering much more flexibility than carbonisation of coal to quickly furnish the increase in primary materials which such a bound in production demanded. Then, in many cases, the processes which existed came into action several years or several months sooner, but still only applied to the semi-industrial scene. The intervention of the Government allowed the normal delays of a massive production to be curtailed, either by confining to the State itself the care of constructing and exploiting the new factories, or by assuring the producers of an abundant market and in releasing them from the worry of the viability of their manufactures.

The main beneficiary of this policy was synthetic rubber; the State constructed in less than 3 years, 14 factories from GR-S of a global capacity of 700,000 tons a year. The preparation of butadiene was a considerable extension, no longer founded only on the dehdrogenation of butylene, but also on the cracking of butane, put into operation in 1943 by Standard Oil, California. The same year, Standard Oil of New Jersey began the industrial manufacture of butyl at Baton-Rouge. Soon after, two of its subsidiaries were installed in Texas, at Baytown (Humble Oil and Refining Co.) and in Canada at Sarnia (Imperial Oil Co.). The first factories in GR-N date also from this time. In 1945 the U.S.A. produced 820,000 tons of synthetic rubber, representing nearly 60 per cent of their petro-chemical industry.

The war also accentuated the orientation of the industry of azota to natural gas. Out of 9 factories put into use at this time, 7 used hydrogen of natural gas. The production of carbon black made a new leap, reaching 477,000 tons in 1945, which was a progression of 85 per cent in five years, against 49 per cent in ten years between 1930 and 1940. At last the war made American petro-chemistry penetrate the domain of fabrications which arrived at the same point via other primary materials. Thus, the extraction of aromatics from petroleum was developed considerably, in particular to cover the increasing needs of the war industry of explosives derived from toluene. The period 1940 - 1945 was thus characterised in the U.S.A. both by a large increase in petro-chemical manufactures and by their variety.

It was also during the war that petro-chemistry reached Canada, with the production of 45,700 tons of synthetic rubber in 1945, and set foot in England, where the manufacture of teepol had begun in 1943, and in the U.S.S.R. where several factories were built to draw aromatics from petroleum. But all that counts for little with regard to the immense transformation which flooded organic chemistry in North America.

C. THE PETRO-CHEMICAL INDUSTRY AFTER WORLD WAR II

American petro-chemistry continued its progress after the war, but more slowly than before. The production of organic derivatives of petroleum and natural gas in the U.S.A. passed from 1,7200,000 tons in 1946 to 3,000,000 in 1950, which is, in four years an increase of 76 per cent, against 661 per cent between 1942 - 1946. This weakening was due to the disturbances introduced into the American economy with the reconversion. Elsewhere, certain manufactures were developed in favour of a situation which consigned the notions of price and competition to a secondary level. These notions did not resist the return of normal economic conditions, which were soon aggravated by the recession of 1948 - 1949 anyway, which was felt more in North America than in Europe.

The most typical case is that of synthetic rubber. Its production fell from 820,000 tons in 1945 to 393,000 tons in 1949. Half the factories in GR-S were temporarily closed. In Canada it diminished by 20 percent between 1946 and 1949. At the same time, that of carbon black ceased to progress (564,000 tons in 1946; 555,000 tons in 1949). In return, the chemistry of ethylene and that of propylene accentuated their progress and were enriched with new activities. From this period dates, in fact, the putting into action or the passing to the industrial stage of many important manufactures, like that of oxide of ethylene by direct oxidation; those of polyethylene, polystyrene, synthetic glycerine, etc. The extraction of the aromatics of petroleum (henceforth benzene and the xylenes, rather than toluene) were stretched much more than the weakening of iron smelting underlining even better the insufficiency of their carbo-chemical source. But, whatever the importance of this development, it has none the less been checked by a certain hesitation amongst American producers in the face of uncertainties of the market in 1948 - 1949.

These hesitations are to be found again in Europe, where the time immediately after the war is characterised by the elaboration of plans to put a petro-chemical industry on its feet, but where no factory actually began to produce before the end of 1949. The problem was much more complex here than in the U.S.A. The necessity of reconstructing (refineries in particular) before developing, constituted in a large number of European countries a factor of retardment unknown in North America. Elsewhere, the past of European carbo-chemistry and the uncertainty as to the pattern of growth of demand for the near future, made the estimation of respective roles delicate; these roles would be devolved by charcoal and by petroleum in the increase in organic chemistry, whereas in the U.S.A. this question had been sorted out quickly during the middle of the war, under the pressure of circumstances.

The recovery of the economic conjuncture, the rearmament for the Korean war, and in Western Europe the achievement of industrial reconstruction put an end to these uncertainties and hesitations. In the U.S.A. the year 1950 marked the debut of a considerable acceleration in petro-chemical development. From 3,000,000 tons in 1950 the production of organic derivatives from petroleum and natural gas grew to 10,000,000 tons in 1960; in 1963 it was approaching 13,000,000 tons (of carbon content) which was 95 per cent of the total production of organically based products. For carbon black, it passed from 555,000 tons in 1949 to 933,000 tons in 1963. The preparation of synthetic ammonia from petro-chemical hydrogen was taken from 900,000 tons in 1951 to 5,500,000 tons in 1963. The factories of synthetic rubber, which had been closed, were put back into use, except one which was technically out of date. Many others have been constructed in the last 20 years. The production of synthetic rubber has thus passed from less than 400,000 tons in 1949 to 1,500,000 tons in 1960 to 1,630,000 tons in 1963. However, it does not represent more than a very weak part of total production of petro-chemistry of the U.S.A. This has definitely lost its character that it had at the beginning - of an industry principally allied to the development of the motor car. The diversification of its activities has not ceased to extend, and places it henceforth at the base of almost all manufactures of organic chemical industry.

Petro-chemistry in Canada has followed the same pattern as that of the U.S.A. From 3 in 1951, the number of factories has gone from 35 in 1960 to nearly 50 in 1964 and nearly 70 in 1965. But the most striking characteristic of this recent period is without doubt the extension of petro-chemical growth outside North America. In 1949 Great Britain was the only country in Western Europe to manufacture products derived from petroleum. The activity of this domain was intensified from 1950 - 1951 when 3 factories of carbon

black were put into use - at Grangemouth, Forth Chemicals began to manufacture in 1952; Associated Ethyl Co. at Ellesmore Port in 1953. In France the effective beginning of petro-chemical manufacture also dates from this time; 8 establishments entered activity from 1949 to 1954, and 3 factories of azota were equipped to use hydrogen of petroleum or of natural gas. In Holland the factory at Pernis, near Rotterdam and in Italy those of Novare and Ferrare date from 1952 - 1953. In West Germany the beginnings seem a little slower; it was in 1954 that the factory at Zweckel of the Society of Phenol-Chemistry began to operate, and then the Farbweke Hoechst undertook the working of natural gas.

During the last 20 - 25 years, progress has accelerated, especially from 1959 - 1960. For all the European countries of the O.C.D.E. petro-chemical production has passed from 200,000 tons (of carbon content) in 1953 to 813,000 tons in 1958, 2,000,000 tons in 1961 and 4,000,000 in 1964. The investments foreseen in 1961 for the years 1962, 1963 and 1964 reached an annual average of $430,000,000 as against $290,000,000 during the 3 preceding years.

Even though petro-chemistry in Western Europe had begun 20 years later than that of the U.S. it is characterised by the great variety of its goods: detergents, solvents, plastics, synthetic fibres, ammonia. In comparison, the first petro-chemical preparation that was materialised in the U.S.A., carbon black, did not arrive in Western Europe until the end of 50 years, except in Britain, where it was more forward. The same was true for synthetic rubber, for which the first factories for getting it by means of petro-chemistry did not begin to produce until 1958 in Italy and Germany, 1959 in Great Britain, France and Holland, and 1963 in Belgium. As for the move towards petroleum for the supply of aromatics, the Donges factory, which marks the first in Europe, dates from 1957. There are, of course, great

differences between Western Europe and North America, in the sense of the entrance on to the scene of the various manufactures of petro-chemistry; they are obviously related to the special characteristics of the market and to the space of 20 - 25 years, which separates the 2 periods of development.

But this same space of time has also, in many cases, allowed the European Chemical Industry to catch up, if not in tonnages of production, at least in so far as it has put the techniques into operation. For the last 15 years, most of the new manufactures have been started at near enough the same time in the U.S.A. as in Europe, i.e., phenol and acetone, by the process of cumene of 1954 - 1955, or more recently, acrylone (acrolonitrile) from propylene and ammonia, benzene by hydrodealkylation, polyurethanes, polycarbonates, stereospecific rubbers etc. Europe was sometimes even the initiator, as in polyproplene (Italy) or acetate of vinyl from ethylene in Britain.

It is also by the size of units of production that Europe is catching up with the U.S.A. With a capacity for production of 300,000 tons/year of ethylene, the "steam-cracker" actually erected at Feyzin in the suburbs of Lyons, is one of the most powerful in the world. In fact, in developing fully petro-chemistry in Western Europe tends more and more to organise vast industrial complexes which are evoking those of the coast of the Gulf (Rotterdam, Grangemouth, Lacq, etc.).

The recent acceleration of the development of petro-chemistry in Western Europe corresponds to its actual debut in the U.S.S.R. (where previous creations remain negligible in respect of actual growth), and in Eastern Europe (except Rumania, which is already very advanced in the chemistry of hydrocarbons, when one takes into account the dimensions of their economy). But the most spectacular growth in the petro-chemical domain is that of Japan, which in 15 years (it's first factory dates from 1956) has overtaken Britain and France and almost Germany.

In developing countries such as Brazil, Spain, Mexico, Argentine, India, and Turkey, growth of this branch of industry is significant.

3. THE PETRO-CHEMICAL BACKGROUND OF TURKEY

In order for the petro-chemical industry to develop in a country (say the U.S.A. and Europe) it requires a substantial market for its product, and also the country itself has to be fully equipped with materials.

A. HISTORY OF PETROLEUM IN TURKEY

The first search for oil began during the Ottoman Empire (Tanoğlu, 1958, p. 313). In 1887 the first concession was granted to Necati Bey in the İskenderun area. Nothing was found, and this concession was annulled in 1913 (Ibid). During this time other searches were taking place in Thrace. Rumanian skilled workers were brought to Thrace for this purpose, but the oil found was not sufficient for commercial exploitation. During World War I, Russians searched for oil in the East of Turkey which they occupied in 1916 - 1917. The oil was found around Kürzot village, and this was used for ships in the Lake of Van.

During the same period the Turks concentrated on the Russian oil fields. In April 1918, the Turks occupied Batum.

In the late 1920's, groups of experts dispersed throughout Turkey in order to explore possibilities of oil discovery. After the Ottoman Empire in 1926, a State Agency controlled all exploration activities in Turkey. In 1933 a new petroleum law was declared, and in 1935 the Maden Tetkik ve Arama Enstitüsü (M.T.A., The Institute for Mineral Search and Exploration) was set up. From 1935 to 1954 all search for oil concessions were granted to M.T.A.

The country's first commercial discoveries were made in 1940 at Raman and in 1951 at Garzan. In 1954 new legislation was passed in which the country was divided into nine regions, seven of which were intended for free exploitation of oil.

B. CRUDE OIL PRODUCTION OF TURKEY

Oil production of Turkey was only 544 tons in 1946. At that time, lack of capital and insufficient technique were main obstancles for the production

of petroleum sufficiently. Since 1954, production of crude oil in Turkey has started to increase significantly because it has been affected by new petroleum legislation. As will be indicated later on, Turkey was wary of accepting foreign aid, and this went on until 1948. However, foreign aid increased year by year after 1948 and she was able to invest capital in any branch of industry which she needed.

OIL PRODUCTION IN TURKEY BETWEEN 1946 - 1972

(Petrol Ofisi, 1965, 1969; Images Economiques du Monde, 1973, p.240)

Year	Metric Ton
1946	544
1947	527
1948	2,854
1949	16,015
1950	17,537
1951	19,064
1952	21,697
1953	26,545
1954	58,008
1955	178,596
1956	305,616
1957	298,139
1958	328,543
1959	389,627
1960	375,122
1961	441,780
1962	595,408
1963	744,933
1964	921,416
1965	1,533,891
1966	2,041,121

(Cont'd.)

(cont'd)

Year	Metric Ton
1967	2,728,120
1968	3,104,476
1969	3,599,194
1970	3,543,000
1971	3,452,000
1972	3,408,000

C. CRUDE OIL CONSUMPTION OF TURKEY

After solving her capital problem, Turkish industry developed significantly and as a result of this her energy consumption notably increased.

OIL CONSUMPTION IN TURKEY BETWEEN 1961 - 1971

(Petrol Ofisi, 1969; Resmi Gazete, 11.1.1971, p. 149)

Year	Metric Ton
1961	785,415
1962	2,864,430
1963	3,638,448
1964	4,462,210
1965	4,920,000
1966	5,400,000
1967	5,940,000
1968	6,517,306
1969	6,469,675
1970	8,200,000
1971	9,334,000

After seeing oil production and oil consumption tables for Turkey it will be of interest to see how her domestic oil production relates to her domestic needs.

SHARE OF DOMESTIC OIL PRODUCTION

IN TURKEY'S DOMESTIC NEEDS 1961 - 1971

Year	Percentage[1]
1961	56.0
1962	20.9
1963	20.4
1964	20.6
1965	31.0
1966	37.7
1967	46.0
1968	47.0
1969	55.6
1970	43.3
1971	37.0

As indicated earlier, the first Turkish oil field was discovered in 1940. In 1946 oil production in Turkey was only 544 tons; since then production has increased very significantly and recently (1969) has risen to 3,599,000 tons, but her aim is to produce at least her domestic demand within the country. As is shown above, in 1961, 56 per cent of Turkey's domestic demand came from her own oil fields, but this percentage has decreased year by year (1962 - 1963 - 1964) because her domestic consumption has very rapidly increased.

After 1964 the share of domestic production in consumption increased to 55.6 per cent in 1969, but after 1969 this percentage decreased again (43.3 per cent in 1970 and 37.0 per cent in 1971) as a result of increasing domestic consumption. Thus Turkey still needs to import almost 60 per cent of its petroleum requirements.

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(1) For our calculations, statistical data has been obtained from Petrol Ofisi, Ankara, 1969, and Images economiques du Monde, Sedes, Paris, 1973.

It remains to examine the increase in the rate of oil consumption per head of population in Turkey, as a possible indication of an increase in per capita wealth which was 29 kg in 1961 and 256 in 1971. However, it is of interest to compare Turkey's rate of increase in consumption with the consumption of other nations, as an indication of the potentiality for future increases in demand.

OIL CONSUMPTION PER HEAD IN SELECTED COUNTRIES (1969)[1]

Country	Oil per head
Canada	3,047
U.S.A.	3,019
Sweden	3,000
Belgium-Luxembourg	1,852
Finland	1,821
West Germany	1,736
Netherland	1,686
Switzerland	1,602
Norway	1,548
United Kingdom	1,485
Japan	1,400
France	1,379
Italy	1,193
Austria	1,069
Spain	624
Greece	620
Turkey	256 (1971)
Yugoslavia	246
India	34

(1) For our calculations, statistical data has been obtained from Petrol Ofisi İstatistik Bülteni ve Tahlilleri, Ankara 1970 and British Petroleum, Our Industry Petroleum, London, 1970.

So, Turkey needs much more than present crude oil production from her own oil fields for her future demand. However, let us try to determine the need for oil of the Turkish market in 1977 and in 1987 by taking into consideration the Rate of Consumption between the years 1961 and 1971, and by using the Least Squares Method, then let us try to determine this need according to the National Income by using the same method and compare the two figures thus found.

Crude Oil Consumption of Turkey in 1977 and in 1987 according to the consumption rates of previous years:

x	y
1961	785,415
1962	2,864,430
1963	3,638,448
1964	4,462,210
1965	4,920,000
1966	5,400,000
1967	5,940,000
1968	6,577,306
1971	9,334,000

$$y = a_o + a_1 x$$

$$y_{1977} = 14,744,718.6 \text{ tons}$$

$$y_{1987} = 21,809,179.6 \text{ tons}$$

Crude Oil Consumption of Turkey in 1977 and in 1987 according to National Income[1]:

	x	y
(1961)	46.5	785,415
(1962)	52.1	2,864,430
(1963)	59.6	3,638,448
(1964)	63.9	4,462,210
(1965)	68.9	4,920,000
(1966)	80.2	5,400,000
(1967)	88.2	5,940,000
(1968)	97.0	6,577,306
(1971)	173.5	9,334,000

$$y_{\substack{279.5 \\ (1977)}} = 16{,}070{,}858.7 \text{ ton}^{(2)}$$

$$y_{\substack{654.7 \\ (1987)}} = 37{,}856{,}645.1 \text{ ton}$$

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(1) National Income in million Turkish Liras.

(2) Since forecasted figures of the National Income of Turkey are available for 1977 and 1987 all our calculations have been done according to this.

As can be seen from the above calculations, in 1977 (1,538,45.8 tons); and in 1987 (16,047,465.5 tons); there will be difference between the two calculations. The difference is likely to continue to increase. Since the increase in the National Income will greatly affect the consumption of the goods by increasing the purchasing power, it can determine the upper bound of the demand for oil, while the first calculations can determine the lower bounds for the demand for oil in the Turkish market, unless the other energy sources replace oil in the next decade or so.

D. REFINERIES CAPACITY OF TURKEY

Because of rapidly increasing domestic need for oil (13.7 per cent yearly) Turkey has decided to build her own refineries and expand their capacities. The first Turkish refinery was erected near Raman oil field by the Türkiye Petroleri Anonim Ortakliği (T.P.A.O., Turkish Petroleum Jointstock Company) in 1956. Until 1958, Turkey had only one refinery located near an oil field, that at Batman, which had a very small capacity (550,000 tons per year). After 1958, two big refineries were built near İstanbul and on the Mediterranean coast at Mersin with 1,000,000 and 3,200,000 tons capacity respectively. The capacity of İstanbul refinery increased from 1,000,000 tons to 5,500,000 tons in 1972. Before the erection of these two large capacity refineries, Turkey was importing oil for domestic use chiefly from Italy where refineries are located. The existing refineries have expanded their capacity year by year as a result of further increase in her domestic requirements.

OIL REFINING CAPACITY IN SELECTED COUNTRIES (1972)

(Images Economiques du Monde, 1973, p. 58)

Country	Metric Ton
U.S.A.	654,360,000
U.S.S.R.	342,000,000
Japan	184,945,000
Italy	173,905,000
West Germany	126,070,000
France	121,950,000
United Kingdom	121,040,000
Spain	31,685,000
Turkey	13,875,000
Yugoslavia	11,900,000
Greece	5,625,000

As can be seen above, in 1972 the capacity of Turkey's refineries reached 13,875,000 tons per year. This capacity is sufficient for her present domestic need, but will not be sufficient for her very fast-growing domestic demand in the future, so T.P.A.O. has decided to erect other refineries at İzmir (it came into operation in 1974 with 3,000,000 tons per year capacity) and at Samsun.

E. INDUSTRIAL BACKGROUND OF TURKEY FOR PETRO-CHEMICAL INDUSTRY

As will be indicated later on, petro-chemical industry prepares the basic materials for other industries to be put into consumer goods.

During the Ottoman Empire, concessions were the main obstacles to the Ottoman Empire establishing their own industry. When the Republican Government took over the country there were only a few enterprises, such as five armament works, two army supply plants, seven cloth and carpet mills, several leather plants, a shoe factory, five large mining enterprises (Zonguldak coal, Ergani copper, Keçiborlu sulphur, Balya lead and Eskişehir meerschaum) one glass plant, two ship repair yards, two vegetable oil and

soap manufacturing plants, 3 breweries and seven power stations (producing 47 million kilowatts). Apart from these of course there were a few hundred small semi-mechanized flour mills, seed presses, looms and metal working shops. Most of them were concentrated in or around İstanbul area because its communication was very adequate as a capital of an Empire. At the same time even in that time the relatively crowded population was a sizeable market for industry. There was no heavy industry.

The 4,240 km of rail-line linked only İstanbul, the Aegean coastal area, and the Eastern Mediterranean, but did not serve central Anatolia (except Ankara, Eskişehir, Afyon Karahisar) the Black Sea Region or the Eastern Anatolia. Some of them were in the hands of foreign companies and semi-usable as a result of World War I and Independent War. The Republican Government was therefore required to be very energetic. Two major aims for economic development of the Republican Government were these:

(i) To start with the aim of the Government was to build up an an infra-structure, so as to lay down the foundation of a new industrial structure.

(ii) In the long run the objective was to establish a broader industrial structure so as to minimize the dependence on foreign countries.

To achieve the above aim the Government's plan and work may be summarized into three points:

(a) To restore existing feeble industry.

(b) To nationalize some industrial establishments which were held by foreign entrepreneurs.

(c) To erect new and modern industries.

But during the initial period of Republic Government from 1923 to 1930 great economic inertia existed. As indicated before, one of the most important reasons was lack of capital. Turkey started to "take off" in 1930, and in the years following 1930 a considerable number of large state industrial enterprises appeared. Until 1948 Turkey was wary of taking foreign aid because she had

suffered very much from concessions and foreign debts during the Ottoman Empire. However, after accepting foreign aid, economic development in Turkey has been very rapid; particularly after 1950, where there have been 20 new cement plants, ports, dams and highways. In 1962, Turkey agreed on three five-year plans. The first ended in 1967, and the second was put into operation in 1968.

During the period 1962 - 1966, a structural change took place in the productive sectors of the economy, although not to the extent envisaged in the Plan. Dependence of the economy on agriculture has been lessened as a result of the lower rate of increase in the value added of the agricultural sector, compared to the rate of increase in the net domestic income. In the period 1962 - 1966 agricultural income rose only by 13.1 per cent while net domestic income fell from 41.1 per cent in 1962 to 36.8 per cent in 1966. During the same period, although considerably below the plan targets, the highest rate of growth was recorded by the industrial sector. As a matter of fact, the value added in this sector recorded an increase of 40.3 per cent during the years 1962 - 1966, and its share in the net domestic income rose from 16.7 per cent to 18.6 per cent. The growth rate of the second plan period when put into operation was 7 per cent.

The main aim of the second five-year development plan, as the Turkish Prime Minister says in that year, "The second Five-Year Plan period is of great and vital significance for Turkey. For it is during this period that the economy will undergo a structural change and its dependence on foreign resources will gradually diminish". (D.P.T., 1969, Foreword).

The basic economic target of the second plan is to secure an overall increase in Gross National Product (GNP) of around 40.3 per cent during the period 1967 - 1972. As a result of this aim GNP, which has been estimated to amount to 85.1 billion T.L. in 1967, would reach 119.4 billion T.L. in 1972. Thus, GNP would register an increase of 34.3 billion T.L. over the period 1967 - 1972. Per capita income would increase by an average rate of

4.4 per cent per annum or by 24.8 per cent in five years, from 2,850 T.L. in 1967 to 3,200 T.L. in 1972. During the Second Plan Period, the industrial sector would be the fastest growing sector of the economy and its share in GNP would increase from 19.9 per cent in 1967 to 24.6 per cent in 1972.

As can be seen from the above, the Turkish people's purchasing power has increased, and Turkish industry has reached a level at which Turkey has become a sufficient market for petro-chemical products.

F. BEGINNING OF PETRO-CHEMICAL INDUSTRY IN TURKEY

In Turkey, in spite of the expansion of Batman refinery since its establishment, T.P.A.O. gave up the idea of establishing the petro-chemical industry there as it was situated far from the big industrial places of Turkey. In 1957, some of the private companies applied to T.P.A.O. for separating ethylene from Batman refinery gases and purifying it in order to use it in the petro-chemical industry. This project, however, was given up due to the fact that the quantity of ethylene obtained was not sufficient. In 1958, the T.P.A.O. planned to establish a refinery in the İstanbul area, and at the same time, they were contemplating adding to it a petro-chemical plant. During all this time of research, T.P.A.O. was given advice by the United Nations, and this went on until the autumn of 1961 when they ended their agreement with the United Nations.

They then made an agreement with the Institute Francais du Petrole (I.F.P.), but their research was slowed down for a while until the First Five Year Plan was drawn up by the Turkish Grand National Assembly in 1962. During this period some foreign companies applied to T.P.A.O. to study the possibility of establishing a petro-chemical industry in Turkey, but none of their offers were acceptable. During the Five Year developing plan (1963 - 1967) the T.P.A.O. carried on their research with the Institute Francais du Petrole. At the same time, other foreign companies were trying to get concessions to establish petro-chemical plants, but the Government

has stipulated that none of the companies share should exceed one-third of the shares of the petro-chemical plant in Turkey, so the Government therefore did not grant them any concessions to establish petro-chemical plants. Thereafter a few companies have applied again but have been rejected for the same reason. The T.P.A.O. formed an agreement with the Blaw-Knox Company for counselling, and this agreement went on until the creation of the General Directorate of Petro-Chemical (PETKIM) on 3rd April 1965.

After the proposal of T.P.A.O. for the establishment of the petro-chemical industry in Turkey, Petro-Kimya Genel Müdürlüğü (PETKIM) was set up in Ankara on 3rd April 1965 with the objective of producing various important petro-chemical products.

After the beginning of 1968 the capital of the Company was increased from 250,000,000 T.L. to 700,000,000 T.L. (£1 = 323T.L.) with the following corresponding shares:

T.P.A.O.	55%(1)
Emekli Sandiği (The State Pension Fund)	25%
Ordu Yardimlaşma Kurumu (The Armed Forces Mutual Assistance Fund)	20%

The Company has planned the realisation of the present and new projects of Yarimca complex in two phases. Among the six units which comprise the present projects, construction and erection of five units were completed in 1969. The present projects, for which construction and erection works started in 1966 (PETKIM Dergisi, 1969, p. 4-5) are as follows:

1. ETHYLENE UNIT

   (Intermediary raw material of polyethylene)

2. POLYETHYLENE UNIT

   (Raw material for the plastics processing industry

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(1) Source: PETKIM Genel Müdürlüğü, Ankara.

3. VINYL CHLORIDE MONOMER (V.C.M.) UNIT

(Intermediary raw material of PVC).

4. POLYVINYL CHLORIDE (PVC) UNIT

(Raw material for the plastics processing industry)

5. CHLOR ALKALI UNIT

(Chlorine and NaOH)

6. DODECYL BENZENE (DDB) UNIT

(Synthetic detergent raw material)

Meanwhile, Auxiliary Facilities and Common Plant Facilities came into operation in this complex.

The Expansion Units

The investment for the projects under consideration amount to 1,042 million T.L. After the operation of these units, PVC and Polyethylene which are the basic raw materials of the plastics processing industry; high-octane benzene, fuel-oil, LPG and Caustic Soda were introduced on to the market.

Due to the increasing demand for petro-chemical products in Turkey, the units had to be expanded 100 per cent, and in 1968, connections were made with licensors and engineering firms. The expansion of projects under consideration are covered in the investment programme of 1969, with the exception of DDB.

The New Projects

This phase is comprised of caprolactam, acrylonitrile, ABS (acrylonitrile - butadiene - styrene units in addition to the carbon black, styrene, polystyrene and synthetic rubber units which are included in the 1968 Annual Programme. Investments have started for carbon black and synthetic rubber, (SRB, CBR), and butadiene extraction projects for which licence and engineering agreements are completed.

Studies are underway for the completion of relevant agreements in connection with the styrene and polystyrene projects. With the realization of these units, carbon black and polystyrene will be produced as the most important raw

materials of synthetic rubber and plastics processing industries.

Second Petro-Chemical Complex

Parallel to the construction of the Yarimca petro-chemical complex which started in 1966, studies have proceeded in the light of Turkish market demand to increase the number and the capacities of units comprising the complex, so as to satisfy market demands.

As a result of these studies, a petro-chemical complex project was planned which would be large enough for all requirements. However, it has been decided that the site on which the present petro-chemical complex has been constructed would be almost occupied by the units commissioned in 1969 and the units which are, and which would be, under construction in 1970.

On the other hand, by taking into account the technical and economical problems expected to arise as a result of further expansion of the present complex in the Marmara region, which is one of the most concentrated centres of industrial development in Turkey, and the rapid development of the market more than foreseen in the Second Five Year Plan period; the establishment of a second complex having larger capacities has been found to be necessary, which led to the idea of purchasing land near the present and planned refineries. According to the studies, with the realisation of the second complex, which will be comprised of fifteen units, important products required by plastic processing, synthetic fibre and detergent industries will be able to to meet the internal demand.

In the seventh chapter, the three most favourable sites for the second complex will be discussed: Aliağa (İzmir), Samsun, and Mersin.

Conclusion

In this chapter, the function of the petro-chemical industry, the general development of this industry in the world, and in particular the background of the petro-chemical industry in Turkey, have been examined.

As the petro-chemical industry prepares the basic materials for other industries, to be put into consumer goods, Turkey has waited to erect a petro-chemical complex until she has reached a certain industrial level.

In the next chapter, the location factors of the first Turkish complex of the industry will be analysed.

SECTION II

THE LOCATION, PRODUCTS AND MARKETS

OF THE TURKISH PETRO-CHEMICAL INDUSTRY

CHAPTER III

THE CHOICE OF LOCATIONS FOR THE PETRO-CHEMICAL INDUSTRY IN TURKEY

THE CHOICE OF LOCATIONS FOR THE PETRO-CHEMICAL INDUSTRY IN TURKEY

1. RELATIONSHIP BETWEEN REQUIREMENTS OF PETRO-CHEMISTRY AND CONDITIONS IN TURKEY

Human and economic geography investigates the interaction between mankind and the geographical environment. Of course, as is known, industrial production is an economic activity of human beings, and the location of economic activity is one of the problems in geography. Every industrial establishment has a location and has a space in the world; that is, it occupies a portion of the earth's surface; but some places have been selected rather than others for specific reasons. The industrial establishment, like the human population, may be concentrated or dispersed under some circumstances.

Requirements are not always the same even within one single industry. From country to country or from region to region, differences exist, such as available techniques, labour conditions, size and organisation of the individual firms; general economic and social environment may have corresponding differences in the requirements for good location.

A. REQUIREMENTS OF PETRO-CHEMISTRY

First of all we should point out that petro-chemistry is an industry which uses petroleum as a chemical raw material and produces raw material for the other branches of industry. In Turkey, unlike some other industries such as food, beverages and textiles, it required huge investment as a main feature of the petro-chemical industry. Its existence cannot be explained by a small amount of local demand, but its market is most of Turkish industry and its customer is most of the Turkish population. This very large and wide market may be reached by way of a very good and very effective transport network. For its many different sorts of products it needs a large enough population, especially where it is built, and at the same time, of course, an industrial integration. A petro-chemical complex needs very skillful and technically-trained workers as a feature of this industry.

2. WHY THE İSTANBUL AREA WAS CHOSEN FOR LOCATING THE FIRST PETRO-CHEMICAL COMPLEX IN TURKEY

A. RELATIONSHIP BETWEEN PETRO CHEMISTRY AND TRANSPORTATION IN TURKEY

Transportation is a vital factor in the location decision of petro-chemistry. Transportation networks are the "arteries and veins" of the country. To bring raw materials to petro-chemical plants and then to transport them to the consumer markets is only possible by a regular and extensive system of transportation. As we indicated before, Isard pays great attention to the transport factor. He (Isard, 1968, p.90) considers transport inputs as vital as four other factors of production which are land, labour, capital and the entrepreneur. He does not think of the transport function as another factor of production, but stresses the point that transport inputs play an important role in production and consumption processes.

As we emphasised before, human beings, unlike animals and plants, try to change their natural environment. To some degree they are influenced by their natural environment and since Turkey is a mountainous country with an average altitude of 1131 m., transportation has been an important problem for a long time. From the beginning of the Republican era, all governments have considered transportation a great problem.

As the Prime Minister of Turkey points out on May 29, 1950 (Hershlag, 1968, p. 234-235):

"We consider communications and public works to be questions concerned very deeply with agriculture and the national economy. We also believe that adequate communications and public works guarantee economic and moral unity in the country. In a period in which the motor facilitates cheap and rapid transportation, we shall give particular attention to roads. We shall furnish assistance from the State budget, as far as possible, for the building of rural roads".

In the 1920's, Turkey paid great attention to building railways rather than roads; the reasons were these:

(i) At that time in Turkey, coal was easier to supply than oil.

(ii) Current costs of railways were lower.

(iii) Maintenance of railways was easier and cheaper than road maintenance, especially in the East of Turkey.

Before 1948, in spite of all government efforts, they had not succeeded in building a sufficient transport system in Turkey because of lack of capital. Since 1948, the achievement has been very great in building sufficient transport networks, particularly roads, sea-ports and airports. As will be seen below, investment in the transportation sector has been very important.

INVESTMENT IN TRANSPORTATION SECTOR (Million T.L.)

(D.P.T., 1969, p.625)

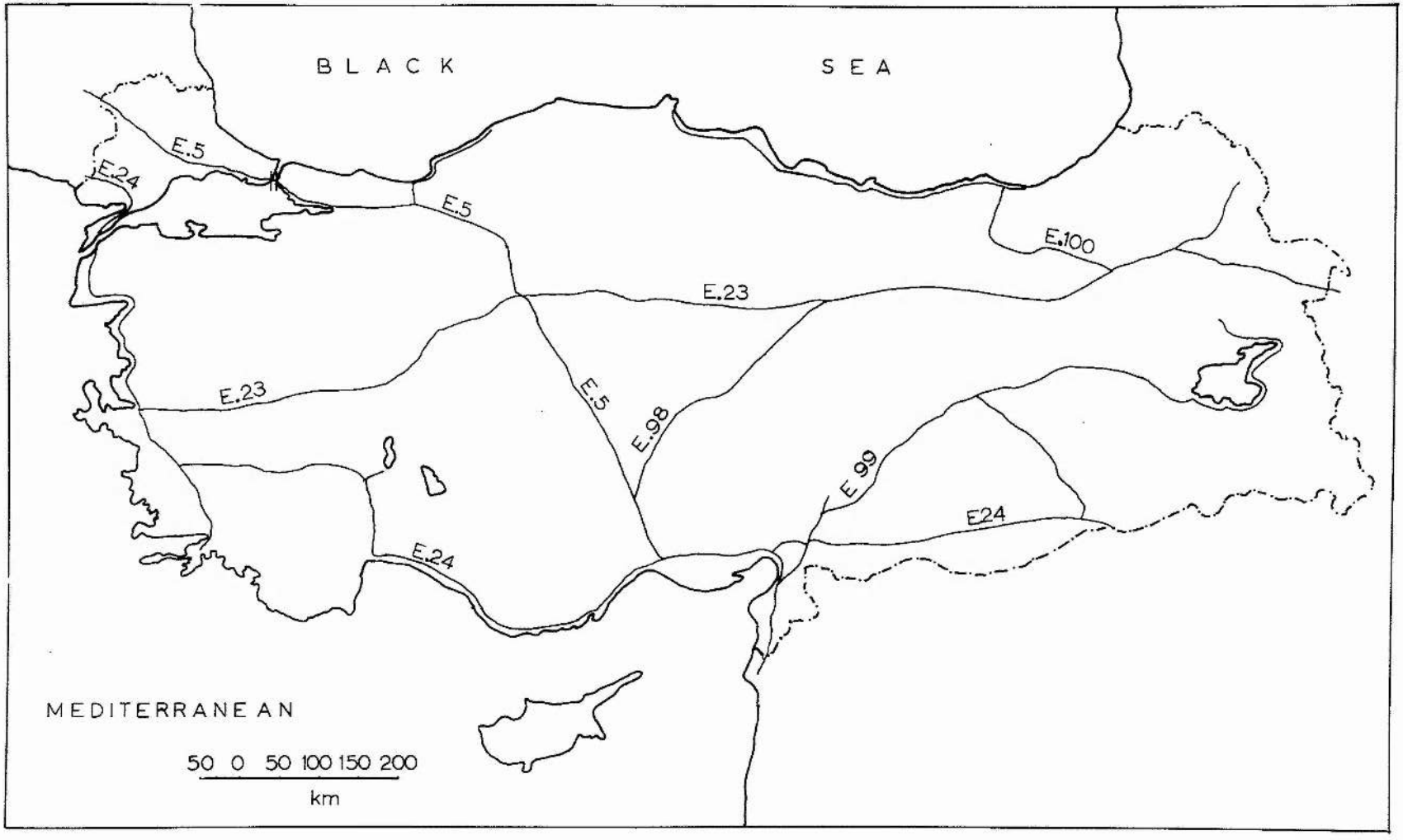
	Total First Plan Period (1963-1967)	1968	1969	1970	1971	1972	Total Second Plan Period
Highway	6,320	2,070	2,230	2,400	2,625	2,845	12,170
Railway	1,562	485.0	600.0	705.0	660.0	700.0	3,150.0
Sea	779.7	183.0	193.0	191.0	166.0	167.0	900.0
Air	220.7	153.0	124.0	63.0	128.0	52.0	520.0
Total	8,922.4	2,891.0	3,147.0	3,359.0	3,619	3,7240.0	16,740.0

To see how much has been achieved, it is better to explain sector by sector.

1 - Roads:

During the Ottoman Empire road links were very weak in the country. From the very beginning of the Republican era, the government saw great importance in the development of transport facilities, but in the 1920's and 1930's great attention was concentrated on the railway network. The extensive programme for highway construction started in 1948 and developed especially after 1950. Before 1950, roads were generally in poor condition since investment in transport was concentrated on railway construction.

In march 1950, the New Turkish Highway Law No. 5539 was published and became effective in that year. Since 1950 there has been a large road building



THE MAIN ROAD SYSTEM IN TURKEY (1971)

programme aimed at linking the main towns by modern highways. In 1923, only some 4,000 km could be considered as all-weather roads throughout the country. At the end of 1970, highway, urban and rural roads would be 221,508 km (D.P.T., 1972, p.190).

As a result of improvements in the road network there has been an increase in road freight traffic, measured in net ton/km from 370 million in 1948 to nearly 7,000 million in 1965 and 18,832 million in 1970 (Ibid). The passenger/km was 1,211 million in 1948; this rose to 22,000 million in 1965 and 47,601 million in 1970 (Ibid). Regarding this, trucking costs have dropped between 20 and 40 per cent in recent years. In Turkey, road transport is widely used for shipping finished goods because costs are lower and the service faster than rail.

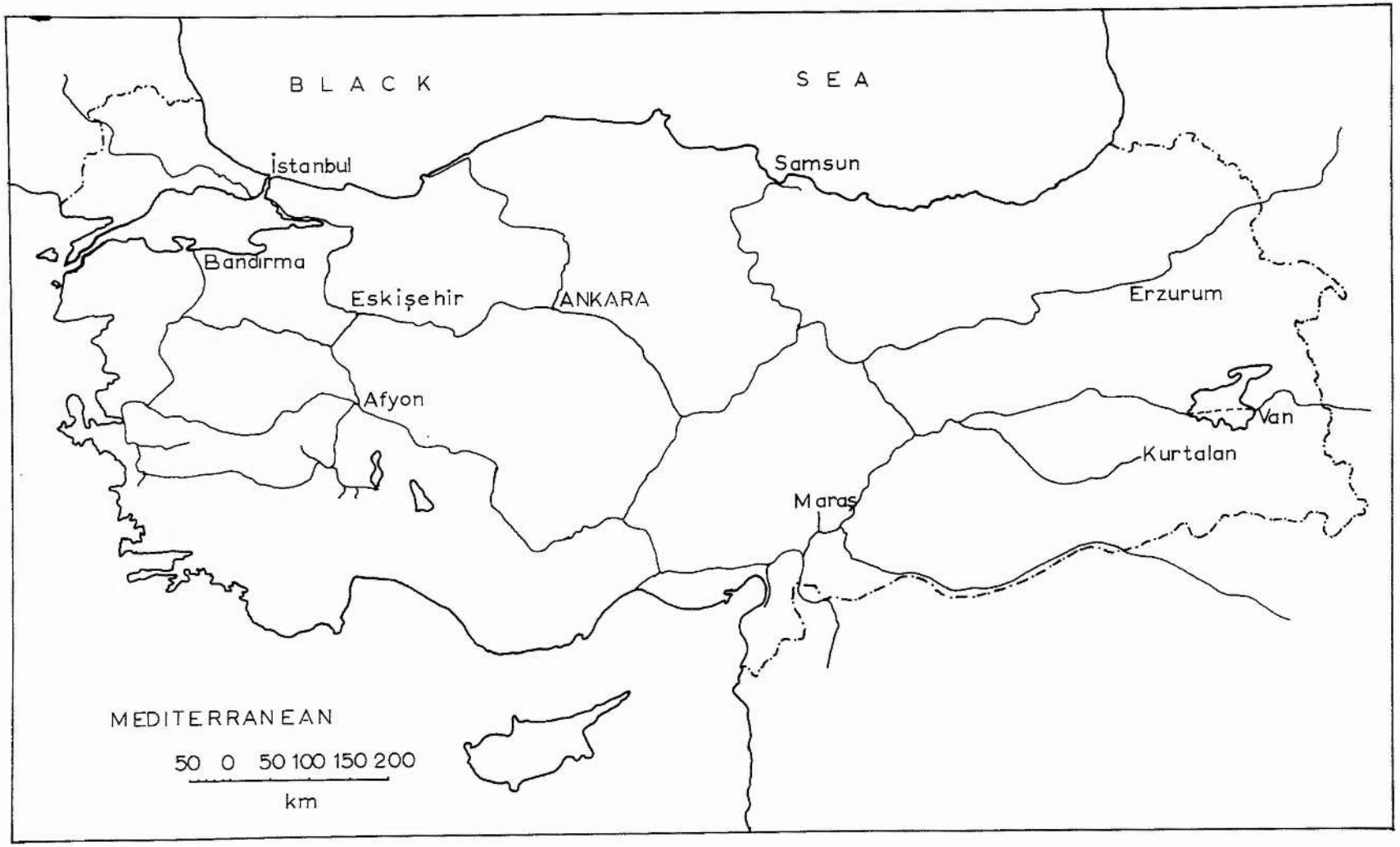
Density of roads is high in and around big centres like İstanbul, Ankara, İzmir, Adana, Bursa, Eskişehir, Gaziantep, but this density rises more in and around İstanbul than other big cities, as a result of being the most populated centre of Turkey.

The international highway E-5 begins at Oostende (Belgium) and leads to İstanbul through West Germany, Austria, Yugoslavia and Bulgaria. After crossing the Bosphorous by ferry (recently a suspension bridge was opened and it has replaced the ferry) to the Asian side of Turkey, this major highway leads through Yarimca, İzmit, Adapazari and Bolu to Ankara. South-east of Ankara the highway passes the Salt Lake west of Kirşehir, through the Toros Mountains to Adana, Antakya and finally to the Syrian border at Yayladağı. Before Adana, this highway joins the E-24.

So, the Yarimca petro-chemical complex takes advantage of these very adequate highway systems to link with İstanbul (as we will indicate later on İstanbul is the biggest market for petro-chemical products in Turkey) and other domestic and external markets.

2 - Railways:

As we indicated before, the first Republican government concentrated all their attention on building railways. The first rail line in Turkey dates back



THE RAILWALS IN TURKEY

to the Ottoman Empire and was built from Edirne to İstanbul in 1888. The first railway linked İstanbul with Vienna and thus with the rest of Europe. In 1900, another railway was completed which was planned to run from Berlin to Baghdad via İstanbul, Ankara, Konya. In the Republican era work on the extension of railways started, particularly after 1924.

In 1923, the railway situation was: 1,734 km of government-owned lines, and 2,352 km of foreign companies' lines. At the end of the thirties, government owned lines reached 6,890 km, and foreign companies held only 434 km.

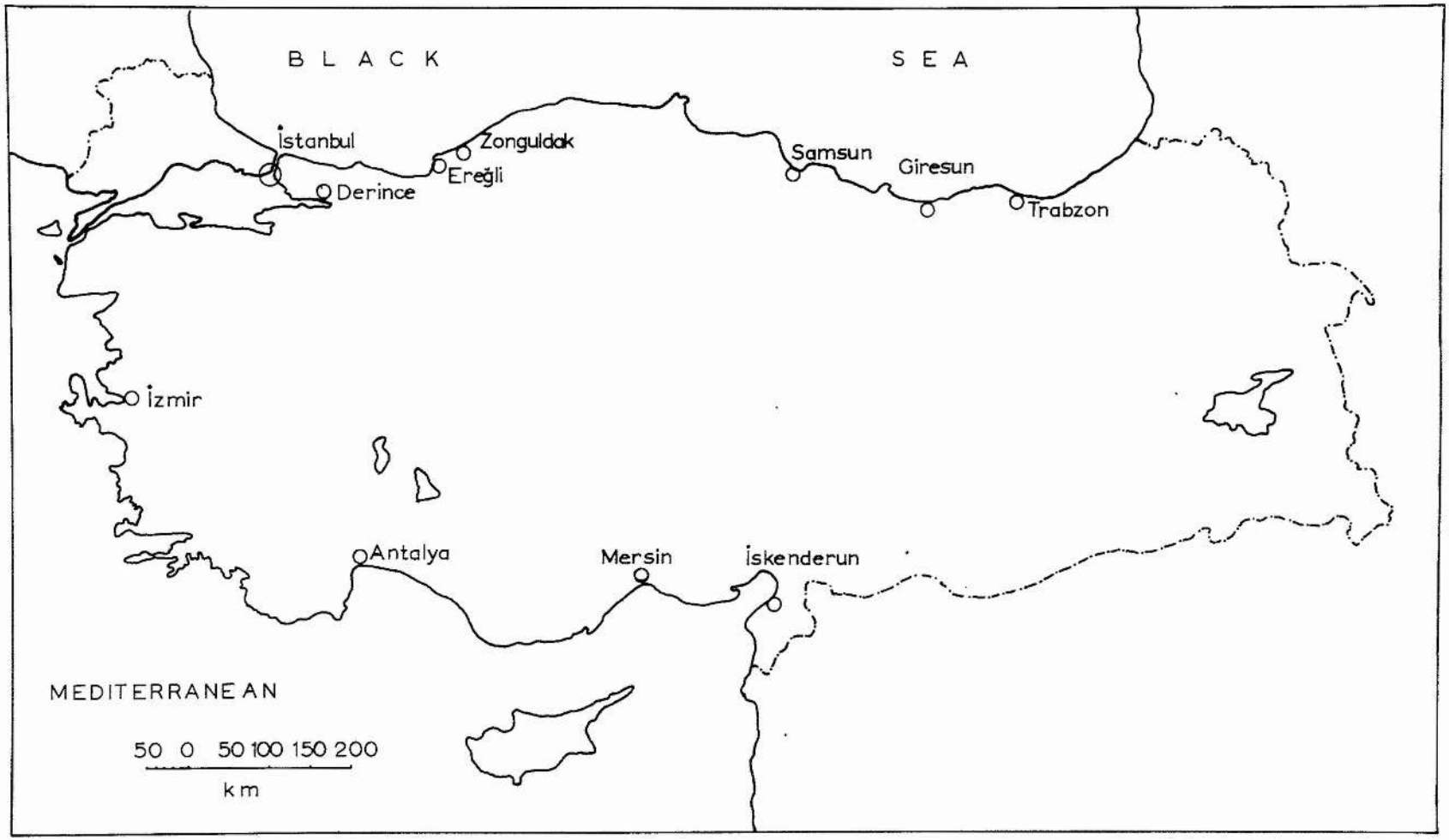
On the eve of World War II, the railway lines crossing Central Anatolia bound it to several vital points on the countries' frontiers and coast-lines. Recently, the Elaziğ line was extended to Teheran via Tatuan-Van which means crossing Lake Van by ferry. So, İstanbul, as the biggest commercial, industrial and cultural centre of Turkey, has been linked successfully with Paris, Munich and the rest of Europe; and with Teheran, Baghdad, Syria and the rest of the Middle-East.

The railway network was 4,086 km in 1923; it increased to 6,808 km in 1938; 7, 295 km in 1946; 7,878 km in 1955, 8,163 km in 1965 and 8,170 km in 1971 (D.P.T., 1972, p.216). At the present time some new railway routes are under construction; for instance, one of these is for reducing the journey-time between Ankara and İstanbul. In 1970, passenger-carrying and goods-carrying capacity of the railway was 5,561 million passenger/km and 6,092 million tons/km, respectively.

3 - Ports:

The shipping facilities of Turkey's rivers are very unsatisfactory owing to their shortness, to turbulent currents during winter and shallow waters during the summer. For this reason, under this title, we will ignore the rivers.

The total length of the Turkish coastline is 8,272 km (D.I.E., 1969, p.21). In the 8,272 km length of coast, 60 small and big ports exist and are in service at the present time, but we will ignore most of them because they have local importance only, and we need only take into account ten of them. Until



THE IMPORTANT SEAPORTS IN TURKEY

1934, maritime services were not important for Turkey because these services were mainly in the hands of foreigners; as was, in particular, the coasting trade. This situation has changed only after the Lausanne Conference (1923) when the government took over the coasting trade and expanded merchant marine and port facilities. The movement of foreign ships was prohibited between Turkish ports, but free access was granted to a Turkish harbour if ships arrived from foreign ports. The government took over the İstanbul wharf installations from a French company and signed an agreement with a company for the construction of an improved harbour at Zonguldak. In the İstanbul harbours further improvements have been planned, but a big improvement has already taken place since 1950. This time, new schemes were concentrated not only on central ports such as İstanbul and İzmir, but also on the expansion of minor ports' facilities, such as Zonguldak and Samsun on the Black Sea, and Mersin and İskenderun on the Mediterranean.

After this explanation, let us consider the situation of the Turkish ports at the present time:

Ports	Capacity (tons) (Resmi Gazete, 30.12.1971, p.68)	(Loading - Unloading) 1963 (D.P.T., 1973, p.593)	1972
Derince	315,000	295,000	600,000
Ereğli	315,000	452,000	2,750,000
Giresun	225,000	58,000	35,000
İskenderun	2,950,000	697,000	900,000
İstanbul	4,750,000	1,753,000	1,900,000
İzmir	2,215,000	674,000	1,175,000
Mersin	1,900,000	370,000	1,200,000
Samsun	790,000	364,000	1,730,000
Trabzon	815,000	224,000	100,000
Zonguldak	260,000	1,510,000	1,900,000

Coastal maritime transport is most important along the Black Sea coast where there are a score of ports with regular services. Steel and coal from Zonguldak and Ereğli; tobacco from Samsun and a variety of agricultural products from more easterly ports are shipped to İstanbul for internal redistribution or export, and manufactured goods of all kinds go in the opposite direction. Aegean and Mediterranean coastal movement is on a smaller scale, maritime traffic being handled by İzmir, Antalya, Mersin, İskenderun. Amonst them, İzmir is an important export point from Turkey.

Let us see the importance of Turkish ports according to their imports and exports.

FOREIGN TRADE BY MAIN PORTS (1969)[1]

Exports

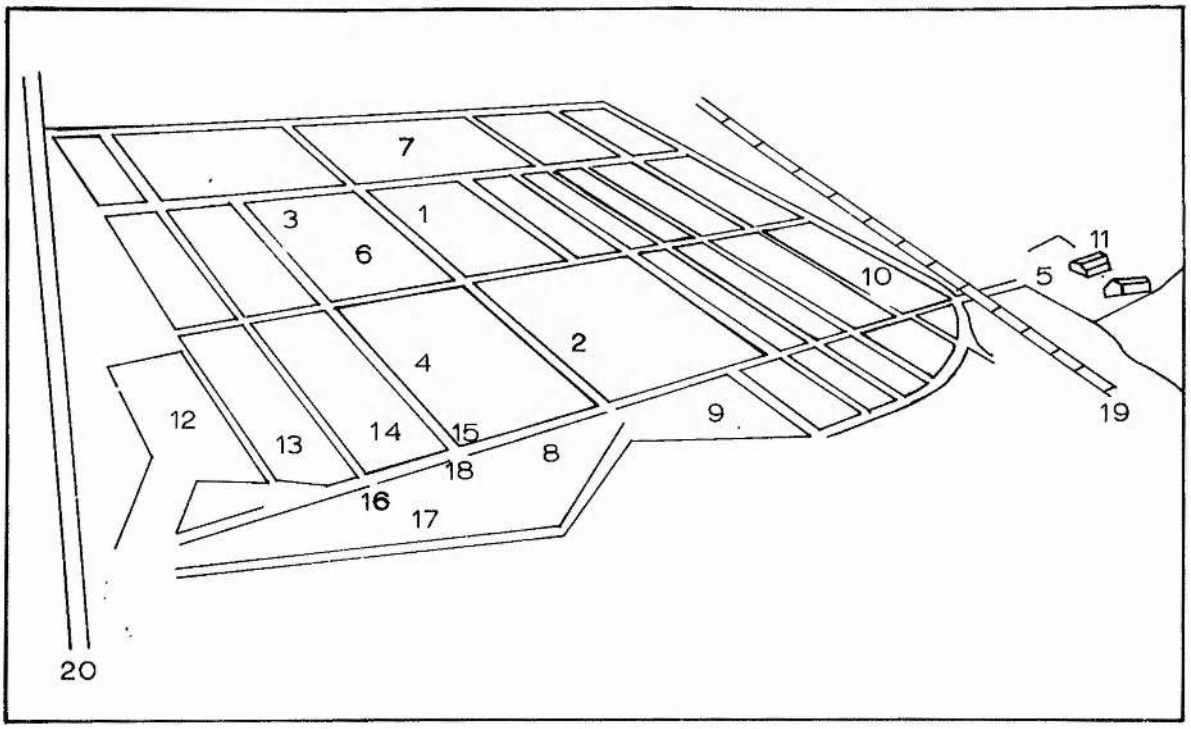
Ports	Share of Ports (%)
İstanbul	13.2
İskenderun	4.7
İzmir	35.0
Mersin	13.1
Zonguldak	0.2
Others	33.8
	100.0

Imports

İstanbul	42.7
İskenderun	4.4
İzmir	9.5
Mersin	7.9
Zonguldak	0.1
Others	35.4
	100.0

(1) For our calculation, statistical data has been obtained from Aylik İstatistik Bülteni, Ankara, 1971.

YARIMCA PETRO-CHEMICAL COMPLEX



1	Ethylene Plant	11	Filling Station - Wharf
2	Polyethylene Plant	12	Administration Building
3	VCM Plant	13	Receiving Warehouse
4	PVC Plant	14	Workshop
5	Chlor Alkali Plant	15	Gate House
6	Utility Plant	16	Marketing Building
7	Tank Farm	17	Cafeteria
8	Truck Scale	18	Infirmary
9	DDB Plant	19	Ankara - İstanbul Railway
10	Flare Stack	20	Ankara - İstanbul Highway

Source: Petkim Genel Müdürlüğü, Ankara

As can be seen from the foregoing tables, İzmir's export share is 35 per cent and is the highest. However, we must bear in mind that in 1965, 85.3 per cent of Turkish exports were agricultural produce, and this decreased to 84.9 per cent in 1966 and 79.4 per cent in 1969. In spite of a decrease in Turkey's agricultural products, it still keeps a high percentage of exports, but the Izmir ports, as we have said before, exported agricultural products of the whole Aegean and Western Anatolian region.

Second to İzmir is İstanbul which exports generally semi-finished or manufactured goods. The third most important port is Mersin, which exports agricultural products and petroleum derivatives from its refinery.

4 - Airports:

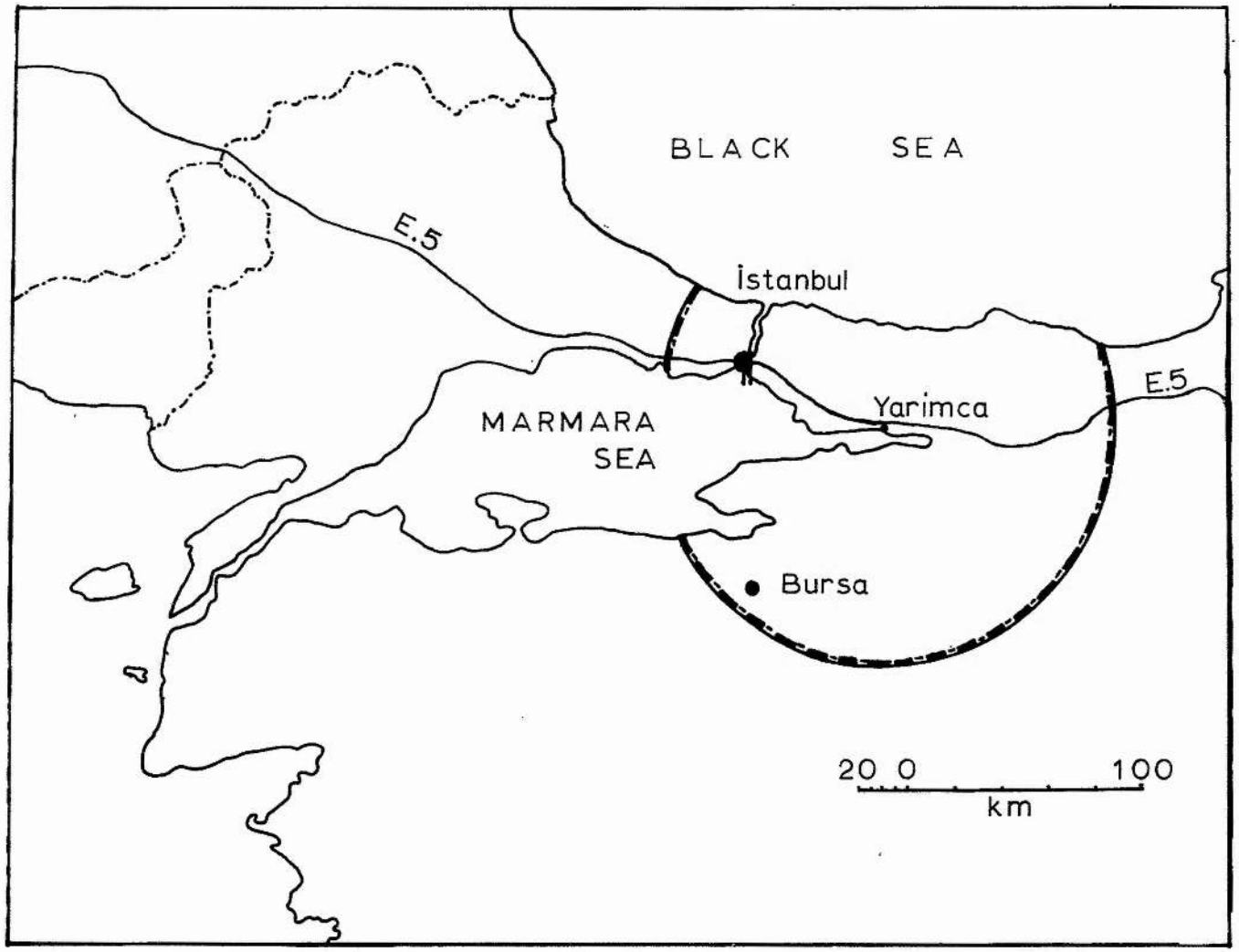
Turkey has three international airports: in İstanbul (Yeşilköy), in Ankara (Esenboğa) and in İzmir (Çiğli). The largest international airport in Turkey is Yeşilköy, so İstanbul is very convenient for business-men from all over the world.

I) What is the Zone of Influence of Existing Plant

The petro-chemical industry in Turkey has an excellent location relating to the transportation network described above. It is located in Yarimca 85 km away from İstanbul and its southern boundary is drawn by the İstanbul - Ankara railway track, and its northern boundary by the İstanbul - Ankara highway, besides which it has wharf facilities. These three most advanced levels of Turkey's transportation networks enable it to deliver raw materials to most of Turkish industry, and especially in and around İstanbul. If we take the petro-chemical plant as the centre of the circle, with an assumed diameter of 100 km, this encircled area possesses more than 50 per cent (in 1965 and now the percentage is even higher) of the total Turkish industry.

The petro-chemical plant is located only 30 kms away from three tyre factories; 60 - 70 km away to the east and west are located three car factories and assembly plants, and plastic making industry.

These excellent transport networks also enable the petro-chemical plant to receive two of its four raw materials, which are: salt from İzmir, and benzene from Ereğli.



AREA WITHIN 100 KM OF THE YARIMCA . COMPLEX

II) What are the Transportation Costs for Petro-Chemistry in Turkey?

Transport costs vary with distance. With regard to Weber's (Weber, 1968, p.62) locational figures and kinds of industrial materials, he says, "Any manufacturing using pure materials from two sources will always locate at the place where finished products are consumed".

As a matter of fact, the petro-chemical industry in Turkey uses four kinds of raw material, but two of them have been obtained near the refinery. Let us see the situation there, according to Weber's Transport Orientation theory.

We will assume that Yarimca complex is the market, as indeed it is. İzmir is one of the sources of raw material (SR) and Ereğli is the second (SR_1). The distance between İzmir and Yarimca is 529 km, and Ereğli to Yarimca is 265 km. Yarimca receives each year 65,000 tons of salt from İzmir, and 26,115 tons of benzene from Ereğli (Türkiye İktisat Gazetesi, 20.4.1972, p.5).

(a) If it was located at İzmir (one of the sources of raw material):

271,395 x 529 = 143,567,955 (naptha from Yarimca)

54,000 x 529 = 28,566,000 (aromatic oil from Yarimca)

26,115 x 734 = 19,168,410 (benzene from Ereğli)

Total 191,302,365 tons/km.

(b) If it was located at Ereğli (another source of raw material):

271,395 x 265 = 71,919,675 for naptha (Yarimca)

54,000 x 265 = 14,310,000 for aromatic oil (Yarimca)

65,000 x 734 = 47,710,000 for salt (İzmir)

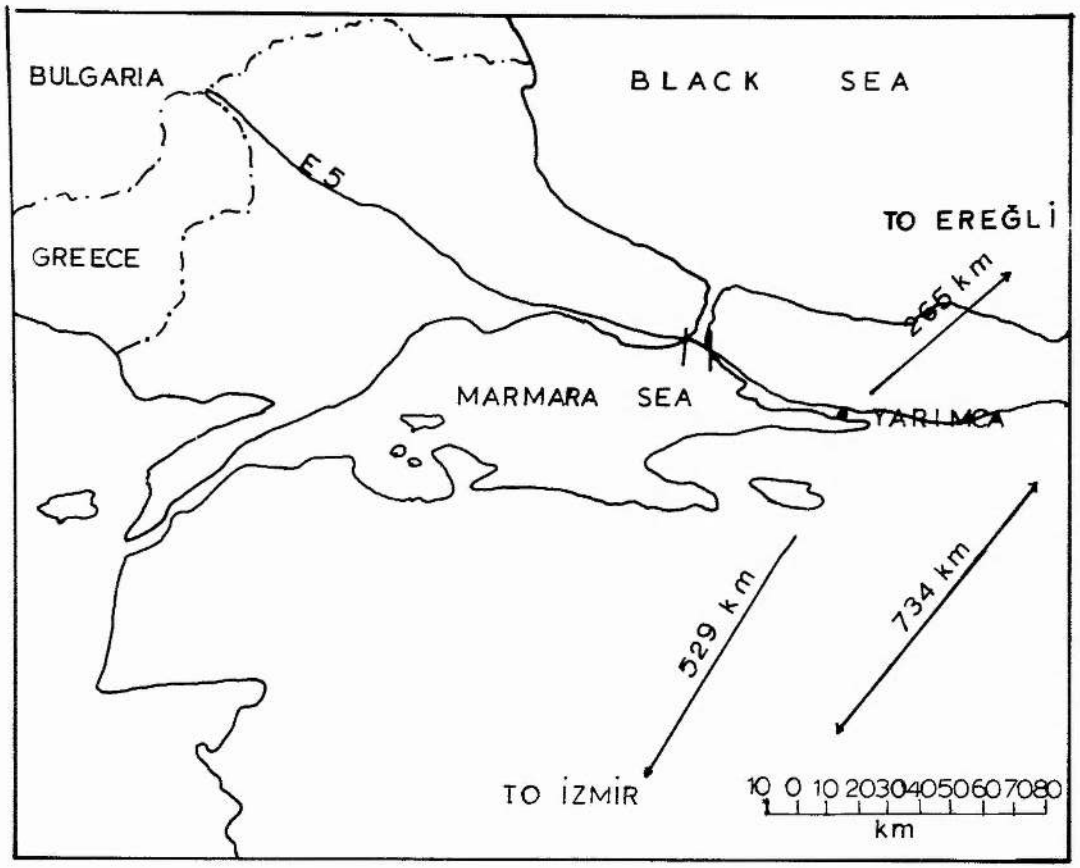
Total 133,939,675 tons/km.

(c) However, at Yarimca, for the same production it has been:

65,000 x 529 = 34,385,000 for salt (İzmir)

26,115 x 265 = 6,920,475 for benzene (Ereğli)

Total 41,305,475 tons/km.



THE DISTANCE OF YARIMCA COMPLEX FROM ITS TWO RAW MATERIAL SOURCES

Source: K. Lokman, T. İktisat Gazetesi, Ankara, 20.4.1972, P.5

III) <u>If Petro-Chemistry was Located at One of the Raw Material Sources, How Much Would Transportation Costs be?</u>

If we calculate the relative costs for different locations (Yarimca, İzmir, Ereğli) we can see the differences between transportation costs for the three places. The transport cost of salt is 59 T.L./ton and aromatic oil, naptha and benzene 92 T.L. (1971 prices).

(a) If the petro-chemical industry was located at the source of raw material:

For İzmir	24,968,340 T.L.	for naptha
	4,968,000 T.L.	for aromatic oil
	2,402,000 T.L.	for benzene
Total	32,338,340 T.L.	

(b)

For Ereğli	24,968,340 T.L.	for naptha
	4,968,000 T.L.	for aromatic oil
	4,030,000 T.L.	for salt
Total	33,966,340 T.L.	

(c) However, it has been paid for Yarimca

	3,835,000 T.L.	for salt
	2,402,580 T.L.	for benzene
Total	6,237,580 T.L.	

It can be appreciated that if it was located at one of the raw material sources, aggregate transportation costs would be very high. This big difference seen above concerns only the transportation of raw materials. If we take into account the subsequent processing to serve its market, its aggregate transportation costs will be even higher.

We will be able to see more clearly the particular advantage of Yarimca if we calculate the aggregate transportation costs of the three places.

As the Yarimca complex was located at the centre of the market, after production most of its products are consumed within a 100 km radius (in

fact, this market is capable of absorbing 100 per cent of some petro-chemical products). But if it were located in İzmir, after production most of its products would be sent to İstanbul and some of it would be consumed by the local market. So, the aggregate transportation costs from İzmir would be (total production of the complex was 263,800 tons in 1971):

	191,302,365	(for raw materials)
	128,233,180	(for products)
Total	319,535,545 km/ton	

Since there is no market for petro-chemical products in Ereğli, the products would be sent to İstanbul, İzmir and other parts of the country. So, after production the aggregate transportation costs would be:

	133,939,675	(for raw material)
	81,278,220	(for same production)
Total	215,217,895 km/ton	

On the other hand, the aggregated transportation costs from Yarimca to markets are:

	41,305,870	(for raw material)
	37,697,020	(for same production)
Total	79,002,890 km/ton	

It is necessary to bear in mind that 100 km away from Yarimca is the maximum journey for most of petro-chemical plant production, but on the other hand for Izmir, 100 km might be a minimum and not a maximum journey as the İstanbul area is the biggest market for it. It should be noted that transport costs for products are higher than those for raw materials.

B. THE RELATIONSHIP BETWEEN RAW MATERIAL AND PETRO-CHEMISTRY IN TURKEY

Petro-chemicals consume only a small proportion of the total petroleum and natural gases produced, but produce a considerable fraction of the total product of the chemical industry.

I) Raw Material

In the petro-chemical industry the main principle is the utilisation of refinery products as chemical raw materials, instead of fuel. So, petroleum

is the raw material. Thus, the petro-chemical complexes are usually built up near the refineries. Petro-chemical plants not only take advantage of the refinery, but also supply products to the refinery, such as caustic soda, which is very important to the refinery itself. In Turkey, other raw materials of petro-chemistry are salt, benzene and aromatic oils.

First of all, Turkey had to await the discovery of oil, and when it was discovered a refinery was not available. The first refinery in Turkey was erected near Raman oil-field in 1956, but this refinery was far away from any big industrial centre, and communications with industrial centres were inadequate. On the other hand, there were insufficient petroleum products for other things. One more point, its capacity was small and only sufficient for domestic fuel. T.P.A.O. (Turkish Petroleum Jointstock Company) decided later on to build a refinery near the İstanbul area. Mersin refinery was built one year later. The İstanbul area was chosen for the petro-chemical plant after two refineries had been erected (İstanbul, Mersin).

There are two reasons for this:

1 - The first reason was most important: that the İstanbul refinery was located at the centre of the biggest market for petro-chemical products.

2 - The İstanbul refinery, like the Batman refinery, is a national refinery. After completion it was owned as follows: 51 per cent T.P.A.O., 49 per cent Caltex. Now it has been taken over by T.P.A.O. and is owned 100 per cent by them. Its capacity also has been increased from 1,000,000 tons to 5,500,000 tons. The Mersin refinery, however, was owned by international petroleum companies - by Shell, B.P. and Mobil-Oil.

Petroleum refining is one of the industries in which weight loss ratio is almost zero. The other raw materials of the petro-chemical industry are pure as well; weight loss ratio is more or less zero in this industry.

II) <u>If it was Located at the Batman Refinery, How Much Would Transportation Costs Be?</u>

At a first glance it can be suspected that two of the four raw materials have been obtained from the İstanbul İpraş refinery because of the petro-chemical plant established there, and it seems that petro-chemistry depends on

raw materials rather than a market and transport network. But let us calculate as we did before. We assume that the plant is located at Batman (first refinery) instead of İstanbul, because there is also a refinery there. The petro-chemical plant can receive two raw materials (naptha and aromatic oil) as İstanbul does, while the Batman petro-chemical plant can obtain two other raw materials from İzmir (salt) and from Ereğli (benzene).

The Batman petro-chemical plant would pay:

65,000 x 1,641 (Batman - İzmir)	=	106,665,000	for salt
26,115 x 1,315 (Batman - Ereğli)	=	34,341,225	for benzene
Total		141,006,225	ton/km.

for raw material from two sources. Then it has to serve the market, that is, the İstanbul and İzmir area. In that case it can be assumed again that the plant produced 263,800 tons of products; there is a distance of 1,441 km to İstanbul, and 1641 to İzmir from Batman, and it was transporting 263,800 tons of its product. So the aggregated transport cost would be:

	106,665,000	for salt
	34,341,225	for benzene
	141,006,225	
	375,211,800	for product transportation to market
Total	516,218,625	ton/km.

As can be seen above, for the same plant, aggregate transport costs would have been much higher if the petro-chemical plant were erected at Batman. As Lösch (Lösch, 1954) says, "The major factor affecting cost of production is the variation of transport costs. If this is minimised, surely the cost of other essential things will be lowered".

So, after this explanation we can say that petro-chemical plant depends on market and transportation costs rather than on raw materials.

C. RELATIONSHIP BETWEEN PETRO-CHEMISTRY AND MARKET IN TURKEY

The petro-chemical industry does not produce finished products, but prepares the basic materials for other industries, to be made into consumer goods. Therefore it is considered to be essential for the Turkish manufacturing industry. Turkey has waited for a long time to reach a sufficient level of

industry for petro-chemical products. Petro-chemicals were produced first in 1969, and until 1969, the market conditions for petro-chemical products developed significantly.

As we indicated before, at present over 50 per cent of Turkish industry is located in and around İstanbul. İzmir, Bursa, Adana, Gaziantep and Mersin are also industrial centres of Turkey, but their industrial strength is not as great as İstanbul's. As a matter of fact, we will give more detail of its market in following chapters. For the present, let us simply note where the strongest market is for its production amongst the industrial centres of Turkey.

Consumption of Petro-Chemical Products

Amongst Industrial Centres in Turkey

Products	Industrial Centre	Percentage of Consumption
PVC	İstanbul	80
	İzmir	14
	Gaziantep	3
	Others	3
		100
Polyethylene (low density)	İstanbul	77
	İzmir	19
	Others	4
		100
Polyethylene (high density)	İstanbul	77
	İzmir	19
	Others	4
		100
Polypropylene	İstanbul	93
	İzmir	6.5
	Adana	0.5
		100.0
DMT	İstanbul	30.87
	Adana	61.72
	Bursa	7.41
		100.0

D. RELATIONSHIP BETWEEN ENERGY SUPPLY AND PETRO-CHEMISTRY

Another feature of Turkish petro-chemistry is that it consumes a huge amount of energy: 120,000,000 - 130,000,000 kw/h a year. For instance, Yarimca complex consumed 10,643,000 kw/h in April (1972); 9,800,000 kw/h in May and 11,500,000 kw/h in July (1972). The price of a kw/h of electricity in Turkey for industry is more or less fixed at 0.123 T.L. because all energy requirements in Turkey have been supplied by Etibank (State-owned institute for energy supply). Since the price of electricity is fixed everywhere, it does not play an important role in the location decision of the plant in Turkey. The only important factor is to find a sufficient electricity supply for the plant, because this huge electricity requirement must be supplied effectively and the current must not be cut down. During the Republican Era total electricity production of Turkey was 47,000,000 kw/h, so there was no possibility of erecting petro-chemical plants since it requires 120,000,000 - 130,000,000 kw/h a year for a middle capacity plant. The electricity production of Turkey reached 312,000,000 kw/h in 1938 and 12,248,000,000 kw/h in 1973[1] (Financial Times, 30.8.1974, p.13).

E. RELATIONSHIP BETWEEN WATER SUPPLY AND PETRO-CHEMISTRY

One of the vital factors of the petro-chemical complexes is water supply. Petro-chemistry uses a huge amount of water which is very necessary for chemical reactions and cooling systems. For instance, the Yarimca complex consumed 410,000 m^3 of water in April, 360,000 m^3 of water in May and 471,000 m^3 of water in July 1972 (PETKIM 1972); the water comes from Lake Sapanca, which is 70 km away from the complex, by pipe-line. The cost of a m^3 of water is 0.60 T.L. This means that the Yarimca complex spends 2,880,000 T.L. a year for its water supply. The water supply was one of the most important factors in deciding the location of the petro-chemical plant. Apart from being

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(1) After putting Keban Dam into operation with its 10,000,000,000 kw/h capacity in September 1974, the electricity production of Turkey will almost be doubled. (Milliyet, 10.9.1974, p. 1 and 7).

the biggest market, the İstanbul area has been chosen for the first complex because of its being easy to supply with water for the huge water demands. Unlike some other countries, as Turkey is a Mediterranean country, the water supply is a serious problem, especially in summer time when some of the rivers dry up.

As we will indicate later on, water supply should be a very important consideration in locating the second petro-chemical complex as well. Because of its capacity, the second petro-chemical complex's demand for water will be $1m^3$ or more per second, which means it will consume millions of tons of water in a year. Since sea water is salty it cannot be used in the complex for chemical reactions which need fresh water. Regarding this, the petro-chemical complex researchers must not ignore the importance of the water supply. Although there is a possibility that after using water in the complex it can be used again by treatment and recirculation, this would mean an increase in costs (Isard, Schoolar-Vietorisz, 1964, p.120). The water supply factor should be even more important than the labour factor in the location decision of petro-chemistry, since labour is very mobile.

F. RELATIONSHIP BETWEEN LABOUR AND PETRO-CHEMISTRY

Employment, generally defined as the active population participating in production, emerges as an important factor and problem in economic and social development. In Turkey, by placing emphasis on industrialisation during the Second Plan, more employment possibilities were created in the cities. Development of the economy within the 7 per cent rate of growth will be supported to increase employment by special measures and particular effort should be made for the areas where the unemployment problem is the greatest to increase employment and reduce unemployment.

During the period 1955 - 1962 the total increase in manpower employed was approximately one million. Of this increase, 27 per cent occurred in agriculture, 35 per cent in industry and 38 per cent in the service sectors (D.P.T., 1969, p.142). Within individual sectors, the increase in employment was 3 per cent in agriculture, 36 per cent in industry and 39 per cent in

services (Ibid). The different percentage increase in employment in each sector has altered the percentage distribution of the total number of persons employed during this period. Persons employed in the agricultural sector made up 82 per cent of the total in 1955, whereas this ratio dropped to 78 per cent in 1962. The total increase in employment between 1963 and 1967 was 1,215,400 people (Ibid).

Turkey has emerged from an agricultural economy and is now becoming industrialised and undergoing rapid development. Unlike some other branches of industry, petro-chemicals require educated and skilled manpower. Educational possibilities for training manpower and changing the vocational structure are scarce in Turkey. The people have a better chance of higher education if they live in big cities, such as İstanbul, Ankara, Adana, Bursa or Eskişehir. For the whole chemical industry, estimated manpower demands are (D.P.T., 1969, p. 165):

1967	1968	1969	1970	1971	1972
1,900	2,000	2,300	2,600	2,900	3,200

For the same industry, supplies are:

1967	1968	1969	1970	1971	1972
1,900	2,000	2,200	2,500	2,800	3,100

Mostly, the skilled labour, technicians and engineers which the petro-chemical industry especially needs are available in the big centres. For this reason, as the biggest cultural centre of Turkey, İstanbul has been very attractive

for this industry. İstanbul is also the most heavily populated city in Turkey with its 3,000,000 population, and 525 inhabitants per km^2. Regarding this, İstanbul easily offered the 2,444 (1972) skilled labour, technicians and engineers which the petro-chemical complex needed. Their average wages are 81.32 T.L./day, so the Yarimca complex spends 271 T.L. (1972) labour wage for each ton of its product. This expenditure for labour is certainly one of the highest in Turkey. If the first complex had been erected somewhere else, for the same product the complex would pay less than this. But, firstly, as İstanbul was the biggest market for its product and it had a refinery, it saved a huge amount of aggregate transportation costs for both, receiving raw materials and transporting its products to the market. Secondly, İstanbul offered more than enough technicians and skilled workers (which petro-chemistry especially needs, and which other regions were not able to provide) being the biggest cultural and industrial centre of Turkey. A. Weber (Weber, 1968, p.103) points out, "Where industry has a high labour coefficient it will be attracted to locations of cheap labour, but only if the savings on labour costs are greater than extra costs involved in deviating from the minimum transport cost".

G. RELATIONSHIP BETWEEN CAPITAL AND PETRO-CHEMISTRY

One of the most distinctive features of petro-chemistry is that it requires big investment. Until now, 1,500 million (Türk Lirasi) Turkish Lira have been invested for this purpose.

Investment in Petro-Chemistry in T.L.

Year	Planned	In Reality	%
1965	115,000,000	43,640,000	37.9
1966	150,000,000	132,189,000	88.1
1967	150,500,000	179,308,000	119.1
1968	235,550,000	237,588,000	100.9
1969	214,459,000	290,741,000	135.6
1970	285,495,000	298,400,000	104.5
1971	340,000,000	227,305,000(1)	66.9

(1) for nine months - source: PETKIM Genel Müdürlüğü.

For the second complex it has been planned to invest 4,097 million T.L. One of the reasons for not starting very early to build petro-chemistry in Turkey was shortage of capital. For this reason planners were very careful to choose the least-cost site for the first petro-chemical complex in Turkey.

H. RELATIONSHIP BETWEEN LAND COST AND PETRO-CHEMISTRY

The petro-chemical industry covers a very wide land surface in Turkey. The Yarimca complex covers 1,000,000 m^2 land. For this huge piece of land, 10,000,000 T.L. were paid in 1965. If it was located in İstanbul instead of near İstanbul, this land cost would be 15 or 20 times more than this amount. It was very difficult to find a huge piece of land like this in İstanbul. Because of the high cost of land in İstanbul, many plants are located along the coast of the Sea of Marmara, especially east of the city. So, it has been chosen as the cheapest and nearest place to the biggest market for the first petro-chemical complex. Since then land prices increased there to 80 T.L. (1971 prices) for each M^2 instead of 10 T.L., because of the demand in that part of the city to erect plants. Now, the east side of the city does not allow the present plant enough room for expansion. As we will indicate later on, for this reason a second and bigger complex has been planned for another part of the country.

I. RELATIONSHIP BETWEEN CLIMATIC CONDITIONS AND PETRO-CHEMISTRY

Climatic conditions play an important role in the location decision of the plant from the point of view of allowing the erection of an out-door complex. If temperatures suddenly change in a short period, this damages the petro-chemical pipes. Since the İstanbul area has a mild climate (see p. 19) it allows an out-door complex to be erected.

J. TO DESTROY HAZARDOUS RESIDUE OF PETRO-CHEMICAL INDUSTRY

As is well known, all petro-chemical plants give off hazardous residues which pollute water and air. For this reason the Yarimca complex has a special installation to pump used water under the sea and to clean air which is emitted from the complex before it can mix with and pollute the atmosphere.

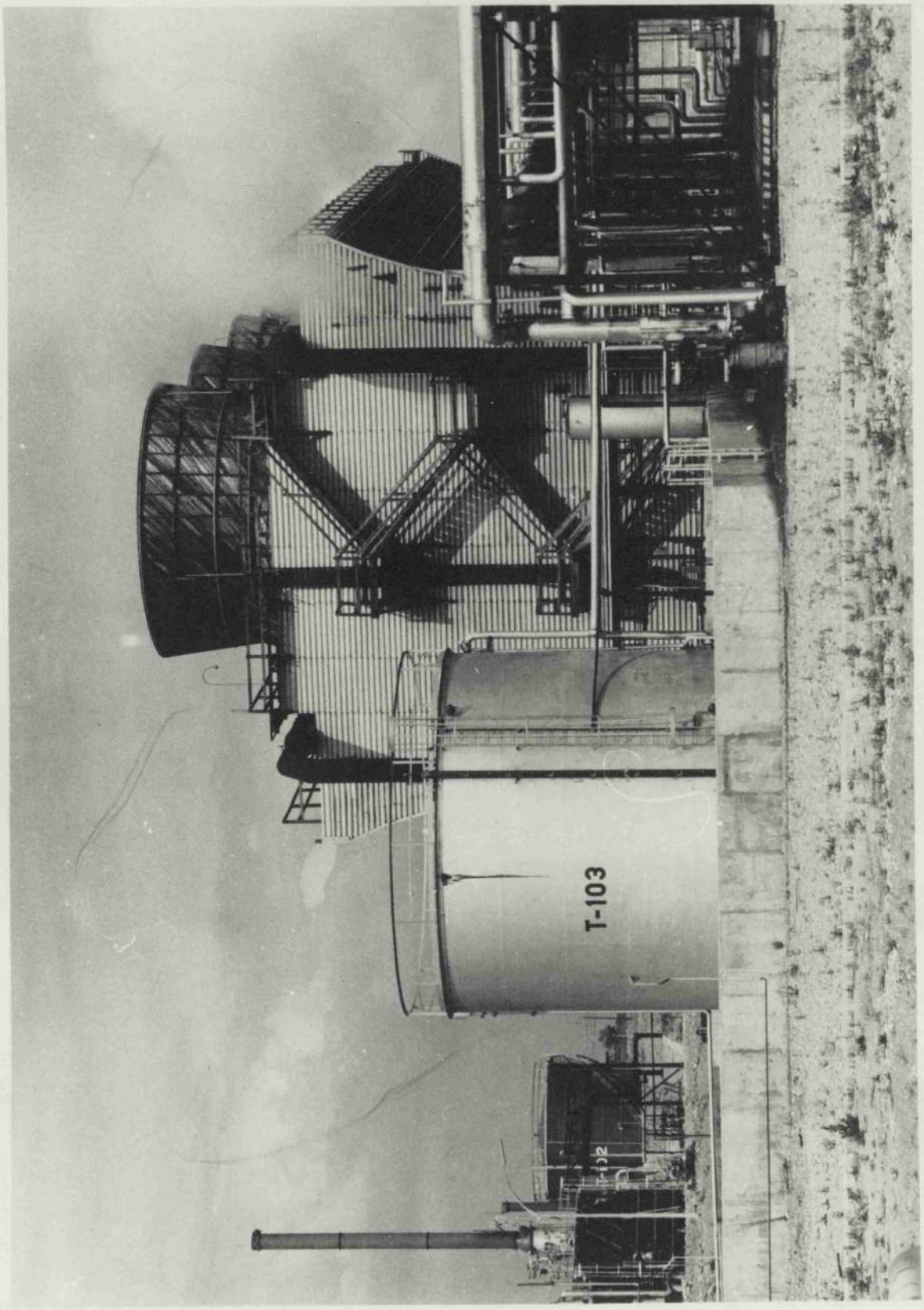
Conclusion

After the Turkish industry achieved a certain level of maturity, the first petro-chemical complex of the country was located in Yarimca, less than 100 km. from İstanbul which is the biggest market for petro-chemical products. The market factor has been very important in locating the first complex of Turkey. In fact, most of the plastic processing industry is within a radius of 100 km. of the Yarimca complex. Besides this, the area was most favourable for this industry as far as the transport network, water supply, skilled labour and raw materials were concerned. An energy supply was available, and climatic conditions were also favourable for the petro-chemical industry in this area.

In the next chapter, the products of the complex will be discussed.

CHAPTER IV

THE PRODUCTION OF THE PETRO-CHEMICALS IN TURKEY



The Water-Cooling System in the Complex

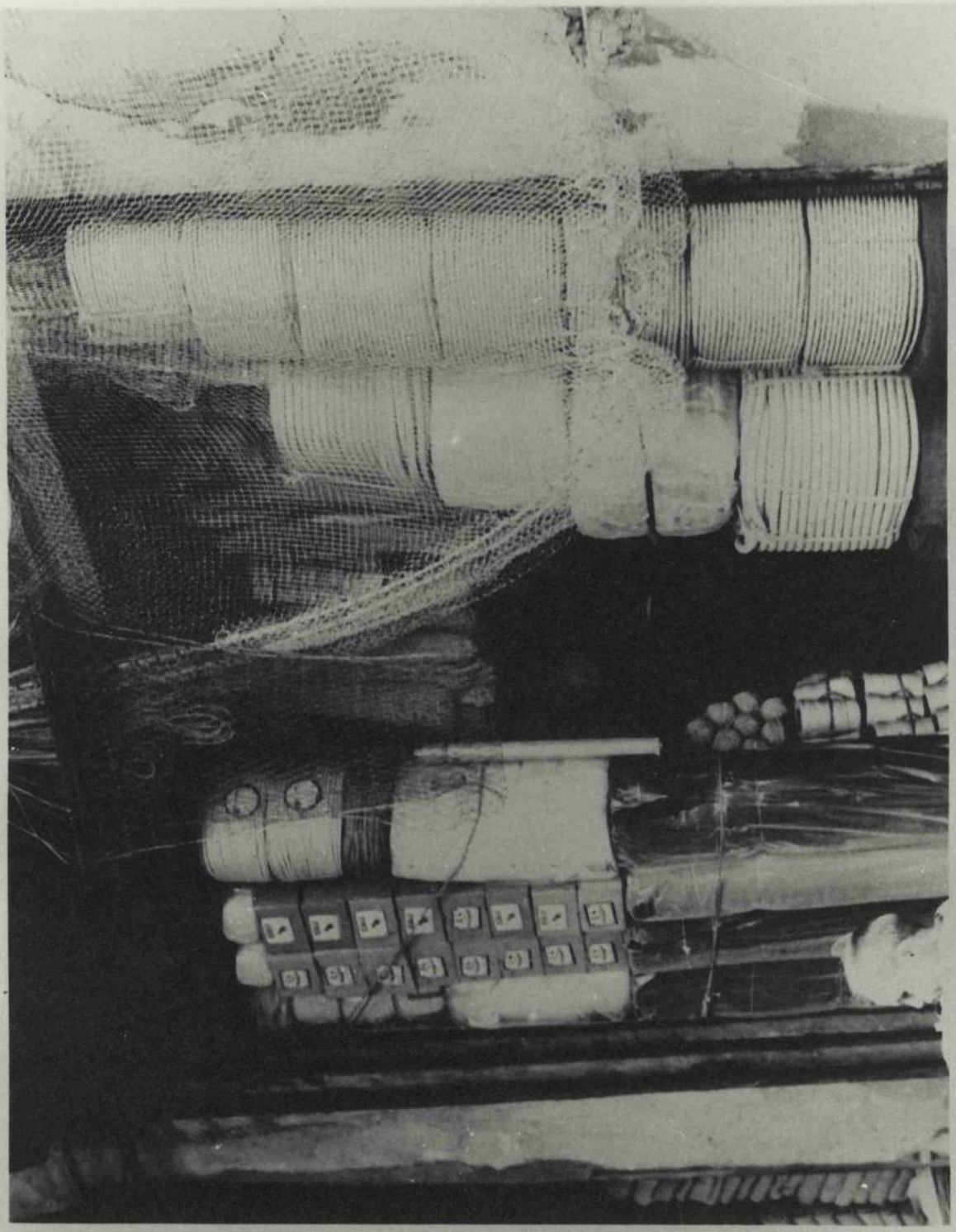
THE PRODUCTION OF THE PETRO-CHEMICALS IN TURKEY

In the previous chapter we explained the choice of locations for the petro-chemical industry in Turkey. In this chapter our attempts will be to explain the production of petro-chemicals in Turkey.

The production of PETKIM (Petro-Chemical Company of Turkey) can only be understood by searching for the reasons for the establishment of PETKIM in Turkey. One of its aims was to provide basic raw material for newly established industrial branches. Secondly, to prepare easily, cheaply produced and better quality materials instead of existing natural and artificial materials. Thirdly, without delay, to follow technological developments in chemistry which convert raw material from coal to petroleum. Fourthly, to increase national income and improvement of taste and need have caused an increase in demand for some products which are based on petro-chemistry. Fifthly, to save foreign exchange by producing petro-chemical products within the country, which were hitherto imported. Since the demand was increasing every year for petro-chemical products, parallel to this the demand for foreign currency was increasing. Indeed in terms of net value, the Company's contribution to the national economy is 445,000,000 T.L., and the annual aggregate savings in terms of foreign exchange is 1,200,000,000 T.L. (PETKIM, 15.11.1971). Sixthly, as was indicated before, petro-chemistry covers most of the organic chemical industry and so it causes other industries to develop.

In the light of these circumstances, the Turkish petro-chemical industry concentrated on meeting the urgent needs of Turkish industry; that is, its production became more important to the domestic market than the external market. As will be seen, the first petro-chemical complex is not able to supply all the present demands of the Turkish market. It will be necessary to build a second and third petro-chemical complex within the country.

Indeed, thanks to this branch of industry today, more than 2500 different items have been introduced to the market (Ibid). Petro-chemicals are considered as a basic industrial branch for the manufacturing industry. It became



Various Materials made from Petro-Chemical Products

possible to produce in a most economical manner from petroleum the plastic materials of all plastics introduced in our daily life, the raw materials of synthetic fibres, detergents, synthetic rubber, carbon black and other chemicals.

Today, most metallic items are replaced by plastics, so very difficult metal working has been simplified. World consumption of plastics has increased three fold in the last ten years. The following table reflects the remarkable increase in the consumption of all plastics in the selected countries.

Per Capita Plastics Consumption (kg)[1]

Country	1955	1960	1962	1965	1966	1967	1969
U.S.A.	9.91	15.61	18.1	24.6	27.5	30.5	40.9
W. Germany	5.87	15.29	18.1	26.2	28.5	34.7	52.2
Sweden	5.00	12.00	17.5	23.0	26.8	32.1	39.5
G. Britain	5.19	9.91	11.8	15.1	15.6	17.0	21.8
Holland	3.03	7.93	10.4	16.4	16.5	16.8	18.0
Turkey	0.30	0.50	0.50	0.70	1.00	1.00	1.50

According to calculations, yearly plastic consumption per head in the world will reach 16 kg (5 kg in 1965) in 1975. Again, according to calculations, plastic consumption per head will be 58 kg in U.S.A. and will be 4.5 kg in the developing countries.

The development of the petro-chemical industry in Turkey is fraught with considerable difficulty. Even after having three refineries in the country she did not have an organisation to deal with the design of the technological equipment required for petroleum refining itself. Only quite recently has all technical equipment for building a petroleum refinery been made in Turkey, and this branch of industry has developed very quickly. Indeed Turkey now offers technical aid and equipment to her neighbours in this field.

But Turkey has only just made a beginning in the petro-chemical industry. It is clear that as far as the first petro-chemical complex is concerned, almost all of the equipment as well as the complete technical know-how has to be purchased together with the patent rights at a fabulous price.

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(1) Source: PETKIM Genel Müdürlüğü, Ankara.

It is also known that even the engineering construction of such complex technological equipment is outside the scope of the Turkish constructor and a large number of technicians have to be brought from outside in the construction as well as in the production stages initially. This is also true with regard to instrumentation and automation in which she is lagging behind. The petro-chemical growth was a great stimulus for research and development in allied subjects. The new materials of construction have contributed to the development of the industry just as much as development on the chemistry and technological side. Petro-chemicals have to their credit many developments in new engineering materials and chemicals. Without developments in materials of construction, instrumentation etc., in design features and data processing, the growth of petro-chemicals would not have been possible. The materials to withstand as low a temperature as $-190^{\circ}C$ and as high a temperature as $+3315^{\circ}C$ are necessary in petro-chemical processing. Vessels, piping, insulation, fittings, supports etc., to stand such varied temperatures were a challenge to the engineering designers. Similarly, a large number of chemicals which can stand various problems of corrosion and temperatures and pressures, like epoxy resins, fluoro-carbons, new elastomers and special plastics which compete with metals and alloys in many fields have revolutionised construction methods and are in further process of development.

Even in Europe, U.S.S.R. and other places, petro-chemical growth has been almost dependent on the co-operation and help received from the U.S.A. Even where some processes were available in Europe it was found to be impossible to compete with rapidly growing techniques in the U.S.A. It was also found to be impossible for European countries to cope with the research and development programmes of the U.S.A. While some countries such as Britain, France, Germany Italy and Japan have made significant advanced in the last 15 - 20 years in the petro-chemical industry, it can be stated that the growth is negligible compared with that of the U.S.A. developments, although the rate of development is showing an increasing trend in advanced countries.

1. RAW MATERIAL

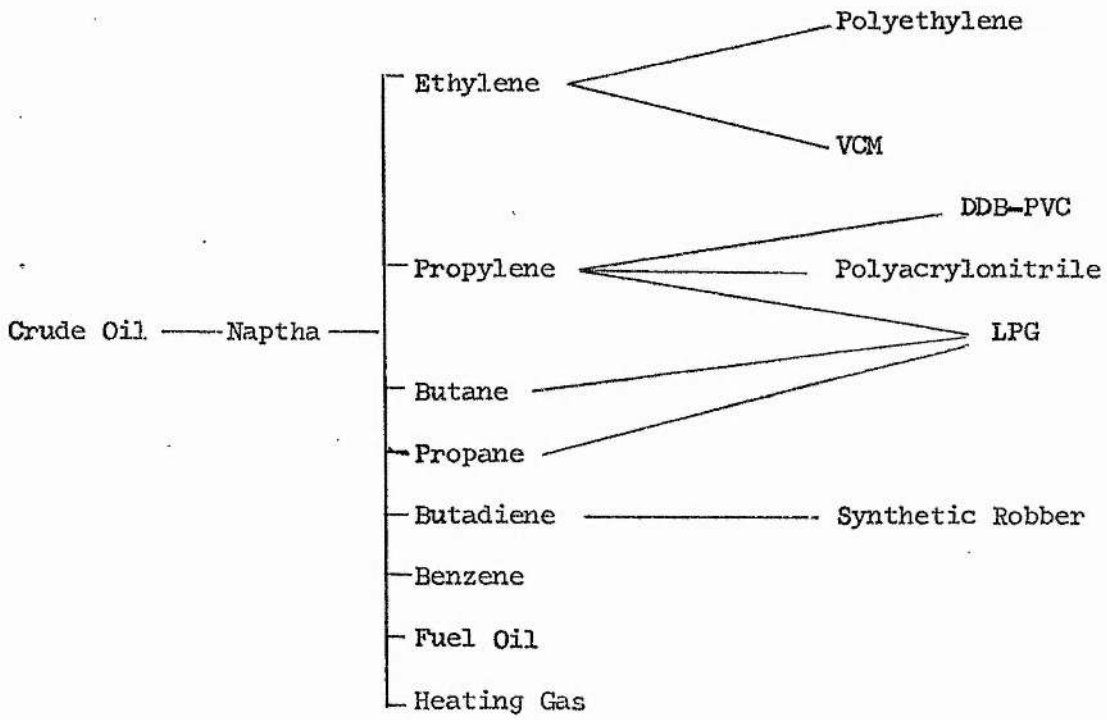
The basic raw materials constituting the sources for chemicals from petroleum may be divided, for convenience, into three groups:

(a) Gaseous

(b) Liquid

(c) Solid

In Turkey, liquid naptha is the basic raw material of petro-chemistry. Naptha can be defined as a fraction of petroleum which has an almost identical boiling range with motor spirit, and can be further classified as being light, medium or heavy. Naptha generally implies medium naptha boiling between 80°C and 140°C. Liquid naptha finds extensive use in the chemicals industry because of its ease in storage and independence of refinery operations. PETKIM also uses some other subsidiary raw materials[1]. In the Yarimca complex the basic raw material, as mentioned above, is naptha, and after this, as shown in the following table. This table also explains why petro-chemical covers a group of plants and why it has been called a complex.



(1) Salt, aromatic oil, benzene and some others.

2. THE PRODUCTION UNITS

A. ETHYLENE UNIT

Erection and construction works of this unit, which was planned for a capacity of 30,000 tons/year ethylene and 20,000 tons/year propylene, started during 1967. Start-up operations in connection with the unit began in April 1969. By means of supplying the products of the ethylene unit to the production units, it is possible to obtain the important raw materials of the market.

Ethylene is the most important olefin of the petro-chemicals produced, followed by propylene and butene. The process consists essentially of cracking the hydro-carbon for maximum olefin yield and separation of cracked products to individual cuts. All cracking for olefins and their separation processes are very high energy consumers.

Ethylene units process 125,000 tons/year naptha and produce 30,000 tons/year cracked gasoline and 10,000 tons/year C_4 fraction for the final product units, in addition to its main products, ethylene and propylene. Start-up operations were completed upon the production of ethylene at the required specification at the end of 1969. The following sequence of operations is adopted in the unit:

(i) Cracking by indirect firing in a tubular still using diluent steam or by direct firing using fluidised technique.

(ii) Quenching of cracked products.

(iii) Fractionation to remove heavy products (benzene to fuel oil).

(iv) Removal of acid gases by caustic or amine scrubbing.

(v) Dehydration to remove traces of water.

(vi) Catalytic selective hydrogenation of acetylene to ethylene.
In the propylene cut selective hydrogenation of propydiene and metyl-acetylene to propylene takes place.

(vii) Low temperature - high pressure or alternative system of separation:
De-methanising
De-ethanising

The Ethylene Unit

C_2 splitting to ethylene, ethane de-propanising and C_3 splitting to propylene, propane.

Methane and H_2 from de-methanisers go to fuel gas. Ethane and propane are recycled or cracked in separated furnaces. If butene butadiene cuts exist they are also separated to recover butadiene.

Production of the Ethylene Unit is as follows:

(PETKIM, 12.7.1972 and 29.3.1974) (Tons)

Products	1970	1971	1972	1973	1974 (It is programmed)
Ethylene	14,447	18,911	24,031	34,436	50,000
C_3 Propane	8,177	11,676			
C_4 Butane	6,424	10,016			
Fuel Oil	3,417	2,608	2,982	7,512	6,670
Fuel Gas	13,190	15,424			
Benzene-high Octane	17,107	18,933			
Benzene-low Octane	862	5,981			

B. POLYETHYLENE UNIT

Construction and erection works of the unit, which produces 12,000 tons/year high pressure (low density) polyethylene, started during 1967 and the unit went on stream in February 1970. The production programme of the unit covers the manufacture of granule, compound and masterbatch types of polyethylene. The first Turkish-made polyethylene was introduced to the market in February 1970.

Polyethylene is the most widely used plastic at present. It has excellent water resistance, electrical insulation properties and colourability, and is used for electrical wire, insulation pipes, moulded parts, paper coatings, bottles, packaging, sheets, etc.

Some of the petro-chemical olefin production undergoes polymerisation processes to supply plastics and resins, synthetic rubbers and man-made fibres. The technique of building polymers is a vast subject and a great deal of research is being done to improve it further.

The Containers made from Polyethylene

Polymers can be divided into additive polymers and condensation polymers. Additive polymerisation is the reaction between the same type of molecules of olefins to form large macro-molecules without chemical changes. Polyethylene, polypropylene, polyvinyl acetate, polystyrene, polybutadiene are in this group. PETKIM produces low density polyethylene which is a type more commonly produced in the world in comparison with the high density polyethylene. According to the world consumption figures, polyethylene follows PVC as the most heavily used product. The production situation of polyethylene in selected countries is given in the following table.

Low Density Polyethylene Capacities in Selected Countries(1)

Countries	1968	1970
Japan	650,000	650,000
W. Germany	378,000	490,000
Italy	357,000	543,000
Britain	340,000	593,000
France	330,000	410,000
Holland	200,000	385,000
Belgium	163,000	163,000
Spain	75,000	85,000
Sweden	70,000	90,000
Turkey	-	12,000

In Turkey, consumption fields of polyethylene were as follows in 1969(2):

(1) Source: PETKIM Genel Müdürlüğü, Ankara.

(2) Ibid.

Consumption Fields	Percentage
Covering Film	24.1
Packing Film	32.8
Kitchen wares etc.	18.3
Bottles and Toys	13.0
Wire and Cable Coating	11.8
	100

As a result of increasing demand for polyethylene in Turkey, the gap has remained as it was despite the increasing supply between 1970 - 1973. (For the domestic demand see Chapter 5). The table below shows the production of this unit (PETKIM, 29.3.1974).

1971	1972	1973	1974 (It is programmed)	(Tons)
9,977	12,413	21,978	27,150	

C. VCM UNIT

One of the most complicated Units of the Yarimca Complex is the VCM Unit. This required product has been obtained by means of transferring 13,000 tons of ethylene and 18,500 tons of chlorine together with the contribution of other auxiliary chemical raw materials.

Construction and erection works of the unit started in 1967 and the unit went on stream in April 1970, with a production capacity of 27,300 tons/year. This unit is planned for 100 per cent expansion. In July 1970, the VCM, at required specification, was transferred to the PVC Unit as an intermediate.

Production of the VCM Unit in 1970, in 1971, in 1972 and in 1973 was 2,300 tons; 9,806 tons; 19,045 tons and 18,246 tons, respectively (PEKIM, 29.3.1974). The production is programmed to be 26,500 tons in 1974.

D. PVC UNIT

The construction and erection works of this unit, utilising the total through-put of VCM to produce 26,000 tons/year suspension and emulsion type PVC and 16,000 tons compound type PVC, started during 1968. The first

Turkish made PVC was introduced to the market in July 1970.

Production of PVC is next to polyethylene. PVC is obtained as a white fluffy powder and can be moulded alone or with plasticisers. PVC sheets with up to 5 per cent plasticisers are rigid and are good for extruded articles like radio cases, helmets, lining etc. With 50 to 100 per cent weight of plasticiser(1) PVC moulding gives flexible and tough material useful for tubing, electrical insulation, etc.

Vinyl Chloride is produced by two methods. From acetylene, by passing a mixture of acetylene and hydrogen chloride over mercuric chloride on an activated charcoal catalyst, at 100°C to 180°C, when 25 per cent conversion takes place. The other process is by dehydrochlorination of ethylene dichloride. Ethylene dichloride is pyrolised in a tubular furnace at 500°C. The reactor effluent is quenched by ethylene dichloride. 70 percent of ethylene dichloride feed is converted to vinyl chloride and hydrochloric acid (HCl). Using ethylene and acetylene mixture, the by-product hydrochloric acid from the ethylene process can be used for acetylene conversion. Polymerisation of vinyl chloride is done by suspension polymerisation, the method using water as a medium and polyvinyl alcohol as a suspension agent in glass-lined autoclaves. Emulsion polymerisation is also practised using water soluble catalysts to a small extent.

The continuous and rapid increase in the plastic demand for countries necessitates capacity expansion of the existing units.

The following table indicates the realised PVC capacities in selected countries:

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(1) Normally dibutyl phthalate, dioctylphthalate and tricresylphosphates are used as plasticisers.

(Tons)[1]

Country	1967	1968	1969	1970
W. Germany	562,000	679,000	769,000	799,000
Italy	377,000	547,000	667,000	667,000
Britain	315,000	380,000	380,000	520,000
France	433,000	433,000	450,000	450,000
Belgium	70,000	215,000	280,000	280,000
Sweden	75,000	75,000	75,000	75,000
Spain	60,000	60,000	75,000	75,000
Norway	-	70,000	70,000	70,000
Turkey	-	-	-	42,000
Switzerland	20,000	20,000	20,000	20,000
Greece	15,000	15,000	15,000	15,000

Although PVC has been, in general, the most extensively consumed plastic product in the world, the recent consumption trends for polyethylene and PVC show similarity to a great extent due to the newly emerging fields of application for polyethylene.

Although Turkey only entered this field of production in 1970, there were already many areas of application for PVC which had developed in the 1960's.

The table below shows uses for PVC in 1967 and in 1968 in Turkey[2].

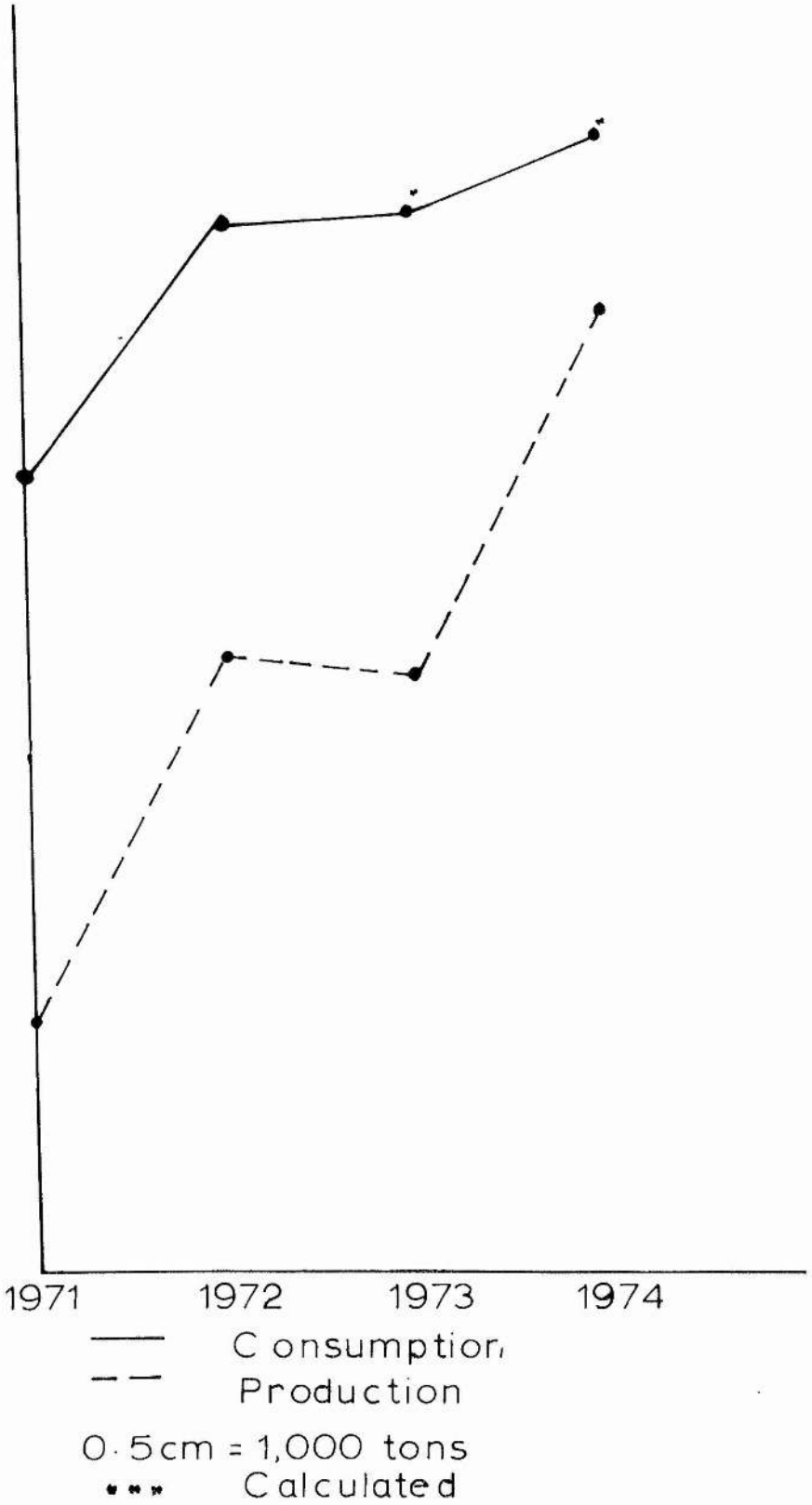
Uses	1967	1968
Shoes	4,018	4,433
Wire and Cable	2,497	2,827
Synthetic Leather	4,844	5,149
Pipes and Profile	2,170	5,759

(cont'd.)

(1) Source: PETKIM Genel Müdürlüğü, Ankara.

(2) Ibid.

THE CONSUMPTION AND PRODUCTION OF PVC IN TURKEY (1971-1974)



(cont'd.)

Uses	1967	1968
Hoses	1,100.5	1,464
Floor Tiles	1,580	2,520
Records	150	150
Bottles and Toys	22	220
Separator	255	295
Miscellaneous	265	310
Total	16,901.5	23,137

After 1970, Turkey produced PVC for her own needs, but since the plant is not working at 100 per cent capacity, the gap between demand and supply did not close even in the following years. The demand increases year by year faster than production, and so the gap enlarges between supply and demand. (For demand see Chapter 5)

PVC Unit Production in Turkey between 1970 - 1974
(PETKIM, 29.3.1974)

Years	Products	
	Suspension	Compound
1970	1,542	-
1971	7,650	98
1972	17,325	1,196
1973	16,706	2,024
1974 (It is programmed)	18,350	12,500

E. CHLOR ALKALI UNIT

Erection and construction works of this unit, producing 18,500 tons/year chlorine gas and 20,300 tons/year caustic soda for the production of VCM started during 1968. The unit went into stream production in February 1970. The chlorine gas was being transferred to the VCM unit in April 1970 and caustic soda was introduced to the market in May 1970.

All of the chlorine produced is used by the VCM unit as raw material and the by-product, caustic soda, as 50 per cent solution, meets the requirements of Turkish industry.

Caustic soda, which is partly imported and consumed particularly in soap and oil refining industries, the textile industry, synthetic silk (rayon) and cellophane manufacturing, chemical products, paper, aluminium and petroleum industries, is one of the most important industrial raw materials.

Chlor alkali unit production was as follows between 1970 and 1974 (PETKIM, 29.3.1974):

Years	Products	(Tons)
	Chlor	Sud Costic (100%)
1970	3,691	3,842
1971	10,465	11,725
1972	16,995	19,302
1973	13,835	15,593
1974 (It is programmed)	16,150	18,200

F. DDB UNIT

All of the agreements of the DDB unit, which meet the raw material requirements of the synthetic detergents industry, were completed during 1967-1968. The unit which covers the propylene tetramer unit went on stream in 1971.

As an extensively used raw material DDB, like plastics, has also a short history of 25 - 30 years. The growth of the synthetic detergent (or surface active agent) industry since the Second World War has been one of the most spectacular developments in the chemical industry. Between 1945 and 1955 production increased by almost 20 fold and by 1961 it had become 260,000 tons. While in 1945 synthetic detergent sales were only 5 per cent of soap sales, by 1953 sales had surpassed those of soap. In 1963, soap sales were only one-third of the detergent sales. Before the Second World War, synthetic detergents were used chiefly in industry; but sparked by the wide use in the

armed forces during the war, the biggest postwar gains were in household use. At present household detergents account for 85 per cent of production.

As a household detergent and industrial wetting agent, soap possesses two important disadvantages. First, it forms insoluble calcium salts which are precipitated from hard water, and second, it is unstable in acid solution. Synthetic detergents have no such disadvantages, and as a result of this, synthetic detergent production increased very significantly compared with soap production. A matter of great importance in this field is that the development of synthetic detergents has influenced the production of glycerine by developing alternative sources for glycerine; e.g., the production of synthetic glycerine from petroleum sources.

With the operation of the DDB unit at the Yarimca complex, the raw material requirements of the synthetic detergent industry are met without need for importation.

The production of DDB unit in Turkey

(PETKIM, 29.3.1974)

(Tons)

1972	1973	1974 (It is programmed)
42	7,475	10,000

3. PRODUCTION COSTS

We should now consider the industry's cost structure.

A. AMORTISATION

If one examines the production costs of PETKIM, one can see that the highest percentage in all expenditure is amortisation. Indeed in 1972, 25.6 per cent of all expenditure was reserved for amortisation (PETKIM, 10.5.1973). The reason for this is that in the petro-chemical complex work is done between -190°C and +3,350°C, as a result of which many parts of the complex wear out quickly and need to be changed.

Although in 1973 the percentage of amortisation decreased from 25.6 per cent (1972) to 19.3 per cent in the total expenditure, the total amount of

The Yarimca Petro-Chemical Complex Products leaving for the Market

amortisation increased from 79,360,000 T.L. (total expenditure was 310,000,000 T.L. in 1972) to 106,343,000 T.L. (total expenditure was 551,000,000 T.L. in 1973). (PETKIM, 29.3.1974).

B. LABOUR COSTS

Other high items of expenditure are labour and administrative costs. Firstly the salary scales in this branch of industry are higher than in some other branches of industry. The reason for this is the use of a skilled work-force. Indeed, in 1972, 20.5 per cent of all expenditure was on employee's salaries. Secondly, we feel that the present set-up is inefficient and that a staff of 1,000 - 1,200 could produce the same result as the 1972 staff of 2,444.

Although the staff of the complex require and receive high salaries because they are more educated and skillful, the main reason for this high salary percentage is the Government policy of reducing unemployment figures, so that more employees than necessary are used. This proposal has been accepted by some authorities who have discussed the matter while our research was being carried out. But it is an error in any new and immature industry to employ more staff than necessary, because the extra staff affect production costs very much and so this complex has difficulties in competing with imported products even within the domestic market.

Indeed, if we take into account 1970 production, 33.4 tons[1] product produced per worker, and this increased only to 58.5 tons in 1971, in spite of increasing production. Also in 1970, for per ton produced, 780 T.L. has been spent for labour and 440 T.L. in 1971. But if 1,000 staff had been used in the company instead of 2,444 production would be 81 tons per worker in 1970 and 140 tons in 1971. Also, if we calculate labour expenses per ton produced, they would be 300 T.L. in 1970 (for 1000staff), and 200 T.L. in 1971.

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(1) For our calculations, statistical data has been obtained from PETKIM Genel Müdürlüğü, Ankara, 12.7.1972; 13.3.1973 and 10.5.1973.

For instance, ethylene is sold for 5,000 T.L./ton without tax, and 7,000 T.L. with 40 per cent tax in Turkey (PETKIM, 12.7.1972); but the same product is sold for 3,647 T.L./ton in Italy (European Chemical News, 12.1.1973, p. 16). If we discount 10 per cent from the selling prices in both countries, we get the approximate production costs of ethylene in Turkey and Italy. In this case, production costs of ethylene in Turkey are 4,500 T.L./ton and 3,283 T.L./ton in Italy.

We feel that this big difference comes firstly from the know-how and royalties for which Turkey pays fabulous prices as was indicated before, and secondly from the high labour costs.

For 1973 it has been planned to spend 21.8 per cent of all expenditure on employees' salaries. In spite of increasing total expenditure, there are two main reasons for this: either salary increases or additions to the existing number of employees.

C. RAW MATERIAL EXPENDITURE

The next highest expenditure is on raw material, this being 44,640,000 T.L. in 1972. This figure would increase in 1973 as a result of production approaching the normal capacity of the complex and would rise to 18.6 per cent of all expenditure from 14.4 per cent.

When the complex is expanded by 100 per cent, raw material expenditure will be as follows: (1972 prices)

	101,932,415 T.L.	for naptha
	16,200,000 T.L.	for aromaticoil
	6,922,500 T.L.	for salt
	58,124,000 T.L.	for benzene
Total	183,178,915 T.L.	

D. TECHNOLOGICAL INPUTS, ROYALTIES

The expenditure for know-how, royalties and interest ranks high in the total expenditure. The most important reason for this, as we explained before, is that Turkey is new in this branch of industry and finds it impossible to

catch up with a very fast growing technology. Huge investment is also needed for research into new products which can be added to the existing petro-chemical products in the world.

Indeed, in this field the U.S.A. has spent several times more money on research alone than Turkey has spent on her entire petro-chemical plant; this investment has, in fact, placed a great strain on Turkey's exchequer.

We believe that Turkish petro-chemistry should not pay huge amounts of money continuously for know-how and royalties, but should invest enough money in sophisticated research within her own petro-chemical industry, because then she would save foreign currency and could employ more native staff.

If this were done production costs could be kept under control and this could also enable Turkey to enter the world market and compete with other countries' products. Also, investment in a large research organisation in Turkey would enable her to develop existing know-how that has been bought from abroad, and then resell it, as Japan does.

A strong research organisation is needed urgently because all technology and know-how that are transferred from one country to another, contain some scientific and technical gaps which should be filled and should be adapted to native conditions. So, the life of petro-chemistry entirely depends on a research and development organisation which would help to solve some technical and scientific problems arising from bought know-how and to adapt this know-how to native conditions.

Indeed, it has been shown that petro-chemical technology makes greater progress where it has been developed than in other countries which have bought the basic know-how. There are two reasons for this; firstly, lack of sufficient administration; secondly, lack of sufficient support and research for bought technology. There are at least 7 or 8 years gap between these two groups of countries (selling - buying countries).

A country which intends to buy know-how, wants to see the technology tested and proven for 3 to 5 years before she buys, because she will be paying

a fabulous amount for this technology. So, if a given process has a life of 15 years, 5 of these years may be lost for the above reason before the country buys it. Another 3 to 5 years out of the 15 might be spent in applying the process within the country. Eventually, there might only be 5 to 7 years of useful life left for the process, and after it is out of date, huge amounts of money must be paid for half the life-time of a new process.

In a short time, like 5 to 7 years, a process is not economic for the world market, and so the country which buys ready know-how does not enter the world market and is obliged to be satisfied with uneconomic production capacities, high production costs and domestic markets.

A country which transfers technology should understand the technology completely and should adapt it to its native conditions in order to gain the maximum advantage from the technology, and to achieve the targets set.

By transferring technology we do not mean buying instruments and operating them but we mean filling the scientific and technical gaps which every technology contains, and adapting it to one's own conditions.

Indeed, PETKIM was not satisfied with the distillation branch of HCl in the Vinyl Chloride Unit, and worked on it in order to fill the technical gap until it succeeded. Again, PETKIM was not satisfied with the salt distillation process which was bought from Olin-Mathieson and could not be used satisfactorily; it was worked on in order to adapt it to the country's conditions and to make it more fruitful, and this was achieved.

In petro-chemical reactions, as in other organic chemical reactions generally it is impossible to convert the first material to the desired product. For this reason, besides the main product, some by-products can be obtained which afterwards may be taken advantage of. So, the economy of petro-chemistry depends to a great extent on the usefulness of these unavoidable by-products, and this in turn depends on the research organisation.

E. SUBSIDIARY MATERIALS

As was indicated before, PETKIM obtains naptha as a main raw material from İpraş Refinery; besides this main raw material some other subsidiary

materials, catalysts, which are imported at high cost, must be obtained.

Licensing firms have advised PETKIM to import certain subsidiary materials for use in their units; the possibility of obtaining these from native sources must be investigated. Firms supplying these materials should also be chosen by PETKIM, and not by the licensing firms, in order to reduce dependence on the licensing firms as much as possible. These measures would result in obtaining the subsidiary materials cheaply, thus reducing production costs.

Subsidiary material expenditure will increase from 13.5 per cent in 1972 to 16.6 per cent in 1973 as a result of increasing production. However, the most important thing is not to increase the percentage of subsidiary material expenditure, but to follow the direction of the licensing firms in deciding which materials to use, how much of them should be used and where they should be obtained. However, as mentioned previously, there are dangers to be avoided if PETKIM follows the directions on where the materials should be obtained: a monopoly would be created if all the materials were bought from suggested firms, thus making competition impossible. Also, since these tend to be foreign firms, it would prevent PETKIM obtaining similar materials from native firms, and would make payment in foreign currency obligatory.

Another drawback to the importation of these materials is that if, for one reason or another, the supply should decrease or fail altogether, then the PETKIM complex, after requiring a huge investment, would have to decrease its output, or close down entirely.

Conclusion

The Turkish petro-chemical industry concentrated on meeting the urgent needs of Turkish industry by using domestically produced naptha as a basic raw material and some other subsidiary materials, that is, its' production is more important to the domestic market than the external market.

Since this industry covers most of the organic chemical industry and causes other industries to develop, petro-chemicals are considered as a basic industrial branch of the manufacturing industry in Turkey.

As Turkey has just made a start in the petro-chemical industry, almost all the equipment, the complete technical know-how, the patent rights, had to be imported at great cost.

Since in petro-chemical products generally it is impossible to convert the first material to the desired product, the economy of petro-chemistry depends mostly on the usefulness of unavoidable by-products. To achieve this and stabilise production costs the industry requires sophisticated research organisations.

In the fifth chapter the domestic market and possibilities of the external market will be considered.

CHAPTER V

THE MARKET FOR PETRO-CHEMICAL PRODUCTS IN TURKEY

THE MARKET FOR PETRO-CHEMICAL PRODUCTS IN TURKEY

In the previous chapter it was pointed out that the petro-chemical industry was established in Turkey in order to meet the demand of the domestic market and, if there is surplus, to export to neighbouring countries. In this chapter the domestic and the external market will be examined.

1. DOMESTIC MARKET

Before the erection of the petro-chemical complex Turkey was importing all her needs. For instance, in 1955 (figures are available for 1955) she imported 0.30 kg plastics per capita. As was indicated earlier, in 1967 and in 1968, Turkey consumed 16,901.5 tons and 23,137 tons of PVC respectively, which came from other countries, because Turkish made PVC was first introduced to the market in 1970. Day by day demand for the petro-chemical products are increasing and it necessitates bigger capacities in order to satisfy the domestic market. At the present, home made products do not satisfy the domestic market's demand. It has been foreseen that after the completion of the Second Complex, which will have a bigger capacity than the existing one, domestic market demands will be satisfied by the home made products, but that in 10 years time it may be necessary to erect a third petro-chemical complex in Turkey.

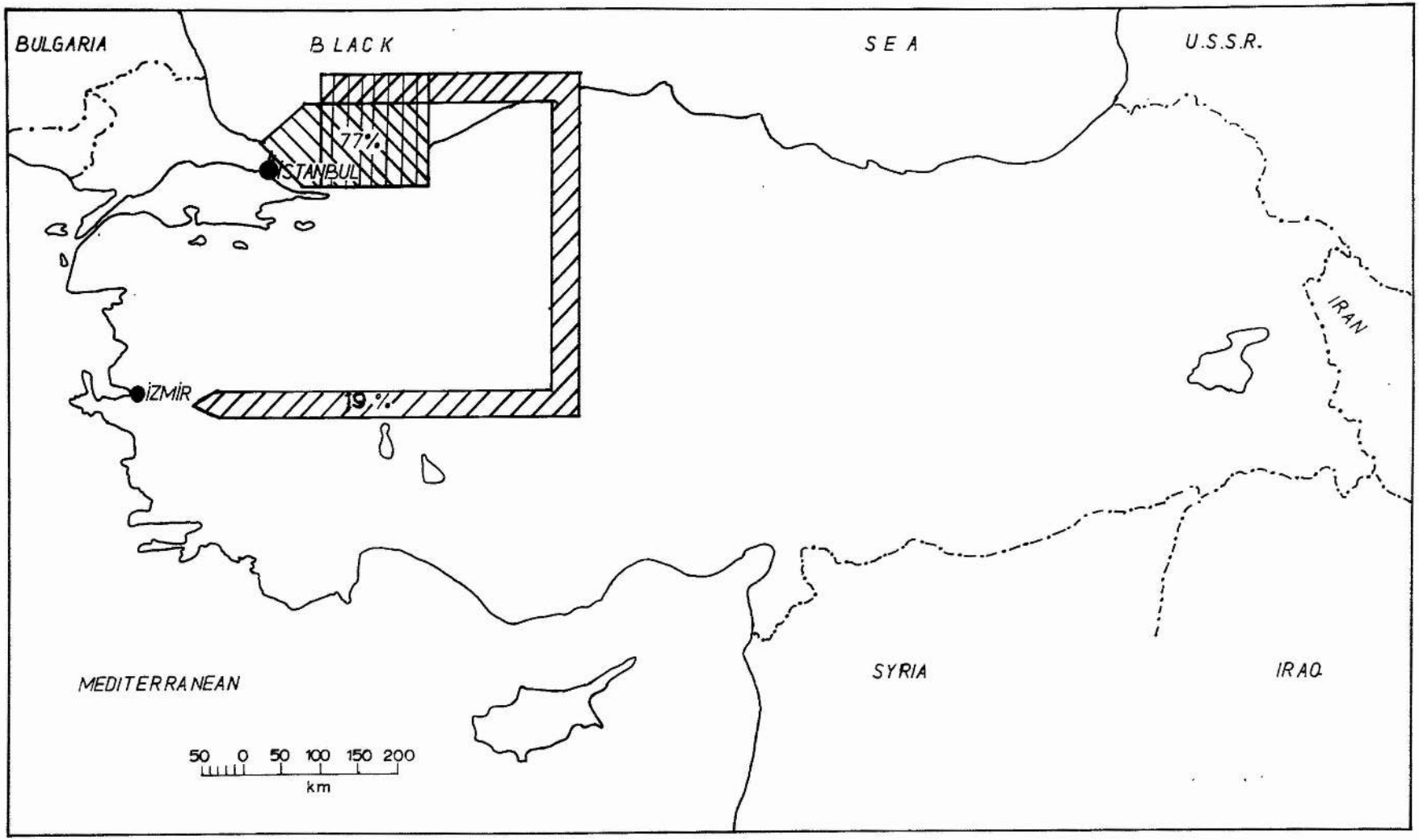
In the domestic market big consumers of the petro-chemical products may be classified geographically into six groups:

İstanbul Region: Since this region is the biggest industrial concentration in Turkey, it is also the biggest consumer of petro-chemical products within the country.

İzmir Region: As a petro-chemical products consumer, this region is second to İstanbul Region.

Bursa Region: Although the consumption is relatively high in this region, it is not as much industrialised as İstanbul and İzmir Region.

Adana Region: This region may be the third largest consumer of petro-chemical products.



THE DOMESTIC MARKET FOR PE (Low Density)

Gaziantep Region: This region for some petro-chemical products exceeds the Bursa and Adana Regions, but for some other products it is the lowest consumer among the above-mentioned industrial zones.

Diğer Regions: Diğer regions are also relatively good consumers of petro-chemical products in the domestic market.

A. POLYETHYLENE (PE)

Most of the PE that is produced in Turkey is, as in other parts of the world, the low density PE. The consumption of high density PE is less than that of low density PE. As was explained before, PE is consumed as raw material in many branches of industry. The demand for PE in the domestic market is increasing daily. For instance, in 1964, 3,783 tons of PE was used by the domestic market; this has increased ten-fold to 36,923 tons in 1972. In the near future this demand will certainly increase. We will first try to determine the need for PE of the Turkish market in 1977, in 1987 and in 1995 by using the Least Square Method, we will then try to determine this need according to the National Income, and compare the two figures thus found(1).

x	y
1964	3,787
1965	4,338
1966	7,787
1967	9,233
1968	20,885
1971	31,131
1972	36,923

$$y = a_o + a_1 x$$

$$a_o = \frac{(\Sigma y)(\Sigma x^2) - (\Sigma x)(\Sigma xy)}{N\Sigma x^2 - (\Sigma x)^2}$$

(1) Since the National Income of Turkey is forecasted for 1977, 1987 and 1995, during our calculations we will take into account these years (1977, 1987, 1995) in order to be able to compare two results.

$$a_1 = \frac{N\Sigma_{xy} - (\Sigma_x)(\Sigma_y)}{N\Sigma_x^2 - (\Sigma_x)^2}$$

$y_{1977} = -8665946.6 + 4412.6 \times 1977 = 57,763.6$ tons

$y_{1987} = -8665946.6 + 4412.6 \times 1987 = 101,889.6$ tons

$y_{1995} = -8665946.6 + 4412.6 \times 1995 = 137,190.4$ tons

According to National Income[1] the Demand for PE in Turkey:

x	y
63,9	3,783
68,6	4,338
80,2	7,787
88,2	9,233
97,0	20,885
173,5	31,131
191,2	36,923

$y = a_o + a_1 x$

$y_{279,5}$ (1977) $= 59,344.8$ tons

$y_{654,7}$ (1987) $= 154,045.3$ tons

$y_{1361,0}$ (1995) $= 332,315.4$ tons

The calculations of the need for PE according to National Income show that in 1977 it will be 59,344.8 tons. However, the calculations which take into consideration the rate of consumption between the years 1964 and 1972 show that this need will be 57,763 tons, which is 1,577.2 tons below the above expectation.

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(1) National Income in Million Turkish Liras.

Sources: United Nations 1970 (1971), p.578, and Resmi Gazete, 27.11.1972, p. 54.

This difference between two calculations will continue to increase. In 1987 the difference will be 52,155.7 tons and in 1995 it will be 195,125 tons. This shows a considerable difference between the two calculations, but it is a well known fact that the increase in National Income will greatly affect the consumption of the consumer goods by increasing the purchasing power. If the estimates of the Five Year Plan come true, considerable increase in National Income is expected which will mean that the consumption of PE will be above the amount predicted from the statistics of consumption between the years 1964 and 1972. In fact, in the few years after 1968, where there was a sudden increase in the National Income the consumption of PE also rose sharply, whereas during the years 1964 - 1968 where there was a small increase in the National Income the consumption of PE has shown a similarly small increase. However, it can be argued that the numbers obtained from the considerations of fast increases in the National Income will show maximum need in 1977, in 1987 and in 1995, whereas the numbers obtained from the extrapolation of the statistical data of recent consumption will show minimum need in 1977, in 1987 and in 1995.

Whether the real consumption will be nearer to the maximum or the minimum will very much depend on the fulfilment of the projections of the Five Year Plans relating to the National Income: if the real National Income will be near the expectation of the Five Year Plans then the real consumption of PE will be nearer to the maximum values, stated above.

33 per cent of the domestic consumption in Turkey in 1972 was fulfilled by the production of the Yarimca Complex which was 12,413 tons (PETKIM, 27.11.1973 and 19.3.1974).

Once the second complex comes into operation in 1977 the total production of the two complexes of PE will be 87,413 (second complex 75,000 tons/year) which is 28,062.2 tons or 29,649.4 tons in excess of the domestic demand, so this amount can be exported. But in 1987 this supply will be rather below the expected demand of 101,889.6 minimum, 154,045.3 tons maximum, so that the difference will either be imported or it will be necessary to build a third

complex within the country.

In fact, if the demand for 1995 will be nearer to the maximum of our expectations, which is 332,315.4 tons, then these two complexes will be able to supply as little as 25 per cent of the demand, and this will necessitate the construction of many other complexes.

B. PVC

As was explained in the previous chapter, the production of PVC which has a wide range of uses was 18,521 tons in 1972 and consumption in this same year was 33,256 tons, so production covers only 55 per cent of consumption. The demand for PVC is increasing quite fast.

It is useful to see what the demand of PVC will be, firstly, according to the statistical data in hand of the previous years, and secondly, according to the expected increases of the National Income and thus of purchasing power of the consumers.

We will analyse these two different expectations of demand for the years 1977, 1987 and 1995.

Future Demand for PVC in Turkey According to Recent Consumption Figures:

x	y
1967	16,901.5
1968	23,137
1971	25,373
1972	33,256

$$y = a_o + a_1 x$$

$$y_{1977} = 44{,}050.9 \text{ tons}$$

$$y_{1987} = 70{,}073.9 \text{ tons}$$

$$y_{1995} = 90{,}892.3 \text{ tons}$$

According to National Income the Demand for PVC in Turkey:

	x	y
(1967)	88.2	16,901.5
(1968)	97.0	23,137
(1971)	173.5	25,373
(1972)	191.2	33,256

$y_{279.5}$ = 40,701.8 tons
(1977)

$y_{654.7}$ = 83,061.9 tons
(1987)

$y_{1361.0}$ = 162,803.2 tons
(1995)

As in the case of PE the differences of the values obtained from these two different ways of calculation will be rather large for the years 1987 and 1995 for the demand for PVC. This difference results from the fact that the estimates for the National Income are quite optimistic.

The values obtained from two different sources of calculations will determine the upper and lower bounds for the demand of PVC, and it is very unlikely that the real demand will be outside these limits.

One point that is worth noting is that the demand for PVC calculated according the National Income considerations in 1977 is lower than the demand calculated from the statistical data of consumption. One reason for this is that in the years 1968 and 1971 PE was used in considerable quantities in the consumption fields of PVC, which makes the numbers shift in favour of PE against PVC(1).

In 1972, the Yarimca complex with a supply of 18,521 tons fulfils 55 per cent of the domestic demand. With the PETKIM second complex coming into

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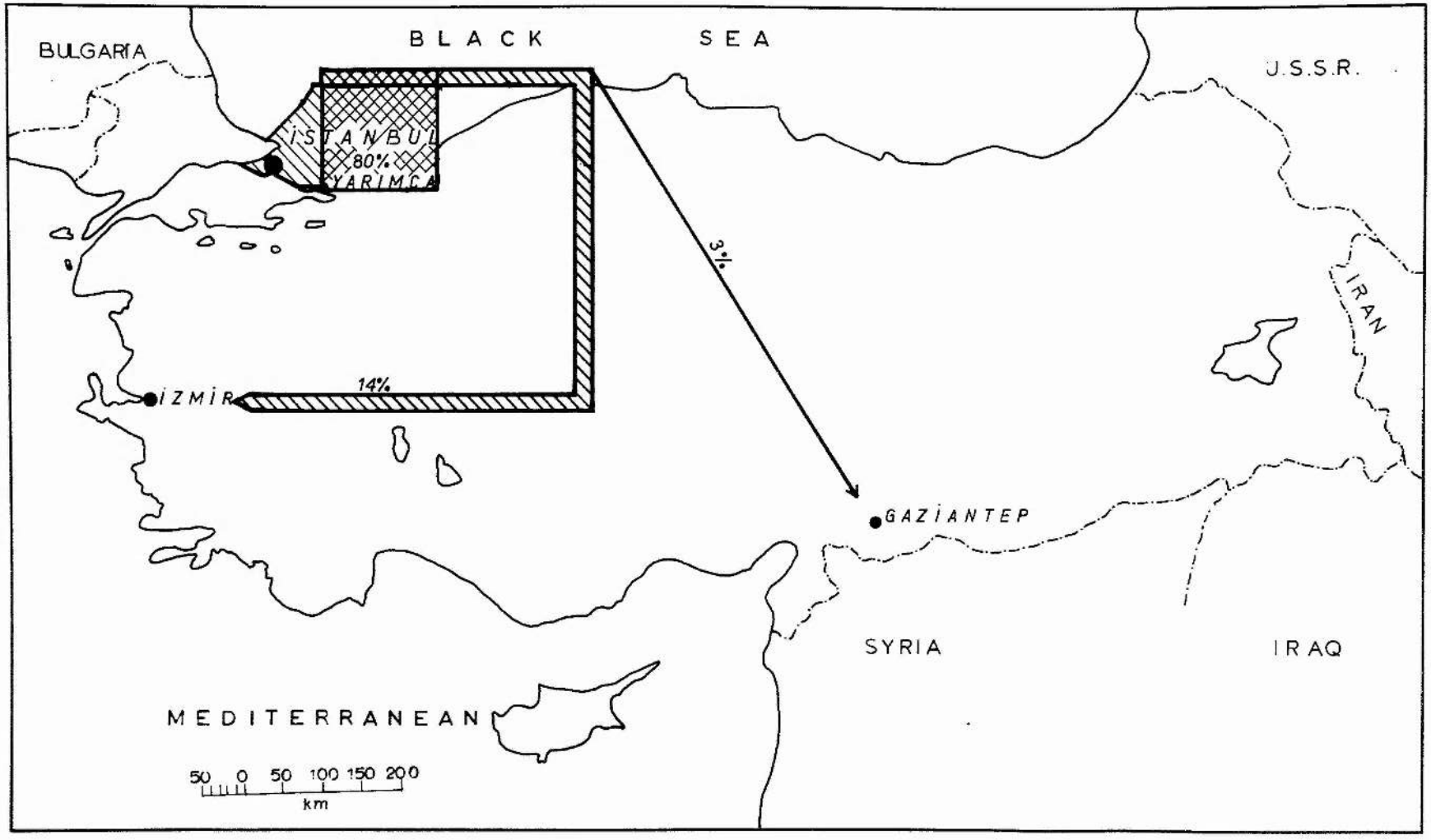
(1) As a matter of fact the future of PVC plants is doubtful. On this matter see The Sunday Times, 13.10.1974, p.3.



THE DOMESTIC MARKET FOR PVC

operation in 1977, the two complexes will then have a total production capacity of 133,000 (second complex 91,000) tons/year, which will exceed the demand considerably in 1977 and in 1987, and there will be a good prospect for exports of these products.

However, if the real demand is nearer to the maximum for our expectations then the supply of these two complexes will be below the demand by nearly 30,000 tons in 1995, in which case this amount will either have to be imported or a new complex be built.

The maximum consumption of PVC in Turkey is in the İstanbul industrial region. This is followed by İzmir, Gaziantep and Adana.

If we plot the consumption of PVC against the distances in kilometres from the Yarimca complex we will find that there is a negative correlation between two variables.

The Market for PVC in Turkey

Yarimca	-	İstanbul	: 85 km
Yarimca	-	İzmir	: 525 km
Yarimca	-	Adana	: 854 km
Yarimca	-	Gaziantep	: 1,077 km

x	y
85	38,962
525	11,129
854	1,459
1,077	1,640

$$\bar{Y} = \frac{38,962 + 11,129 + 1,459 + 1,640}{4} = 13,297.5$$

$$\text{Exp} = 641888225$$

$$\text{Total} = 641888225 + (38,962 - 13297.5)^2 + (11,129 - 13297.5)^2 + (1,459 - 13297.5)^2 + (1,640 - 13,297.5)^2 = 1581304566$$

$$r = \sqrt{\frac{641888225}{1581304566}} = \sqrt{0.40} = 0.63$$

As seen from the graph above there is a negative correlation between the consumption of the Yarimca Petro-chemical products and the distance in kilometres from the Yarimca complex. In other words, as the distance (x) from the Yarimca complex increases the demand (y) decreases. In fact, with 38,962 tons consuming power of PVC the İstanbul region alone could use up the whole domestic supply in 1972 which was 33,256 tons.

In 1972, İstanbul region alone consumed 73.2 per cent of the total for the whole country. This is followed by İzmir region with 20.9 per cent of the whole consumption. Therefore, within 525 km of the Yarimca complex there is the capacity to consume 94.1 per cent of the whole. The remaining 5.9 per cent of the consumption is outside this 525 km range.

C. POLYSTYRENE

Polystyrene is an odourless, tasteless and non-poisonous plastic. Polystyrene is at the same time colourless and has a high optical defraction. For this reason it is widely used in the production of illumination materials. Polystyrene, which can be produced in pieces, in granular form or in foams, can easily be coloured. Uses for polystyrene are as pieces of aspirators, drying machines, parts of refrigerators, utensils, toys, industrial containers etc.

At present the Yarimca complex does not produce polystyrene, and so supplies for the domestic market have to be imported. The consumption of the domestic market was 1,680 tons in 1963, and this rose to 13,325 tons in 1972. In the future, demand for polystyrene for the domestic market can be as is calculated.

The Demand for Polystyrene in Turkey

According to Recent Consumption

x	y
1963	1,679
1964	3,061
1965	3,608
1966	4,722
1967	4,725
1968	5,985
1971	6,202
1972	13,325

$y = a_o + a_1 x$

$y_{1977} = 15{,}071.8$ tons

$y_{1987} = 24{,}735.8$ tons

$y_{1995} = 32{,}467$ tons

According to National Income

the Demand for Polystyrene in Turkey

	x	y
(1963)	59.6	1,679
(1964)	63.9	3,061
(1965)	68.6	3,608
(1966)	80.2	4,722
(1967)	88.2	4,725
(1968)	97.0	5,985
(1971)	173.5	6,202
(1972)	191.2	13,325

$y_{279.5} = 16{,}045$ tons
(1977)

$y_{654.7} = 38{,}632$ tons
(1987)

$$y_{1361.0} = 81,151.3 \text{ tons}$$
$$(1995)$$

The first method of calculation shows that the demand of the domestic market for polystyrene will be satisfied after 1977 until 1995 by the second petro-chemical complex which will have 32,000 tons/year capacity. But if the demand in the domestic market increases according to the National Income, it is clear that 32,000 tons of production will not satisfy the demand of the domestic market and in 1987 there will be 6,632 tons of deficit. This deficit will increase to 49,151.3 tons if the conditions do not change until 1995, and before 1995 it will either be necessary to build a third petro-chemical complex or import to cover the demand.

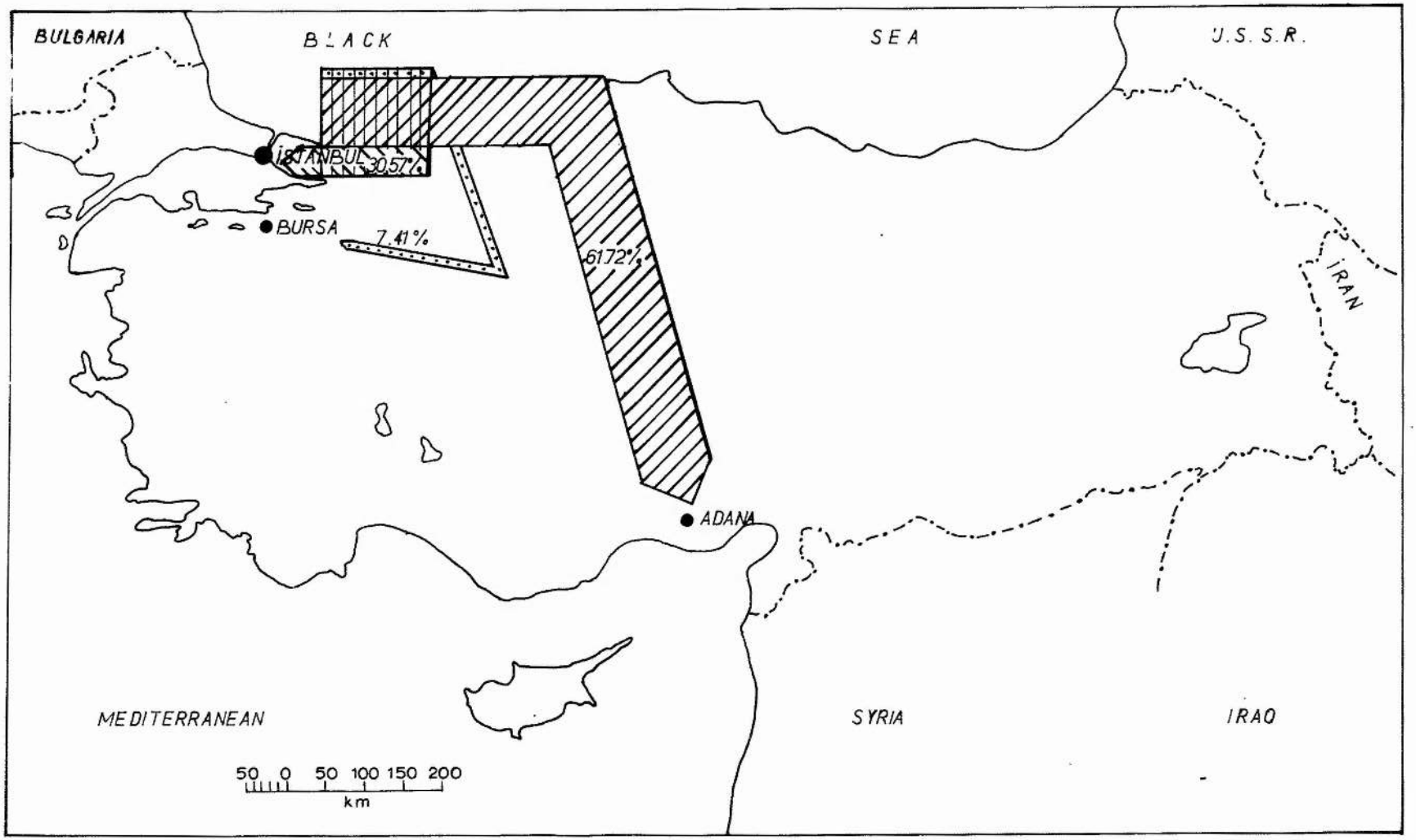
D. DDB

In 1963, 163 tons of DDB, the raw material used in making surface active agent or detergent, was used within the country, all of which had to be imported. The imported DDB has been consumed after 1963 as follows: 1223 tons in 1964; 1198 in 1965; 2604 tons in 1966; 3330 tons in 1967 and 5716 tons in 1968. But unfortunately statistical data are not available for recent years so it makes us unable to forecast the demand for the future.

In 1972, Yarimca petro-chemical complex produced only 42 tons of DDB. The production of this unit was 7,475 tons in 1973 and it is programmed to produce 10,000 tons in 1974 (PETKIM, 29.3.1974), but the capacity of this unit has not been given, which makes it difficult to calculate and forecast whether this unit product will satisfy the demand of the domestic market for the future.

E. DMT

The polyester origin fibre which is produced from DMT is not only convenient to mix with natural fibre, but is also convenient to mix with artificial fibres. For this reason, as far as the consumption rate is concerned, DMT comes just after polyamids in the world market. In fact, it has been preferred to Nylon 6 in the textile industry. In the domestic



THE DOMESTIC MARKET FOR DMT

market 15,290 tons were consumed in 1972. The demand for this product naturally will increase in future years.

The Demand for DMT in Turkey

According to Recent Consumption

x	y
1969	8,849
1970	10,618
1971	12,747
1972	15,290

$y = a_o + a_1 x$

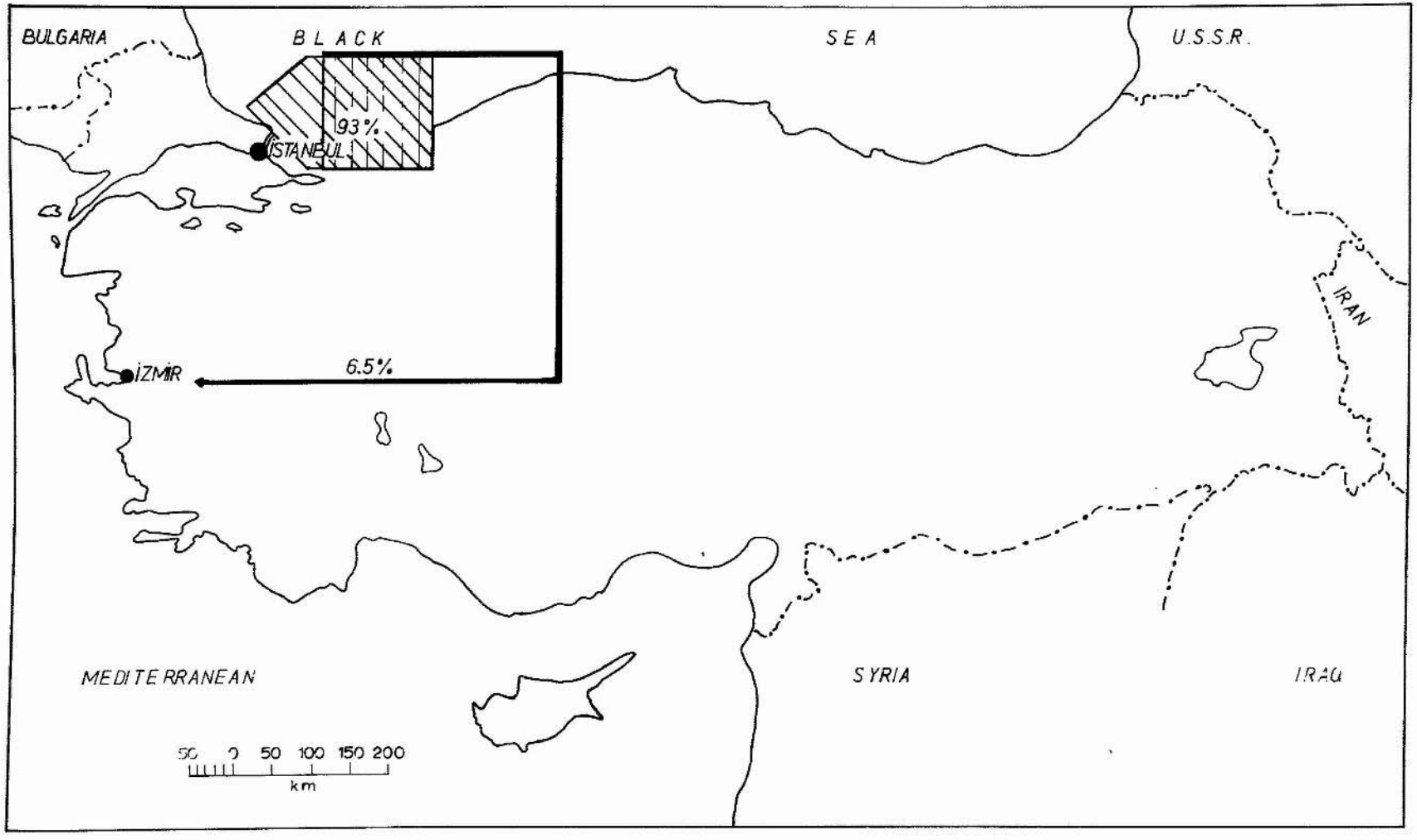
$y_{1977} = 25,819.8$ tons

$y_{1987} = 47,2718$ tons

$y_{1995} = 64,433.4$ tons

Until 1977 the domestic market will be satisfied by imported DMT, but after 1977 the domestic market will be satisfied by products of the second petro-chemical complex (40,000 tons/year) and this situation will continue almost until 1987 without the necessity of any imports. If the situation does not change until 1987, in other words if the second complex capacity will not expand or the third complex is not built, there will be a 7,271.8 tons gap between supply and demand and this gap will enlarge to 24,433.4 tons in 1995. But it will be reasonable to fill this gap with the erection of the third plant, because as will be explained in the external market, as partners of Turkey in RCD (Regional Cooperation for Development) Iran and Pakistan signed an agreement to import all their DMT needs from Turkey.

The forecasting from the point of view of the National Income could not be done since the figures of National Income of Turkey for 1969 and 1970 were not available.



THE DOMESTIC MARKET FOR POLYPROPYLENE

F. POLYPROPYLENE

Paper, cardboard, wood, polystyrene bags and polystyrene foam are common packing materials. Besides these materials, sacks and bags made from jute are also notable consumers of packing materials. For this reason, every year the needs are increasing for sacks and bags from jute, and Turkey spends 180,000,000 T.L. foreign exchange for this. But at the present, polypropylene is replacing jute and has some advantages over jute. These advantages are: lightness, cheapness, strength.

The main fields of consumption for polypropylene are bags, sacks and rope industries in Turkey. As a matter of fact, six establishments had been erected for this purpose in as short a time as one year in Turkey. These six establishments are as below:

Capacity of Polypropylene

Consumers in Turkey (Firms' own information)

	1970	1971	1975
Sasa	1,200	2,000	3,000
İşbir	1,200	1,200	2,000
Polimer	600	1,200	2,000
Sunjüt	600	600	2,000
Polijüt	600	600	1,200
Eval	500	500	1,000
Total	4,700	6,100	11,200

There was no demand for polypropylene in Turkey in 1969, but this suddenly increased to 4,500 tons in 1970. As the statistical data for recent consumption of polypropylene was not available, the future demand of the domestic market for polypropylene could not be determined. The only data that were given were that in 1975 the domestic market demand for polypropylene will be 20,625 tons (PETKIM, 1970, p.95).

Since the Yarimca complex does not produce it, the demand for the domestic market will have to be satisfied by importation until 1977. When the second petro-chemical complex comes into operation, all requirements for Turkey will be met by home production in 1977, since it will have 35,000 tons capacity. As there are exportation possibilities for petro-chemical products, after 1980 there will be a need for a third petro-chemical complex.

G. ETHYLENE OXIDE

In 1967 the need for detergent was 18,000 tons, of which 5 per cent was ethylene oxide. There was $\frac{1}{0.8}$ need of ethylene oxide for ethylene glycol. The ethylene oxide can be consumed for detergent dyes, and ethylene glycol. As the Yarimca complex does not produce ethylene oxide at the present time, all needs of the domestic market are imported. This situation will continue until 1977 when the second complex comes into operation.

As there is no information on the domestic consumption for recent years, it has not been possible to calculate the future demands of the Turkish market for this product. However, as the second complex will produce 46,000 tons of ethylene oxide a year, the domestic need will be satisfied by this at least until the mid-1980's.

H. ETHYLENE GLYCOL

The chief consumption fields of the ethylene glycol are as follows: antifreeze, dye industries, textile industries, production of polyester, fibres and cosmetics.

As in the case of ethylene oxide, ethylene glycol will be imported until 1977 as Yarimca complex does not produce it. When the second complex comes into operation it will have 30,000 tons capacity.

In 1963, 165 tons of ethylene glycol had been imported and consumed; this figure rose year by year, and came up to 1,678 in 1967. If the 1977, 1987 and 1995 demands are calculated from these figures, it can be found that domestic demand in 1977, 1987 and 1995 will be 5212.7 tons, 8904.7 tons and 11923.1 tons respectively. Since the second complex will have 30,000 tons

capacity for ethylene glycol, all domestic needs can be met by home production, and the surplus can be exported.

The Demand for Ethylene Glycol in Turkey

According to Recent Consumption

x	y
1963	165
1964	298
1965	554.4
1966	1,000
1967	1,678

$y = a_o + 1_1 x$

$y_{1977} = 5212.7$ tons

$y_{1987} = 8940.7$ tons

$y_{1995} = 11,923.1$ tons

THE GENERAL SITUATION OF PETRO-CHEMICAL PRODUCTS

After the above explanation of the situation of petro-chemical products in the domestic market, let us examine the general situation of petro-chemical products for final market destination, and how many tons of different Yarimca products travel, how many kilometres away from its complex.

If we plot the percentage of consumption of petro-chemical products against the distances in kilometres from the Yarimca complex we will find that there is a negative correlation between two variables. If we denote these two variables by (y) and (x) respectively, then (y) decreases as (x) increases; in other words, as we move away in different directions from Yarimca complex, the demand for petro-chemical products decreases, and markets become weaker.

In fact, 71.31 per cent of all petro-chemical products are consumed within 85 kms by the İstanbul industrial region. This percentage is 86.44 per cent within 525 kms range. Only 13.56 per cent of petro-chemical products

have been transported outside this 525 kms range. In fact, after 1977, the second biggest market and consumer for petro-chemical products to İstanbul, which is the İzmir industrial region (13.9 per cent) can consume the products of the second petro-chemical Complex, since it may be nearby.

Besides this, the İstanbul industrial region is capable, with its huge capacity, to consume 100 per cent of most of the petro-chemical products (e.g. in 1972, 33,256 tons of PVC had been consumed in the whole of the domestic market: in the same year, İstanbul had a consumption capacity of 38,962 tons of PVC), so there will be no need to look for markets for petro-chemical products outside the İstanbul industrial region.

The Domestic Market for Petro-Chemical Products

Yarimca - İstanbul	:	85 km
Yarimca - Bursa	:	145 km
Yarimca - İzmir	:	525 km
Yarimca - Adana	:	854 km
Yarimca - Diğer	:	1,000 km
Yarimca - Gaziantep	:	1,077 km

x	y
85	71.31%
145	1.23%
525	13.9%
854	10.3%
1,000	2.76%
1,077	0.5%

$$\bar{Y} = \frac{71.31 + 1.23 + 13.9 + 10.3 + 2.76 + 0.5}{6} = 16.6$$

Exp. = 3,072,398 Total = 3,076,125

$$r = \sqrt{\frac{Exp}{Total}} = \sqrt{\frac{3,072,398}{3,076,125}} = \sqrt{0.99} \quad r = 0.994$$

The answer to this is, surely, to build the factories in the İstanbul area as this would minimise transport costs.

Following the above explanations, it would seem wise to build a pipe-line from the Yarimca complex towards the İstanbul industrial region, which is the biggest consumer, with a main depot at the end of the pipe-line for distribution. This kind of solution would be useful and economic from several points of view. If there is a pipe-line, 4,963 lorries could be withdrawn from the Yarimca-İstanbul road which has very heavy traffic on it.

Let us suppose that for the whole business(1) 50 lorries are reserved. If 7,445 different 10-ton lorries were used, each lorry would do 85 x 2 = 170 km, whereas 50 lorries would do 25,312 km in order to transport their share of petro-chemical products from Yarimca. If each lorry is worn out after 200,000 km, every 7.7 years 50 lorries should be renewed. If each lorry is 700,000 T.L., this means that 35,000,000 T.L. would be lost. It is clear that demand for petro-chemical products of the İstanbul industrial region will not stay as it is in 7.7 years time; obviously it will increase, so every 7.7 years will need more lorries to transport petro-chemical products, which means that more money will be lost every 7.7 years.

A pipe-line, however, is flexible, although first investment for it will be high, and can be adjustable according to supply and demand. The transported items in it can be increased or decreased. Besides this, there will be no problem as far as the land is concerned because there will be a kind of distribution centre or main depot that the produced materials can be kept in. Even from this main depot, a secondary pipe-line may be built for the biggest petro-chemical products consumers. The other firms which have smaller capacities can join this pipe-line grid with smaller diameter pipe-lines according to their capacities, so all the petro-chemical products consumers can take advantage from the grid, thereby saving a great deal on transportation and packing costs.

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(1) See chapter 6

2. EXTERNAL MARKET

The economic and social position of Turkey enables her to trade with markets in Europe, Asia and Africa. Turkey is also an associate member of the E.E.C. However, the Annex Protocol signed between Turkey and the European Economic Community became effective from 1st January 1973. It was ratified by the Parliaments of the six Common Market countries. This protocol regulates Turkey's entry into the transition phase of her association with the European Economic Community. In his address at the Union of Chambers in July 1972, the Secretary-General of the European Community stressed the importance of this association in these words (Turkish Digest, 1973, p.2).

"The exports of industrial products, other than traditional products exported by Turkey, are increasing regularly. From 1964 to 1970 exports increased from $14,000,000 to $83,000,000; that is, six times. The reports of the Union of Commerce show that against 85 new export products in 1969 this figure had increased to 125 in 1970, most of which was industrial. With respect to cotton yarn(1), Turkey has, since 1970, become the first supplier of the Community exceeding the traditional suppliers which were Spain and Yugoslavia. Especially since the interim protocol came into force in September 1971, which gives Turkish industrial products free access without customs duties to the Community, the exports of industrial products to the Community have marked a spectacular development with an increase of more than 150 per cent compared with the same period in 1970. This development is likely to continue in the current months of this year. This indicates that the preferences given by the Community have begun to bear fruit. Turkish exporters can explore the possibilities of the Common Market under particularly favourable conditions due to these preferences, and in this way they can prepare themselves to confront the markets of the countries of the Third World. The Common Market also plays a stimulating role in Turkey's whole foreign trade".

(1) For more detail of this matter see: The Times Business News, 29.7.1974, p.15.

There are great possibilities for Turkey to export her industrial products to RCD (Regional Cooperation for Development) countries, Middle East countries and African countries. The President of Turkey, with the Shah of Iran and the President of Pakistan, established RCD when they first met in İstanbul on 21 July 1964 (D.P.T., 1970[A], p.6). Turkey, Iran and Pakistan, as RCD countries, have common aims, some of which are: close technical cooperation, close trade cooperation and close research cooperation among member countries. These three countries established several committees in order to organise relations amongst themselves. One of the six important committees is the Petrol and Petro-Chemical Committee. The chairman of this committee is from Turkey. This committee arranges all relations concerning petrol and petro-chemical products amongst member countries. There are agreements over 50 common projects amongst the member countries so far. The Petrol and Petro-Chemical Products Committee decided to buy petrol and petro-chemical products from each other as much as possible. For this reason Turkish petro-chemical products can find wide markets in RCD countries, Middle East countries and African countries, but it is, at least for the time being, quite unlikely to find markets in the EEC countries since production costs are higher than EEC countries.

A. POLYETHYLENE (PE)

As was calculated before, in 1977 there will be 28,062.2 tons or 29,649.4 tons of PE surplus after the consumption of the domestic market in Turkey. This surplus figure will continue, but will decrease yearly until 1980, so this surplus can be exported. However, after 1980, if the situation does not change, the possibility of exporting PE will disappear since the production of Yarimca and the second complex, which will be 87,413 tons/year, will not meet the demands of the domestic market.

B. PVC

Since Turkey will produce 133,000 tons/year of PVC in 1977 against 40,701.8 tons or 44,050.9 tons of PVC consumption, there will be 88,949.1 tons

or 92,299.2 tons surplus; this surplus will continue, but will decrease, yearly until 1987, so this can be exported. In 1987, demand from the domestic market will be either 70,073.9 tons or 83,061.9 tons of PVC, so according to this there will still be 49,938.1 tons or 62,926.1 tons of PVC surplus, and this surplus can be exported. The surplus will also continue, but will decrease, yearly until the 1990's.

C. POLYSTYRENE

Turkey, herself, has been importing polystyrene for her needs for the time being. This will go on until 1977 when the second complex comes into operation, but after 1977 all domestic needs will be satisfied by home production, and there will even be 15,955 tons or 16,928.2 tons surplus. This surplus can be exported. In 1987, if domestic need is 24,735.8 tons, according to our calculations there will be 7,264.2 tons surplus to be exported. However, after 1987, if the situation does not change, the possibility of exportation will weaken yearly as a result of increasing demand in the domestic market, and eventually the possibility of exportation will disappear entirely.

D. DDB

The available data makes us unable to calculate domestic demand for the future, so there is no possibility of arguing whether there is an exportation potential or not for this product.

E. DMT

As in the case of polystyrene, Turkey herself has been importing DMT for her domestic needs, but this situation is expected to change with the operation of the second complex in 1977. The second complex with its 42,000 tons/year capacity will satisfy all domestic market needs. Even in 1977, 14,180.2 tons surplus can be exported to Pakistan, since Pakistan, under a RCD agreement, will buy her DMT needs from Turkey. If the situation does not change in 1987, as a result of increasing domestic need Turkey will not export DMT, but if Turkey increases her DMT production, she will export to

Pakistan continuously, as an RCD partner. In addition to this, on 19.9.1970 with the meeting of Turkish representatives, the President of the External Trade Company of the United Arab Republic noticed that they wanted to import 15,000 tons of DMT from Turkey (PEKIM, 1970, p.90). In view of this, therefore, it will be wise for Turkey to have a capacity of 80,000 - 90,000 tons of DMT by 1987.

F. POLYPROPYLENE

The needs of the domestic market will continue to be met by importation until 1977 when the second complex comes into operation. Since the second complex will have 35,000 tons/year capacity, it will meet all demands of the Turkish market. As domestic need is expected to be 20,625 tons in 1975, 5,000 - 6,000 tons of surplus polypropylene can be exported to the Middle East or African countries. In fact, the Middle East and some African countries informed Turkey that they can import 15,000 - 20,000 tons of Turkish-made polypropylene, so, as a result of this, Turkey needs to increase her polypropylene capacity up to 55,000 - 60,000 tons in the 1980's.

G. ETHYLENE OXIDE

Since the Yarimca complex does not produce ethylene oxide, the domestic market in Turkey will be satisfied by importation until 1977 when the second complex comes into operation. With its 46,000 tons/year capacity the second complex will feed the domestic market, and a surplus of this product can be exported, but as a result of increasing domestic need, exportation will eventually be stopped.

H. ETHYLENE GLYCOL

Yarimca complex does not produce ethylene glycol, and domestic needs will be imported until 1977. The second complex, with its 30,000 tons/year capacity, will be able to meet all the demands of the domestic market. According to our calculations, domestic need will be satisfied by home products until 1995, with a surplus in 1977 of 24, 787.3 tons; a surplus in 1987 of 21,059.3 tons; and a surplus of 18,076.9 tons in 1995, all of which can be exported.

Conclusion

The first aim of the Turkish petro-chemical industry was to satisfy the domestic market, because before the erection of this industry within the country all her needs had to be imported.

As the national income of the country increases, the demand for petro-chemical products increases in the domestic market, present markets widen and new markets emerge; especially if we add external demand from the Middle East, R.C.D. and African countries for the Turkish petro-chemical products, it becomes obvious that the existing complex cannot meet all the demands. So, according to our calculations, Turkey will need a second and even a third petro-chemical complex in the near future. But any complex will affect the area in which it is placed and so, in the next chapter, some problems associated with the industry will be discussed.

CHAPTER VI

THE EFFECT OF THE PETRO-CHEMICAL INDUSTRY UPON THE ISTANBUL AREA

THE EFFECT OF THE PETRO-CHEMICAL INDUSTRY UPON THE İSTANBUL AREA

In the previous chapter we attempted to explain why the İstanbul area was chosen for the first petro-chemical plant. In this chapter our attempt will be to find out how the first petro-chemical industrial plant affected the İstanbul area. There is no doubt that the petro-chemical plant of Yarimca affected the İstanbul area in many ways. The effects are upon agriculture, transport systems, housing and pollution.

The effects have not been caused by the petro-chemical plant only; no doubt the other industrial plants have also contributed. As is known, petro-chemical plants are integrated with other branches of industry, since they produce raw material for them. As was explained in the section under the title of "Why the İstanbul area was chosen for the first petro-chemical industry in Turkey", this part of Turkey offers better market conditions than others because of the concentration of industrial establishments. It means industry is attracted by industry, and petro-chemicals attracted other industries. The attraction is mutual, and dependence is integral.

For this reason, it is not reasonable to isolate the petro-chemical industry from other industries in that area, since the petro-chemical industry acts as a sort of raw material source for the other industries. So, while we shall be dealing with the petro-chemical industry in researching these matters, the other industries from time to time will be taken into account.

1. THE EFFECT OF THE PETRO-CHEMICAL INDUSTRY UPON AGRICULTURE

The effect of petro-chemicals upon agriculture may be divided generally into three groups:

A. THE EFFECT OF PETRO-CHEMICAL INDUSTRY UPON AGRICULTURE FROM THE AGRICULTURAL AREA POINT OF VIEW

All industrial establishments cover area according to their size and purpose, but Turkey is a mountainous country. Industry which prefers flat land is therefore in competition with agriculture, which also cannot use the

steep mountain slopes. However, there is little land in Turkey which is suitable for agriculture and for farming generally. The agricultural area has not only been restricted by the structure of the land but also by climate and water supply.

As Turkey's population is increasing very rapidly (almost 3 per cent per annum) and has grown from 13,650,000 in 1927 to 37,010,000 in 1972 (Images Economiques du Monde, 1973, -.240), to feed the country's people will be the most important and as yet unsolved problem in the near future. This obvious fact nonetheless has been ignored. The fertile plains have been opened up to industrial establishments. In addition to industrial establishments some parts of the fertile plains are rapidly being covered by dwellings. This means the amount of arable land is simultaneously being reduced. It should be noted that man needs to feed himself first, and only afterwards may he act as a most important producing and consuming factor in the industrial activities.

As a matter of fact, according to Toprak-Su Genel Müdürlüğü (General Directorate for soil and water sources) technically arable land is 217,000 km^2 instead of the 275,000 km^2 which has often been quoted in the statistics. 7,000 km^2 out of the 217,000 km^2 has an aridity problem; 18,000 km^2 has a drainage problem and 131,000 km^2 has an erosion problem (Resmi Gazete, 27.11.1972, p.80).

It should also be taken into account that each year 86,000 km^2 of fallow fields are included in this 217,000 km^2, and these are not productive from the agricultural point of view.

There is one further point on this matter that must be brought out. According to the State Planning Organisation Department, 4,170 km^2 land will be transferred from agricultural land to grazing land until 1987 (Resmi Gazete, 27.11.1972, p.84). From this restricted and daily diminishing agricultural area must be subtracted the industrial areas, most of which have been gained from the agricultural area. Thus, the importance of this problem for Turkey may be understood. If the low rate of yield is added to this in the agricultural

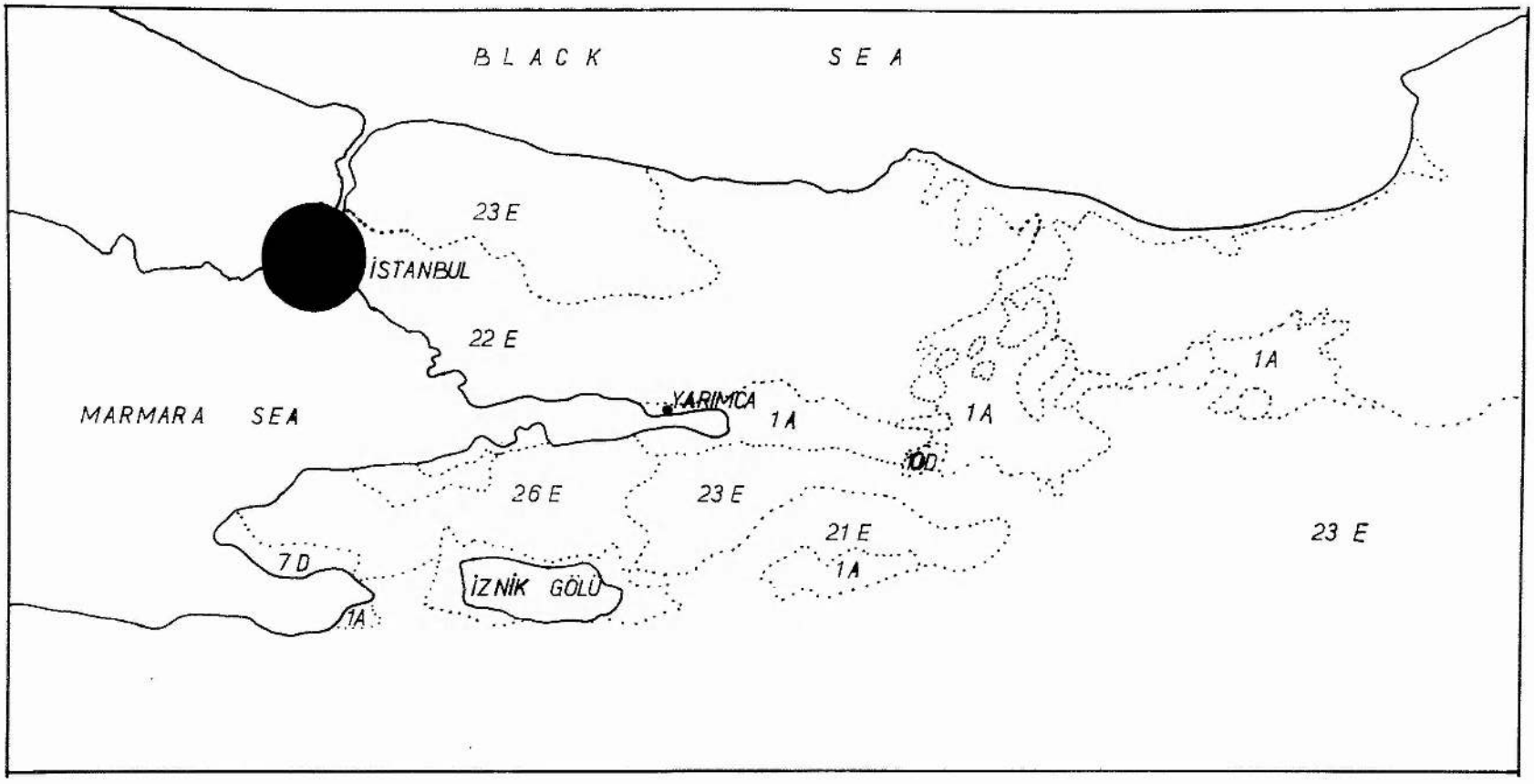
area, the difficulty of the situation may be seen clearly. However, yield in the agricultural area, according to 1963-1964 wheat production, was 3,910 kg per hectare in Britain; 2,620 kg in France; and only 1,270 kg per hectare in Turkey.

But this obvious fact also has been ignored; each day some piece of agricultural land yields its place to industrial establishments. Concomitant with this, more of it is being occupied by dwellings, roads, and so on. A vivid example of this is the Kütahya plain, because most activity there has been taking place within the last twenty years.

In 1964 - 1965, while doing research on the economic activity of the Kütahya Province in Turkey, we emphasised forcibly the agricultural importance of the Kütahya plain (Engin, Graduation Research, İstanbul, 1965). In 1964 - 1965, according to our research in that area, some parts of the Kütahya plain, which is one of the most important and rare agricultural areas in the country, had been occupied by industries; and some parts of it had been occupied haphazardly by dwellings. Therefore, some parts of this fertile agricultural area have now been lost for agricultural products.

Also, as we pointed out in the same research, to establish an industrial plant in Kütahya plain is not safe because of the earthquake threat. However, as we demonstrated with pictures in the same research, several hundred concrete piles have been constructed in order to place a sugar factory over them, because of the soft and unsafe alluvial plain. Certainly this has increased investment costs as well.

A similar thing happened when the government encouraged establishment of industrial plants in the agricultural zone between İstanbul and the Adapazari plain a few decades ago. This area was also a major agricultural zone in Turkey. According to the information available to us and the soil map from the University of İstanbul, Department of Geography, the existing Yarimca petro-chemical complex was set up on the soil which is shown as 1A on the map, and which is composed of alluvium, young soils and flat land (0 - 1 per cent). In fact, as can be seen from the other map, the Yarimca complex was located



THE SOIL MAP OF EAST MARMARA REGION

Source: University of İstanbul Department of Geography

Interpretation of the Map

1A - Composed of alluvium and young soils, flat (0 - 1 per cent).

7D - Terra Rossa, red Mediterranean soils, very inclined (8 - 15 per cent).

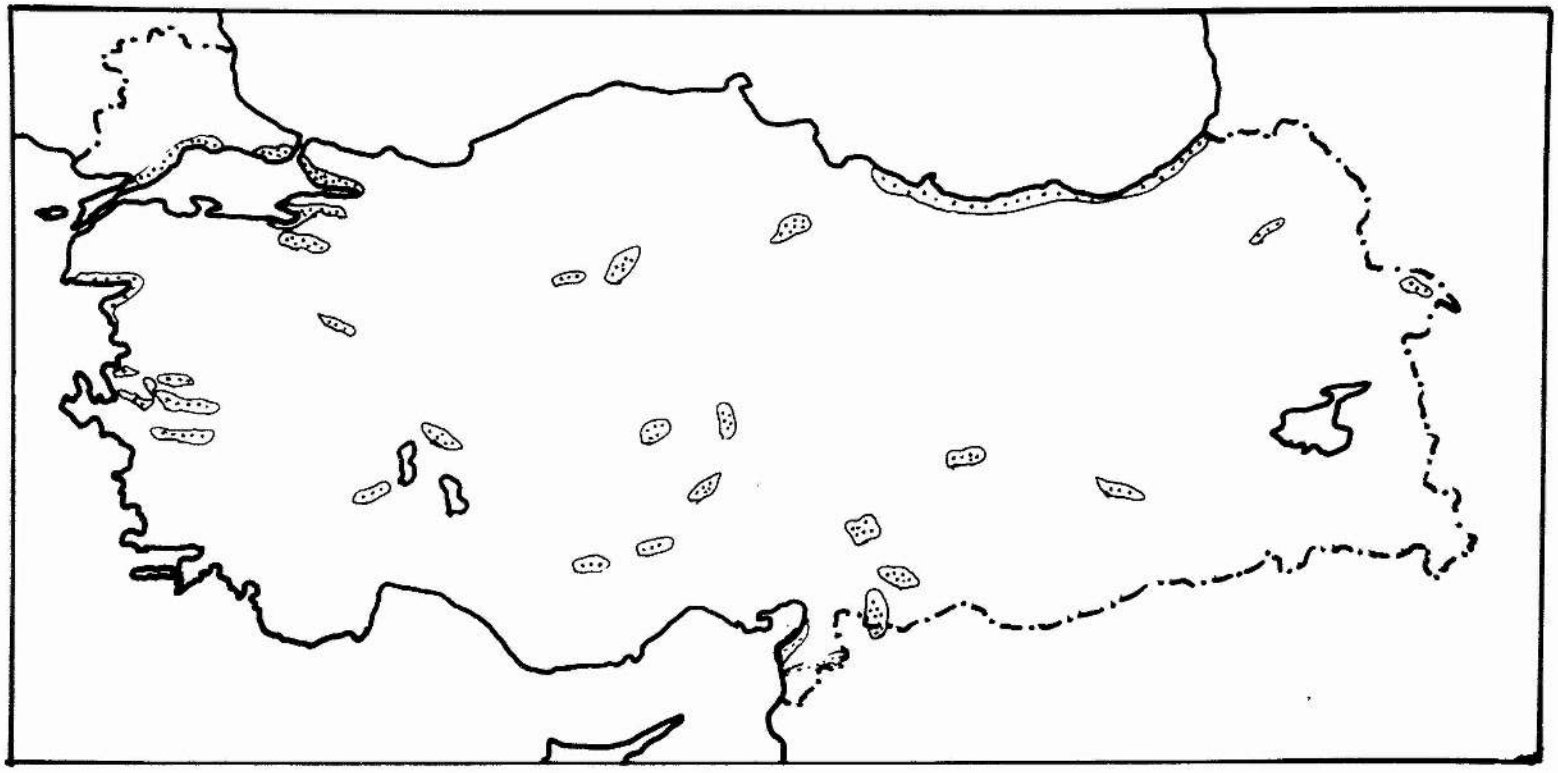
10D - Rendzina soils, very inclined (8 - 15 per cent).

21E - Rough, defective land (Rendzina soil material).

22E - Rough, defective land (non-calcic brown soil material).

23E - Rough, defective land (brown forest soils).

26E - Rough, defective land (brown forest and Podzolic soil materials).



100 0 100 200 300

km

THE MAIN CULTIVATED AREAS IN TURKEY

Source: Prof. F. S. Duran, Büyük Atlas, İstanbul 1972

on one of the main cultivated areas of Turkey.

According to research which took place in 1968, between 1961 and 1968, in the İstanbul area, 163 establishments were set up, and all of them employ at least 20 or more workers. According to Prof. E. Tümertekin (Tümertekin, 1970, p. 37), for most of these establishments the two sides of the İstanbul-Ankara highway were chosen as their location places. These establishments either receive their raw materials from Anatolia or they send their products to Anatolia and nearby industries. Even some of the old establishments which were on the west side of İstanbul have been moving to this (east) part of the city. As a matter of fact, 88 large establishments (employing 20 or more employees) have been set up in the İstanbul area between 1941 and 1950. This figure has risen to 279 between 1951 and 1960, and, as was indicated above, to 163 between 1961 and 1968. As a result of the attraction of new industries by existing establishments, therefore, the area for agricultural use is diminishing proportionately.

B. THE EFFECT OF THE PETRO-CHEMICAL INDUSTRY UPON AGRICULTURE FROM THE AGRARIAN POPULATION POINT OF VIEW

Since the agricultural area is restricted by the structure of land, climate and water supply, the agricultural population density is higher than in some of the other countries, and was 125 in 1965. This figure became 176 in 1970[1]. Therefore, as a result of the daily decreasing agricultural land in conjunction with the significant increase in density of agrarian population, migration from agricultural areas to industrial centres has grown; and while the number of people who have migrated to big cities is large, the greater portion have moved to industrial centres. According to the Statement, about 5,000,000 people migrated from the agricultural area to the industrial centres and cities in the last fifteen years. However, this movement from the agricultural areas is not a result of attraction by industrial areas, but

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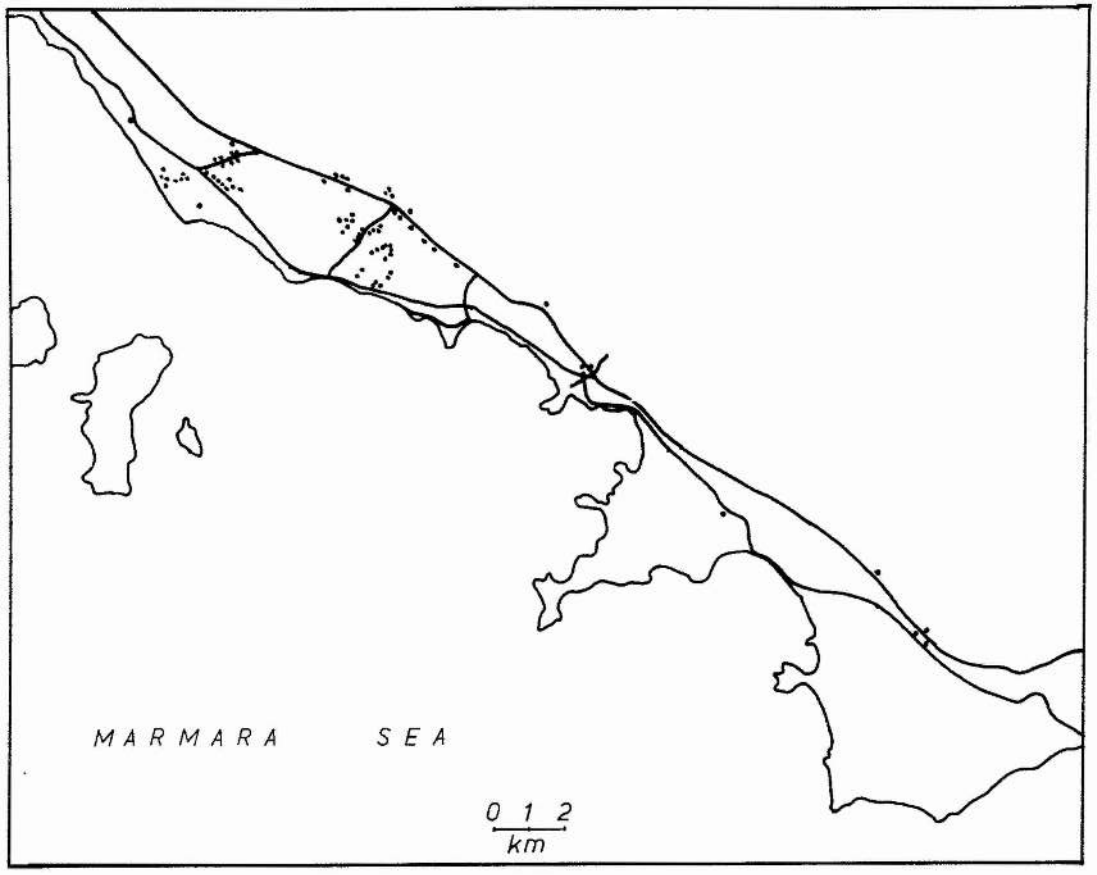
(1) For our calculations, statistical data have been obtained from Resmi Gazete, Ankara, 8.12.1972, p.47. The fallow fields have been ignored during our calculations, since these fields are not productive agricultural land.



THE INDUSTRIAL DISTRIBUTION AT THE EAST COAST OF MARMARA SEA

Source: Prof. E. Tümertekin, İstanbul'da Sanayi, İstanbul 1970

Industrial Establishments

emerged more importantly by the pressure of the high density of agrarian population as a result of fast-growing population and decreasing agricultural land.

In fact, these migrations originated many years ago from the high density agrarian population of areas such as Trabzon (498), Rize (792), and Kars (3,913), and focused generally on industrial regions, but mainly on the İstanbul area.

As a result of themigration of surplus and overcrowded agrarian population to the cities and industrial centres, there was no urbanisation, but on the contrary, ruralisation of existing cities and industrial centres. In fact, these migrations created several problems in the industrial centres. For example, one of the most important is, as we will point out in more detail later, that they created almost 200,000 Gecekondu (unauthorised construction set up in one night, squatters' house, shanty. For the relation between industry and Gecekondu in the İstanbul area, see the attached map) in and around the İstanbul area, and as the second industrial centre of Turkey, over 60,000 Gecekondu are in and around the İzmir area.

Although industrialisation in Turkey has been significant recently, it has not been as fast as population growth within the country, and it has been located on agricultural land for the most part. The number of jobless people, therefore, increased year after year, and have added to the already jobless population. However, owing to an external demand for Turkish workers, at least a million workers(1) were absorbed, and this has helped to diminish their numbers. But this is not a permanent solution to this problem and is rather a very temporary one, because the population of the country is increasing more or less at the same rate as in the past, and industrialisation, as we indicated above, is not as fast as population growth.

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(1) According to a spokesman for the Ministry of Labour, more than 1,000,000 workers and their families are abroad, and most of them are in West Germany (1972).

C. THE EFFECT OF THE PETRO-CHEMICAL INDUSTRY UPON AGRICULTURE FROM THE CHEMICAL FERTILISERS AND INSECTICIDES POINT OF VIEW

Rapid rates of growth in the population (almost 3 per cent per annum) and a surplus labour force are characteristic of Turkey. In Turkey, as was indicated before, the farm labour force ratio is so large that only a fraction of the annual intake into the labour force can be expected to find employment in the non-farming sectors.

An efficient strategy for agricultural development will affect the process of structural transformation and overall economic growth. During the last few decades, the improved production possibilities resulting from the seed-fertiliser have offered the hope of rapid and relatively low-cost increases in agricultural production, and these can be achieved by an intensification of agricultural production which offers the possibility of absorbing a considerable fraction of the growing labour force into productive employment. This latter is especially significant for Turkey, in which the transformation of the economic structure has been limited, so that the farm labour force is still large in total and will continue to increase in absolute size for at least a few decades.

In the light of these matters, the effect of the petro-chemistry industry upon agriculture from the chemical fertilisers and plant protection point of view is important. Crop production was not very good in the 1960's, although at different rates for different products. Wheat and oil seed production did not meet the domestic demand. Significant developments in apple and citrus fruit production were made; a tendency to adjust production according to consumer preferences emerged, and fruit quality was improved.

In agriculture, the highest realisation rate of the 1960's was in fertiliser use. Despite this high rate of increase, the total quantity of fertiliser used was far less than that required. It is clearly seen that the use of chemical fertilisers plays a major role in realising the envisaged increases in crop production. In fact, the contribution of various measures

to the increase in production is as follows: irrigation, 20 per cent; use of fertilisers, 52 per cent; use of improved seed, 10 per cent; reduction of fallow land and changes in the structure of production, 8 per cent; pest control and other measures, 10 per cent.

According to the 1966 - 1969 figures, average cotton production in selected countries was as below:

Country	Yield kg/hec
Greece	695
Turkey	605
Italy	265

Now, it is interesting to consider the consumption of fertilisers in selected countries (Resmi Gazete, 27.11.1972, p.141):

Country	Chemical Fertilisers kg/hec (1970)
Holland	790.52
Belgium	590.03
W. Germany	374.51
Luxembourg	363.74
France	217.81
Mexico	32.31
Turkey	16.07
Pakistan	13.92
Iran	7.50

As a matter of fact, in 1972, 24.9 per cent of all agricultural land was fertilised by chemical fertilisers in Turkey. In 1977, it is estimated that 43.4 per cent of all agricultural land will be fertilised by 5,612,000 tons of chemical fertilisers. As a result of this, in 1977, 428 kg of fertilisers will be used per hectare in Turkey(1).

(1) For our calculations, statistical data have been obtained from Resmi Gazete, Ankara, 27.11.1972. During our calculation, fallow fields which comprise 86,000 km^2 each year, have not been considered as permanent agricultural

Agricultural production increased, and will increase year by year, as a result of this. Let us examine the selected agricultural products one by one:

Grains: As a result of a 15.9 per cent increase in wheat production from 1971 onwards, domestic demand is fully met from domestic production. In 1967, the 10 per cent of land fertilised had increased to 52 per cent by 1972. The use of selected seed has increased from the 1967 level of 10 per cent to 30 per cent. Insect and pest control services have increased 30 per cent above the 1967 level. Maize, rice and barley have also increased recently.

Cotton: Since the possibility of increasing cotton acreage is limited, any possible increase is connected with the use of fertilisers on all the irrigated cotton land and use of selected seed. The cotton production in Turkey, as a result of using chemical fertilisers, increased to 725 kg/hec in 1972. This will be 855 kg/hec by 1977 (Resmi Gazete, 27.11.1972, p.87).

Fruits: The citrus fruits, mainly oranges and tangerines, have increased by 37.6 per cent in the last five years. This increase is realised by an increase in the number of productive trees, in fertilisation and in more effective pest control. Significant increases in apples and peaches have also been realised.

Grapes: A 13 per cent increase in production is realised through fertilising, better care and pest control in recent years.

Vegetables: In this sector of agriculture, an increase of 21.1 per cent in productivity has been achieved by fertilisation and pest control in recent years.

There is no doubt that using chemical fertilisers and controlling pests affect agricultural products significantly. Let us examine the quantity of selected agricultural products forecast for 1982 after using chemical fertilisers and pest control:

Agricultural Product	Quantity of Product (in tons)	
	1972 (Images Economiques du Monde, 1973, p.240)	1982 (Resmi Gazete, 27.11.1972, p.75)
Wheat	12,085,000	13,500,000
Cotton	516,000	760,000
Sugar	870,000	1,310,000

As a result of increasing agricultural products, at least migration from agricultural land to industrial centres and to big cities can be diminished in future, since it can satisfy more people than at present.

2. THE EFFECT OF THE PETRO-CHEMICAL INDUSTRY UPON THE TRANSPORT SYSTEMS

The petro-chemical industry needs an advanced transport system in order to deliver its product to its consumers quickly. As was pointed out in the third chapter, the first petro-chemical plant of Turkey can take advantage of the three (road, railway, ports) transport networks which are nearby.

A. ROAD FACILITIES

Since the İstanbul area has more than 50 per cent of the whole of Turkish industry, the density of vehicles is great. Every year becomes worse than the previous year. When the building of industrial establishments started a few decades ago, the road system was sufficient, but the number of establishments increased and both sides of the road from 20 km west of İstanbul to 150 km east of İstanbul became a built-up area. As a result of this, the number of vehicles has increased; the road, however, which has two lanes, has stayed as it was in the past. As a result of this, the road has become the busiest in Turkey, since it is used for all purposes and no alternative exists.

The Yarimca petro-chemical complex, of course, forms part of this development. In fact, in the İstanbul region, 74,447 tons of final petro-chemical products (if we take into account some intermediate products this figure will be even higher) were consumed and the region had a consumption capacity in 1972 which would tax the road facilities of the area very

severely. If it is supposed that 74,447 tons had been transported by 15 ton lorries, it will need 4,963 lorries for this transportation. These 4,963 lorries would make two journeys, whether first departure was from İstanbul or from İzmit (near Yarimca) since eventually they will return to their final departure point. So, 4,963 should be multiplied by 2, and this figure will be 9,926. It means that 15 ton lorries use this road 9,926 times. If it is supposed that 10 ton lorries are used for transportation instead of 15, this time the number of lorries will increase to 7,445; in other words, this heavily congested road would be used 14,890 times during the year.

This road is the only road which links İstanbul, as the biggest industrial, commercial and redistribution centre for all kinds of good produced in or imported to Turkey to every part of Anatolia, since the railway system is slow and relatively expensive in Turkey. The number of vehicular passengers increased very significantly. For instance, in 1963, 19,269 million passenger/km; in 1967, 36,100 million passenger/km; and in 1972, 61,325 million passenger/km were carried by roads. Since the European part of Turkey is very small compared with Anatolia, the share of the European part of Turkey is very small in these figures. Therefore, most of the traffic has been confined to this road. If we add the commercial and industrial goods which are being carried by road, the importance of this road increases even more. For instance in 1963, 6,717 million ton/km goods; in 1967, 12,500 million ton/km; and in 1972, 25,700 million ton/km goods were carried by roads (Resmi Gazete, 27.11.1972, p.187-188). Since this road is very narrow and is far from sufficient for all purposes and an alternative does not exist, it has been decided to build a dual carriageway as an express road; but this has been very slow in realisation.

I) <u>The Density of Vehicles in this Area</u>

In Turkey, the number of motor vehicles per 1,000 km^2 was 243 in 1965 (excluding tractors and suchlike, but including cars, lorries and buses) and

increased to 340 motor vehicles in 1968[1]. This number varies depending on whether it is from an industrial area, agricultural area or a sparsely populated area. The figures decrease very much in the eastern part of the country where there are mountains and a lack of industry. For example, in Hakkari province, the number was 7 in 1965, and much smaller than the average for the whole country; but on the other hand, in the industrial areas this figure increases thirty times, and even more; and in the İstanbul area this figure was 8,915 in 1965[2].

Further, in 1968, this figure was only 12 in Hakkari province, where there is a lack of industry, and 12,843 in İstanbul where over 50 per cent of the country's industry is located. Let us see the situation among the other industrial regions in Turkey:

İzmir Region: This region is second to the İstanbul area industrially. This region is also the second largest consumer of petro-chemical products in Turkey. The number of vehicles per 1,000 km^2 was 1,199 in 1965 and 1,422 in 1968.

Mersin - Adana - Gaziantep industrial zone: This industrial zone is the third largest consumer of petro-chemical products in Turkey. The number of vehicles in this zone was 304 in 1965 and 400 in 1968.

In these three industrial areas, road conditions are more or less the same; i.e., the E-5 starts from Ostende and goes via İstanbul - İzmit and Ankara to Mersin and Adana. The same class roads E-23 and E-24 serve the İzmir region from Europe and Anatolia, but the number of vehicles per 1,000 km^2 is different from one region to another and is highest in the İstanbul area.

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(1) For our calculation, statistical data has been obtained from Petrol Ofisi İstatistik Bülteni, Ankara, 1969, p.53.

(2) For our calculation, statistical data has been obtained from Devlet İstatistik Enstitüsü, Ankara, 1969, No. 638, and Petrol Ofisi, İstatistik Bülteni, Ankara, 1969, p.53.

For this reason, this area (İstanbul area) suffers very much from a high density of vehicles. Since the number of vehicles is highest in this part of the country, another big problem arises when crossing the Bosphorous by ferry. Each day several ferries served this route, but this did not correspond with the numbers of vehicles. For example, 15 ferries in 1968 handled 4,500,000 vehicles crossing the Bosphorous. But day by day, the number of vehicles, especially lorries and buses, in the queue for crossing the Bosphorous, had increased. Sometimes these lorries spent several hours, or have had to wait overnight in the queue in order to cross the Bosphorous by ferry, so there was always a delay in reaching the destination for commercial goods and passengers.

This inconvenient situation forced the authorities to plan the building of a suspension bridge between the two continents of Europe and Asia. This suspension bridge eliminates the delay in crossing the Bosphorous in İstanbul by ferry. Both main towers of the bridge are on land and each is 165 m. high. The construction of this first road bridge link in history between Europe and Asia started on 20th February 1970. The bridge has a single main span of 1,074 m. giving clearance of 64 m. over the Bosphorous to permit the passage of the largest ships. This suspension bridge was completed in 1973 and helps to relieve vehicular congestion on both sides of the Bosphorous. As a matter of fact, this bridge has a 6 lane roadway capable of handling 7,500,000 vehicles per year.

There still remains a problem in this matter, however, which is the completion of the dual carriageway from İstanbul to İskenderun. Although construction has started already and steps have been taken, the work on this road goes slowly and the dual carriageway has reached only to Gebze so far.

B. RAILWAY FACILITIES

In Turkey, the railway is always considered slower than the road systems.

As we indicated in previous chapters, during the Republican era, the government concentrated their attention on the railway network. Their goals were reached in that era, but since then significant contributions have not been made, e.g., in 1946 the length of railway was 7,295 km; in 1971 it was 8,170 km. When it was built, it was designed to serve the important city centres, since it was the most important transport network in its time and since road systems were in a bad state. For this reason, when the road system improved significantly during the last few decades, the railway has lost its importance.

Firstly, the above mentioned design for serving the important city centres caused lengthening of the railway, and as a result of this, the journey became longer by railway. For instance, the length of railway between Ankara and İstanbul via Eskişehir (which is circuitous) the distance is 650 km, but on the contrary, the road distance between the same cities is 426 km. This makes a big difference from the point of view of saving time.

Secondly, the railway system is single track in most parts of Turkey (including the Ankara - İstanbul railway track). For this reason, apart from being a longer journey than by road, it is much slower; for instance, from İstanbul to Ankara takes 6 hours by road, but it usually takes 11 hours by railway.

Although railway carriages have been modernised significantly, single track systems and unnecessary curves prevent railways from being fast and competing with the road systems.

Although it has been decided to build a double track between İstanbul and Ankara in order to reduce the length of the journey and increase its speed, it is not expected to contribute very much to carrying commercial goods, and its economic feasibility is doubtful, since it needs a big investment and it takes a very long time to complete.

C. PORT FACILITIES

Since a petro-chemical complex is more or less at the centre of the market area, distances of final destinations for its products are not very great and their containers need not be of the size which might involve sea vessels. Thus, road transport is relatively cheap, and so port facilities are not as important as the road system. In addition, some of the customers are not located at or near harbours.

If we make a distinction among the three transport systems, the road system has advantage over railway and sea transport for petro-chemical products.

As a matter of fact, in 1972 there were 5 large, 11 medium-sized and 151 small plants devoted to plastic products; in addition, over 700 small workshops produced a variety of plastic extrusions and injections. Most of these plants are located very close to the complex and so they use road links for their needs rather than railway or sea-routes.

The installed large and medium-sized PVC capacities amongst industrial centres were as follows in 1972 (Firms' own information).

	Firms	Capacity (Tons)
İstanbul:	Derby	10,542
	Plastel	3,610
	Pimaş	12,000
	Suni Deri Sanayi	1,787
	Yildiz Plastik	1,580
	Vinilex	9,443
İzmir:	Göktepe	10,000
	Ege Yildiz	1,129
Gaziantep:	Güney Plastik	1,640
Adana:	Pilsa	1,459

Even in towns other than İstanbul, the firms indicated above use land routes to obtain various petro-chemical materials from the complex. This obviously leads to a great amount of commercial transportation along the road leading to Yarimca.

On the other hand, road services have no difficulty in amalgamating different goods and a fifteen or twenty ton capacity lorry can carry fifteen or twenty separate (except road tankers) one ton consignments. For consignments of about fifteen to twenty tons, which just fills a lorry, road costs will be at their lowest.

A most important factor in comparing road and rail freight costs lies in their methods of dealing with consignments which do not fill a rail-car or a lorry. On the railways, it is not usually possible to amalgamate these loads. This means that a consignment of one ton will be considered as a waggon load and be said to fill one waggon even though the total capacity of the waggon is ten or fifteen tons.

This ability to amalgamate loads gives a very important advantage to the roads for carrying smaller consignments. Road facilities also have an advantage over railway and sea from the storage point of view. In Turkey consumers of petro-chemical products do not buy all at once and do not store what they need for a year. They usually prefer to buy periodically. Thus, consignment weight is not heavy enough to warrant being carried by train; the quantity is not very big, so the railway becomes expensive.

On the other hand, road systems are able to carry small quantities and are also capable of delivering them easily and quickly. For this reason, lorry transport is always chosen by the consumer of petro-chemical products. Besides, not all consumers have railway facilities to their factory, nor are they located near a railway. If their consignments are carried by the railway, after a certain point they again need to use road facilities for their final destination.

Even according to the plans which look ahead to 1995, the gap between the railway and road systems' capacity for handling goods for the domestic market will be maintained. In fact, this gap will be larger than at present. For instance, according to the plans, the present capacity of the railway

for goods is 6,600 million ton/km, and will be only 40,937 million ton/km in 1995, while the road system capacity will grow from 25,700 million ton/km in 1972 to 336,702 million ton/km in 1995, for domestic service.

If consumers transported their needs by sea from the petro-chemical plant, after docking, they would need transport by lorries. They may even have to pay transportation costs from the harbour to their factory which could be as much as the costs directly from the petro-chemical plant to their factory. As a result of the importance of road transport for carrying petro-chemical products, the number of road vehicles (especially lorries) have increased in that area.

3. THE EFFECT OF PETRO-CHEMISTRY UPON HOUSING

Housing is an important economic and social problem of society. In fact, housing is and will be one of the most important aspects of rapid concentration of population in the industrial areas in Turkey.

As we explained before, the concentration of population in the industrial areas has been caused by pressure of overpopulation on agricultural land rather than by the attraction of the industrial area, since industry has not developed as fast as population growth in the agricultural areas.

Although urbanisation only became a major force following World War II, it had limited development in Turkey and created great problems. For many years it was argued that urbanisation should and could be prevented. It was suggested that migration to cities should be subject to special permission, or measures should be taken to create urban type activities in villages in order to restric migration to cities. Urbanisation was considered to be an undesirable phenomenon to be put up with, rather than an indicator and accelerator of development.

Although it has been accepted in the 1960's that urbanisation is a yardstick for development, the Turkish government favoured a balanced urbanisation which meant that cities should only grow as fast as new job opportunities are created.

Thus, the concept of treating urbanisation as a factor of economic and social development emerged. This situation restricted the success of the policies and measures taken in order to correct the inter-regional imabalances in Turkey. As pointed out above, balanced growth among regions depends on the conscious expansion of urbanisation. The implementation of the re-settlement policy was not sufficient to solve this problem. The tax reduction to encourage investment in the less developed regions was not effective. Organised industrial districts which were considered as a tool of development in the less developed regions could not be established. Some improvements were made in social services, and public funds for this purpose were channelled into the less developed regions. The present state of urbanisation in the less developed regions shows that there are certain urban centres which will grow rapidly and influence their environment.

It is important to support this trend towards urbanisation with industrialisation and to make use of this capacity. It is interesting to see the increase in the percentage of urban population in Turkey.

Increase in the Percentage of Urban Population in Turkey

(D.P.T., 1969, and Resmi Gazete, 8.12.1972, p.47)

Years	City Population %
1927	16.4
1935	16.6
1940	18.0
1945	18.3
1950	18.5
1955	22.1
1960	26.3
1965	29.9
1970	35.9

As is seen in the above table, migration from agricultural areas to industrial centres and cities increased significantly after the road systems deveoped. In the near future the rate of urbanisation in Turkey will increase still further. The population of cities, according to estimates, during the next two decades will reach 25,000,000 - 30,000,000 and half of the total population of 55,000,000 will live in cities.

It is not difficult, therefore, to predict that in the near future Turkey will be faced with very inportant problems, of which one of the most important is housing. Urbanisation in some countries is different from urbanisation in Turkey. Although in some countries there is a balance between the absorptive capacity of the cities and the outflow from the rural areas, in Turkey the population which is obliged to leave rural areas is not easily employed in cities. Although there is some absorptive capacity in the cities, the main reason for urbanisation in Turkey, as we indicated before, is the propelling force from the rural areas caused by the limitation and decrease of suitable agricultural land.

As the activities in the cities, especially industrialisation, did not develop rapidly, the cities were not ready to absorb the influx of people. For this reason, urbanisation in Turkey is essentially demographic. Cities with increasing populations did not develop their urban characteristics either economically or socially. Technological change in agriculture continues in Turkey as was indicated before. If agricultural technology does not develop, production will remain stagnant, the rural population will increase, people-land relationships will deteriorate, per capita income will drop and rural population will be forced continuously towards industrial areas and cities. However, it should be pointed out here, that if there are technological changes in agriculture, this will increase agricultural production, but also the mechanisation necessitated by this new level of technology will free a part of the agricultural labour force and

consequently will encourage migration again; migration, therefore, is an unavoidable phenomenon. Probably, industrialisation along with saving agricultural land as much as possible, will be the most reasonable solution to the migration problem.

The Marmara and Aegean regions, which are the first and second industrial areas of the country, are more urbanised than other regions of Turkey. Between 1960 and 1965 an important development took place; namely, the population of the larger cities increased at a higher rate than the others. Migration from the less developed to the more developed regions continued. The fact that the rate of urbanisation in the less developed regions increased shows that the excess agricultural population freed from rural areas can now be employed in urban areas because of the economic development that has taken place.

As a matter of fact, in 1960, 43 per cent of the Marmara region was urbanised, and by 1965 this figure had risen to 47 per cent. The percentages for the eastern Anadolu (Anatolia) region for the same period were 13 per cent and 17 per cent respectively.

In the same period (1960 - 1965) İstanbul, as the biggest industrial centre of the country, received 36.6 per cent of all immigrants in Turkey, while İzmir received 9.6 per cent of all immigrants as the second industrial centre (Resmi Gazete, 27.11.1972, p.269). As a result of the rapid growth of population and the migration and urbanisation after the Second World War, the housing problem gained importance in the country but especially in the industrial centres, particularly the İstanbul area. The difficulty of finding inexpensive housing resulted in the mushrooming of Gecekondu around cities and industrial centres. This situation created enormous problems in cities as well as important economic and social imbalances. The housing problem was studied for the first time as a whole in the First Plan (1963 - 1967). A large number of measures have been taken to solve the housing

problem in accordance with the housing policies. Some of the measures could not be implemented and some were only partially implemented. Co-ordination could not be established and resistance from various groups had a negative effect on implementation.

It is interesting to note the number of housing units in cities with a population over 10,000 between 1955 and 1967 (D.P.T., 1969, p.304):

Number of Housing Units in Cities with a Population over 10,000 (1955-1967)

Year	City Pop.	Total Number of Housing Units	Number of Gecekondu	Number of Normal Ur. Houses
1955	5,324,397	1,050,000	50,000	1,000,000
1960	7,307,816	1,440,000	240,000	1,200,000
1965	9,395,159	1,880,000	430,000	1,450,000
1967	10,437,233	2,100,000	450,000	1,650,000

The living condititions are good in 41 per cent of the urban dwellings, reasonably good in 33 per cent and poor in 26 per cent; 27 per cent of the dwellings have no kitchen, 7 per cent no toilet, 49 per cent no bath-room, 26 per cent no electricity and 45 per cent no running water.

The improvement of dwelling conditions is largely dependent on expansion of the infrastructure in cities. The ratio of those renting housing increased from 36 per cent in 1955 to 42 per cent in 1960. This rate continues to increase as a result of migration and urbanisation. The ratio of those living in rented housing is greater in large cities and industrial centres. In 1960 this ratio was 42 per cent in Turkey as a whole, but it was 61.4 per cent in İstanbul.

On the average, 13.4 per cent of the total family income in Turkey is spent on rent. This rate is high compared with some other countries. For those who receive salaries, the average rate of income spent on rent is

20 per cent. For those who make less than a few hundred Turkish Liras a month it is evident that unless the families spend a large part of their income on rent they will be obliged to live under poor housing conditions. Rent is a heavy burden for the medium and low income groups.

As a result of this, in 1960 there were about 240,000 Gecekondu in Turkey and 13.5 per cent of the urban population lived in these dwellings. The number of Gecekondu increased to 430,000 in the 1960 - 1965 period. The number of the urban population living in these houses increased to 2,365,000, representing 21.8 per cent of the total urban population. By 1969, the number of Gecekondu had risen to 500,000 and the number of their residents to 2,750,000. There were about 700,000 Gecekondu in 1972, and İstanbul had most of them, being the largest industrial centre.

We can consider that each family has three to five members, so between 585,000 and 975,000(1) people lived in these poor conditions in İstanbul in 1970; there is no doubt that their number has increased since 1972. This means that almost one third of all İstanbul's population (almost 3,000,000) live in Gecekondu.

The annual average growth of the urban population during the 1968-1972 period was 6.6 per cent. Such a trend in the growth of the urban population creates a rapidly increasing housing demand, especially in the large cities and industrial centres, and makes solution of the housing problem more difficult. Housing problems encountered by the migration of people from villages to cities are of special importance. The fact that the housing demands of migrants and low income families in the cities cannot be met, according to supply and demand within the market mechanism, results in a housing shortage and construction of Gecekondu. Housing supply is presently directed towards meeting the demand of higher income groups.

The situation continues to be serious since financial resources are not channelled into the construction of utility housing. There is a lack of

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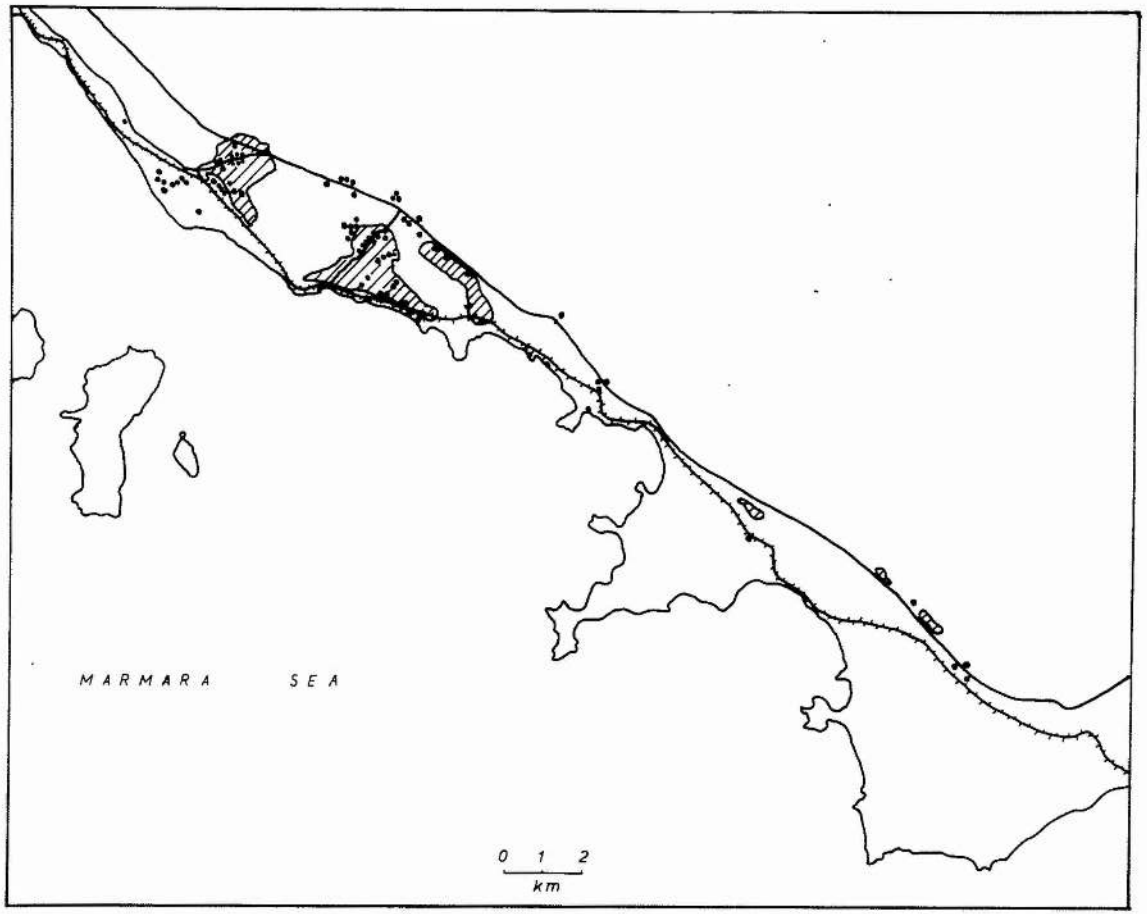
(1) For our calculations, statistical data has been obtained from Resmi Gazete, Ankara, 27.11.1972, p.270.

organisation to divert resources from the construction of Gecekondu into Utility housing, and establishments that can supply inexpensive houses are non-existent. Institutions that can assume responsibility in this field have not shown initiative.

Furthermore, construction regulations and their supervision, which play a great role in housing construction, are insufficient for implementation of the housing policy. Projects are not usually prepared by competent technicians. No development has taken place in constructing utility housing and conducting technical research to reduce costs.

The public sector does not possess sufficient land to influence the housing policy. The existing public land is sold without preventing land speculation. Investment in land continues to be profitable. A land office to organise the sale of public land centrally has not been established. Public control over the growth areas of cities has not been realised. Holding vacant land in urban centres and the sale of city land for cash, instead of renting and leasing these lots, raises the cost of land in housing investments. The land utilisation rate in construction plans is low and there is substantial waste. The public sector is not taking full advantage of the increase in land values resulting from public investment. Because there is no long-term infrastructure plan for the housing programme, the effect of infrastructure on the cost of urbanisation is great. One of the reasons that infrastructure is expensive is that many individual houses are built.

Large agencies and construction companies have not been established to take advantage of large scale construction. The credit mechanism is not conducive to the operation of such establishments in the housing field. A system of constructing and selling on a small scale, which is not consistent with the housing policy, has emerged. The credit institutions have not put emphasis on the construction of utility housing units and on selling them on credit to those in need. Mass housing construction has not been developed, and, therefore, the problem of rental housing suitable for the low income groups



THE RELATION BETWEEN INDUSTRY AND GECEKONDU AT THE EAST COAST OF MARMARA SEA

Source: Prof. E. Tumertekin, Istanbul'da Sanayi, İstanbul 1970

İstanbul - Ankara highway

İstanbul - Ankara railway

Industrial Establishments

Gecekondu (Squatter) Areas

has not been solved.

Participation by the purchaser in the cost of housing investment is deemed mandatory under the present credit mechanism. This reduces the credit available for the low income groups. The activities of the housing cooperatives have not been consistent with the housing policy and small savings which could have been channelled into housing investment have not been utilised. The Real Estate and Credit Bank has not been effective in the implementation of the housing policy. In spite of some positive developments, research on housing is still insufficient.

The establishment of a Construction Research Institute and coordination among the related agencies could not be realised. Since policies to be implemented are related to a large extent to the activities of the private sector, it is essential that the public becomes fully aware of the housing policy.

After the above explanation, it is interesting to look at how serious the housing problem is in three industrial centres of Turkey.

İstanbul: In 1965 there were 509,100 (Resmi Gazete, 27.11.1972, p.269) reasonable houses; 132,000 more houses were needed for newcomers but only 75,900 houses were built; for this reason mushrooming of Gecekondu increased and in 1970 the number of Gecekondu reached 195,000. This number represented 32.5 per cent of all Gecekondu in the country.

İzmir: In 1965, there were 187,600 (Ibid) houses; 33,000 more houses were needed, but only 18,400 houses were constructed, so the second largest industrial centre of the country in 1970 had 60,000 Gecekondu. This figure was 10 per cent of the whole country's Gecekondu.

Adana: In 1965 there were 86,500 (Ibid) houses; 20,000 more houses were needed, but only 2,500 were constructed. As a result of this, in 1970, Adana had 28,800 Gecekondu, which represented 4.8 per cent of all Gecekondu in Turkey.

These three industrial centres had 47.3 per cent of all Gecekondu within the country.

As was indicated before, the lack of control made Gecekondu housing a profitable field. Since the factories have not been forced by the authorities to build residences for their employees, the proportion of rental for such houses varies from 30 per cent to 60 per cent, according to the region.

It is easy to understand how Gecekondu are mushrooming in the cities and industrial centres, but especially in the İstanbul area, if petro-chemistry builds only 60 houses as residences for its 2,444 (1972) workers, technicians and engineers. In fact, as little as 0.25 per cent of all (almost 3,600,000 T.L.[1]) petro-chemical investment has been spent on house construction for plant employees. As can be appreciated, those not staying in these 60 houses either have to come to the plant from long distances where the rent is quite reasonable or have to pay a good part of their salary in order to be close to the plant.

Obviously, the most likely solution to this seems to be for the employee who has not been offered a house, to build a Gecekondu near to the plant since there are not sufficient controls on building them.

4. THE EFFECT OF THE PETRO-CHEMICAL INDUSTRY UPON POLLUTION

Like every industrial complex, petro-chemistry gives off residues which pollute the atmosphere, water and soil in Turkey[2].

A. AIR POLLUTION

Air pollution in industrial areas is the product of many factors acting in concert. A study of air pollution shows that the rise in atmospheric pollution increases the incidence of attacks of cardiac and respiratory illness significantly. In addition to the harmful effects on health, atmospheric pollution damages plants, animals and buildings. Petro-chemistry emits residues

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(1) Source: PETKIM Genel Müdürlüğü, Ankara.

(2) For more detail on this matter see: Engin, N. (1974) "Türkiye ve Çevre Kirlenmesi", Cumhuriyet, İstanbul, 6.6.1974, p.2.

which polluted the atmosphere; among them are sulphur dioxide, carbon dioxide and ammonia.

Sulphur Dioxide: Oil contains sulphur from 0.2 per cent to 3 per cent, but some oil contains as much as 7 per cent; petro-chemistry emits sulphur dioxide which is the main cause of atmopsheric damage, because sulphur dioxide transforms to sulphur trioxide which becomes sulphuric acid when it mixes with water particles. When sulphuric gas enters the lungs it brings on a temporary spasm of the smooth muscle in the bronchial wall. Vegetation is almost completely destroyed by sulphur dioxide. Sulphur dioxide is one of the most important pollutants (The Guardian, 21.2.1974, p.2).

Carbon Dioxide: Oil contains 85 - 90 per cent of carbon, which is then one of the most important factors upon the atmospheric pollution deriving from the petro-chemical complex and refinery. Since carbon dioxide absorbs long-wave radiation, in the long run it causes an increase of the temperature in the atmosphere surrounding the complex.

Ammonia: Ammonia arises from two sources:

(1) It is added to water used in certain processes to control corrosion.

(2) The breakdown of nitrogen compounds occuring naturally in the raw materials of the process. A good deal of the ammonia reaching the process sewers can escape into the atmosphere.

But all these atmospheric pollutants do not do any harm to their surrounding area, because they are burned in the chimney given sufficiently high temperatures, which hampers them from leaving any smog in the surrounding area.

B. WATER POLLUTION

Since the major component of the human body is water, the importance of water pollution in terms of human life is clear. In Turkey, the main source of pollution from petroleum refineries and petro-chemical plant is the large volume of wastes containing oils, suspended and dissolved solids, wax, sulphides, mercaptans, phenolic compounds and many others. Petro-chemical and refinery wastes may be classified as follows:

(1) Chemically contaminated water

(2) Oil contaminated water

Hydro-carbon or Oil Wastes: Hydro-carbon wastes usually result from leaks and spills. Water washing of crude oil in order to clean and desalt it results in loss of oil. Other sources of contamination include water which is incompletely separated from oil in storage tanks, and the loss of oil during chemical treatment.

Sulphur Compounds: Sulphur compounds are discharged through process sewers to the separators, and then to the main sewer system.

Alkaline Wastes: In the petro-chemical industry alkalines are used to purify various hydrocarbon streams.

Phenolic Wastes: Phenols and creosols are produced by refinery cracking processes. Most of these leave in the oil streams, by solution in water condensed from steam in reflux coolers, or as a sodium salt combination in the caustic solution.

Process Water: The petro-chemical industry discharges process water containing compounds not found in natural waters, or which do not occur naturally.

All of these water pollutants are treated in order to avoid harming surrounding areas, and then they are poured into the sea, but some of them, like the residue of V.C.M. which has an industrial value is sold to consumers.

C. SOIL POLLUTION

Soil pollution occurs most importantly from waste water which enters the soil in increasing volume and with increasing toxicity. The soil has a great capacity for self-purification. The billions of micro-organisms per volumetric unit of soil are capable of breaking-down and neutralising many of the substances harmful to human health, but their capacity to do this is not unlimited.

The purity of surface water has been affected by the general use of chemical agents in agriculture. The chemical agents penetrate the soil, rivers and lakes.

The effects of petro-chemistry on this matter are indirect in Turkey since the petro-chemical complex treats its wastes before releasing them. The indirect effect of petro-chemistry is via chemical fertilisers.

Although air, water and soil pollution are important in Turkey, petro-chemistry treats its own wastes in order to avoid harming human health.

Conclusion

In this chapter some effects of the petro-chemical complex have been studied.

There are certain negative effects of petro-chemistry on agricultural areas, agrarian populations and housing conditions, as an individual industry on its surrounding area, and it is also a source of raw materials which attracts other industries.

However, the petro-chemical complex has not been completely disadvantageous in all respects; the advantages to industry and agriculture are considerable. Some of the advantages were the help given to the agrarian population and land by increasing agricultural products and creating additional jobs.

In the seventh chapter we will weigh these advantages and disadvantages against the locational requirements of the industry and examine how they should affect the choice of location for the second complex.

CHAPTER VII

WHERE SHOULD THE SECOND PETRO-CHEMICAL COMPLEX OF TURKEY BE LOCATED?

WHERE SHOULD THE SECOND PETRO-CHEMICAL COMPLEX OF TURKEY BE LOCATED?

As we indicated before, the present plant cannot supply all the Turkish market demand in spite of being expanded. In view of this, the Government has decided to erect a second petro-chemical plant in the country which will have a bigger capacity than the first plant.

Initiation of refinery construction in another part of Yarimca is impossible owing to the cost of land, shortage of water, and a growing population. Moreover, the inadequate capacity of ethylene for a 100 per cent expansion in Yarimca, through the rapid development of market demand and other similar factors, necessitated the establishment of a second petro-chemical complex in other regions.

Before we see which part of Turkey may be suitable for the second complex, we should point out again that in the petro-chemical industry the main principle is the utilisation of refinery products as chemical raw materials; basically petro-chemical plants are set up near the refinery. Regarding this, when we are searching for a suitable place for the second complex we will take into account the existing refinery sites (Mersin), refinery sites under construction (Aliağa) and planned refinery sites (Samsun).

1. RELATIONSHIP BETWEEN THE SECOND COMPLEX AND TRANSPORTATION

Roads:

Aliağa (İzmir): As we indicated before, the E-24 enters Turkey from Greece and runs to the Aegean coast via İzmir and merges with the E-5. This road is a good quality road, open at all seasons to traffic, and there is a possibility of linking with this road by way of a very short additional section.

Mersin: This region also has good quality roads and there is a possibility of using it all the year round. The E-24 is passing by and merging with the E-5 after Mersin.

Samsun: Samsun has the E-100, which is a good quality road and open to traffic in all seasons.

Sea-Ports:

Aliağa (İzmir): There are good port facilities in this region because of the presence of the refinery. This port allows loading and unloading for 100,000 ton ships. If the second complex is located here, it could take advantage of these good port facilities.

Mersin: The port facilities are also good and can be used for the second complex all year round (p.96). All heavy duty equipment is available for loading and unloading.

Samsun: Samsun port has also sufficient facilities and is very well equipped.

The above explanation shows that three of the port facilities are sufficient for the second complex receiving raw materials and distributing products. The only difference is that Aliağa port facilities have been reserved for petroleum only and can be reserved for the second complex; there is no other heavy industry which uses that port's facilities. For the other industries, İzmir port has been reserved. Mersin and Samsun ports have also been reserved for other heavy industries such as Azot, Karadeniz Bakir, Akdeniz Gübre, and so on.

Railway:

Aliağa (İzmir): A railway open during all seasons will be only 27 km away from the second complex if it is erected here. For this 27 km, advantage can be taken of good land roads by lorries.

Mersin: This region has also good railway facilities which allow for the heavy goods.

Samsun: Samsun has also sufficient railway facilities.

Regarding railway facilities, then, Mersin and Samsun seem to have the advantage over Aliağa (İzmir) because the railway is 27 km away from this last region. However, this is not in fact critical to Aliağa, since in Turkey road transport is cheaper than rail.

Airports:

Aliağa (İzmir): An international airport open at all seasons exists in İzmir for business men.

Mersin: For business men there is an airport not in Mersin but in Adana.

Samsun: There is an airport which business men use.

İzmir and Samsun are superior to Mersin regarding airport facilities. If we make a distinction between İzmir and Samsun, the first has the advantage over the last since it is an international airport.

2. RELATIONSHIP BETWEEN THE SECOND PETRO-CHEMICAL COMPLEX AND RAW MATERIAL

Naptha:

Aliağa (İzmir): According to the plans for the second complex, it will use 850,000 tons of naptha. 150,000 tons of this amount will be obtained from İzmir refinery and the rest of it will be imported. This refinery will be in operation in 1974 and its capacity will be 3,000,000 tons of petroleum. If we take into account Western Anatolia's need for petroleum, this refinery will be expanded in 10 years' time. After expansion of this refinery, all the needs of the second complex for naptha will be met from the nearby refinery.

Transportation costs for the naptha will be:

700,000 tons x 92 T.L. = 64,400,000 T.L.

The second complex is expected to use 850,000 tons of naptha, but 150,000 tons of it will be obtained from the nearby refinery, so that transportation costs of this will be small. A few years later, when the refinery expands, all needs of the second complex will be met from the nearby refinery so the transportation costs for naptha will be zero.

Mersin: Mersin refinery is already naptha producing, but this naptha is reserved for the Akdeniz Gübre Sanayi (Mediterranean Fertiliser Industry) according to an agreement between them some time ago. So there is no possibility, at least for the time being, of obtaining naptha from the nearby refinery. If the complex is located there, naptha will come from İzmir refinery or will be imported.

Since there is no possibility of obtaining naptha locally for the second complex, in spite of having a refinery in this region, naptha must be transported either from İzmir or from foreign countries. Therefore, transportation costs for 850,000 tons of naptha must be taken into account:

$$850{,}000 \times 92 = 78{,}200{,}000 \text{ T.L.}$$

There is also no possibility in the future of obtaining naptha from the nearby refinery since there is no plan for expanding its capacity.

Samsun: A refinery in Samsun has not been planned yet. If it is not constructed, naptha will have to be obtained from the İzmir refinery or from abroad. Since a refinery there does not exist yet it is very difficult to say anything about the transportation costs of naptha, because there is no information about what the refinery's capacity will be. But it is possible to say that even the future refinery may not provide all the naptha needs of the second complex, since in this region industrial strength is not as great as İzmir or Mersin. For this reason, it will be reasonable to calculate for transportation costs of at least 700,000 tons of naptha, because of not having a bigger refinery capacity than that of the İzmir refinery. Therefore, transportation costs for naptha, in this case, will be at least as high as in the İzmir region. However, if a refinery is not built, transportation costs will be higher than İzmir and will be even higher than Mersin for the same amount of naptha, owing to its greater distance from the naptha exporting countries.

Salt:

Aliağa (İzmir): Apart from naptha, the other raw material, which is 100,000 tons of salt, will be obtained from nearby Çamalti (İzmir) which has a capacity of 350,000 tons of salt, yearly. For this reason, for 100,000 tons of salt, the transportation costs will be negligible for İzmir, owing to its being very close to the second complex.

Mersin: The salt will be obtained either from Çamalti (İzmir) or Koçhisar, Yavşan (Konya - Kirşehir) for this complex. Unlike Aliağa (İzmir), for this region the transportation costs of 100,000 tons of salt must be taken

into account since there is no salt nearby:

100,000 x 59 = 5,900,000 T.L.

Samsun: This complex, like the Mersin complex, will obtain salt which it needs, either from Çamalti (İzmir) or Koçhisar and Yavşan. For this region's petro-chemical complex, transportation costs of salt from Çamalti (İzmir) will be at least:

100,000 x 59 = 5,900,000 T.L.

or even higher than this amount owing to the distance being greater than Mersin to İzmir.

After the above explanation, it will be interesting to see aggregate transportation costs of the three different regions' petro-chemical complexes.

Aliağa (İzmir):	700,000 x 92	=	64,400,000 T.L. (for naptha)
Mersin:	850,000 x 92	=	78,200,000 T.L. (for naptha)
	100,000 x 59	=	5,900,000 T.L. (for salt)
	Total		84,100,000 T.L.
Samsun:	At least 700,000 x 92	=	64,600,000 T.L. (for naptha)
	100,000 x 59	=	5,900,000 T.L. (for salt)
	Total		70,300,000 T.L.

As can be seen from the above explanation and calculation, in terms of raw material costs[1], the İzmir region has priority over others (Mersin, Samsun).

3. RELATIONSHIP BETWEEN THE SECOND COMPLEX AND THE MARKET

The market factor is vital for the petro-chemical industry since it produces raw material for the other branches of industry. It is therefore an important factor in the location decision for the second petro-chemical complex that it should be close to the biggest market, which is İstanbul, because it affects transportation costs of the products; it will produce 900,000 tons of different items.

Aliağa (İzmir): Second to İstanbul, the largest market is İzmir with its industries, both those already established and those in process of development,

(1) Since information is not given about other raw and subsidiary materials during our research they are not taken into account.

which use petro-chemical products. This region is also nearer to İstanbul than the other regions.

So, aggregate transportation costs of production will be:

720,000 x 529 = 380,880,000 + 18,000,000 = 398,000,000 ton/km.

Mersin: Closest market to this region is Adana and Gaziantep, which have a synthetic fibre industry, PVC pipe industry and some other small industries. For this region, transportation costs of production to İstanbul would be:

900,000 x 904 = 813,600,000 ton/km.

Samsun: In this region both medium and small plastic industries exist, but these do not use petro-chemical products on an economic scale. If the second complex is erected there, transportation costs of production to İstanbul will be: 900,000 x 751 = 675,900,000 km/ton.

In view of these calculations, we see that as regards the market situation of the petro-chemical products and being near to the biggest market, İzmir has advantage over Mersin and Samsun.

4. RELATIONSHIP BETWEEN THE SECOND COMPLEX AND ENERGY SUPPLY

Aliağa (İzmir): Second complex needs will be obtained from Etibank. The price of electricity has been fixed at 0.123 T.L. in Turkey since it has been supplied by Etibank. On the other hand, an oil-fired power station may be erected there since fuel-oil will be produced in İzmir refinery.

Mersin: For the second complex, energy will be obtained from Etibank. When energy is obtained from Etibank the price of the energy will be fixed at 0.123 T.L. per $kw/_h$. Regarding this, there will be no restriction for electricity.

Samsun: Also in this region, Etibank will supply electricity for the second complex as it does for the Azot complex and Karadeniz Bakir İşletmeleri. There will also be no restriction for energy supply.

So, since energy will be supplied by Etibank, there will be no problem over energy for the three different regions, nor will there be any price differential for the energy; that is, regarding price of energy, none of the

regions has advantage over the others. The only thing is that Aliağa may use the oil-fired power station as well. This gives a certain advantage to the İzmir region.

5. RELATIONSHIP BETWEEN THE SECOND COMPLEX AND WATER SUPPLY

Aliağa (İzmir): There is a possibility of obtaining water from the Gediz river. There is even an alternative - to obtain water from the dam on the stream of Güzelhisar, which Devlet Su İşleri (State owned General Directorate for obtaining water) is contemplating building. The water will be brought to the complex by pipe-lines. But there is no possibility of digging water wells in order to obtain water for this complex because the local sub-soil is clay-schisty. The water of this region is of good quality for the petro-chemical complex's needs.

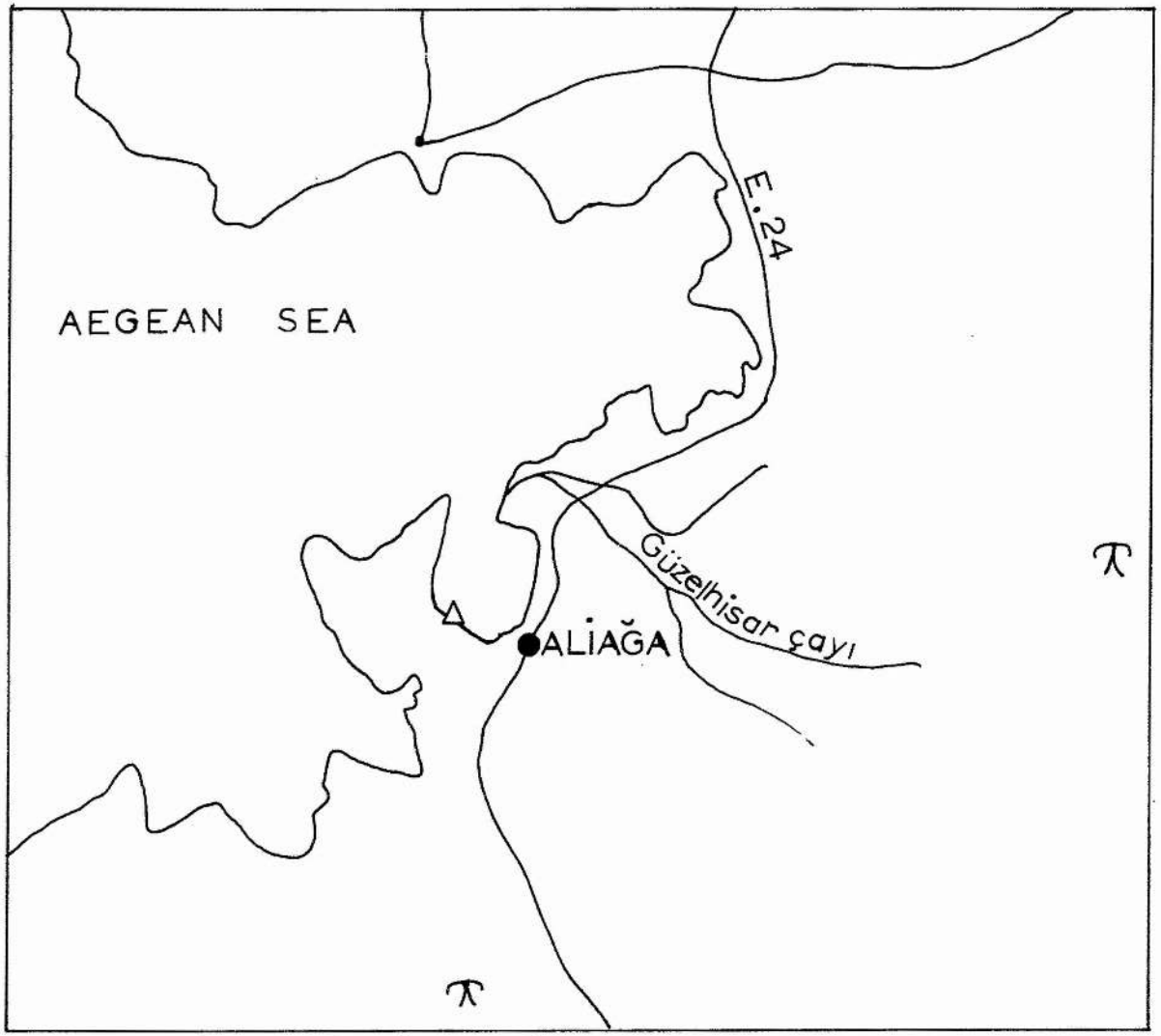
Mersin: In this region water will be obtained from wells which Devlet Su İşleri is constructing for irrigating the plains. It is possible to obtain 20 lt. water per second from each well, but there is no possibility of obtaining water from the Deliçay river because of low flow in summer (Mediterranean climate). This water is also of good quality for the petro-chemical complex.

Samsun: In this region the requirement of water for petro-chemistry will be the unsolved problem. The water needs of the complex cannot be sufficient as the Azot complex and Karadeniz Bakir İşletmeleri (Black Sea Copper Complex) are under construction; since the Abdal stream is small, its water will not be sufficient for three big complexes.

From the point of view of water supply, therefore, the İzmir region has more advantages than the Mersin and Samsun regions.

6. RELATIONSHIP BETWEEN THE SECOND COMPLEX AND LABOUR

Aliağa (İzmir): İzmir, being one of the biggest industrial centres of Turkey, has a good number of skilled workers, which the second complex needs. According to a statement of the labour office in İzmir, the situation was as follows between 1960 and 1967.



İZMİR (ALİAĞA) REGION

π Power Station Δ İzmir Refinery

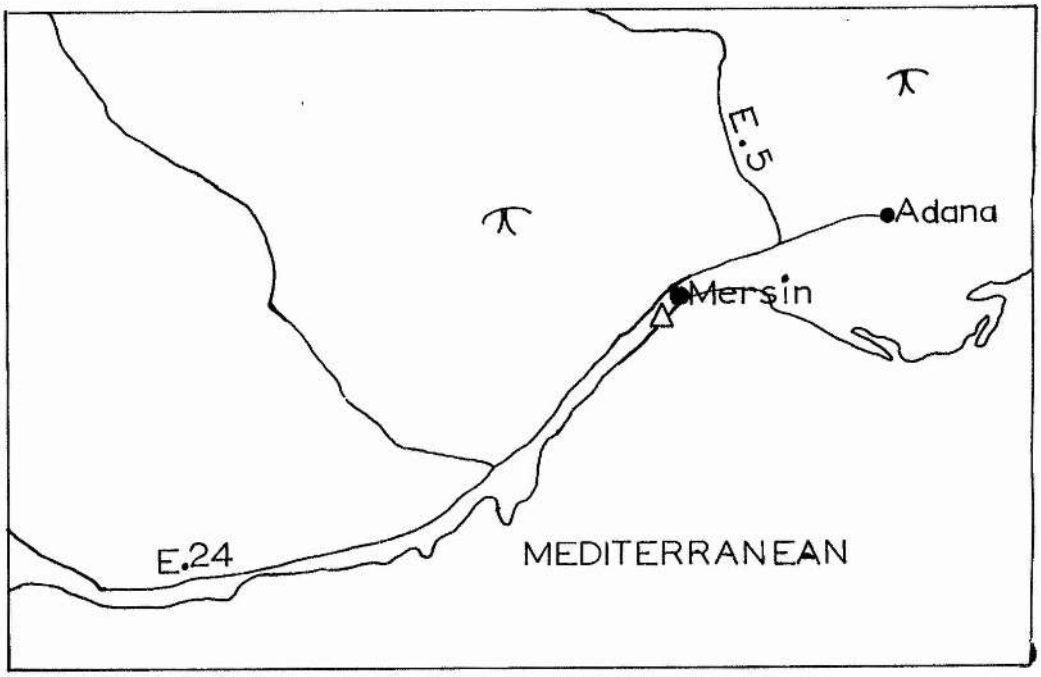
Year	Applied for Employment	Actually Employed
1960	36,004	27,831
1961	34,676	25,863
1962	25,279	13,979
1963	25,699	11,582
1964	19,927	6,999
1965	19,853	8,186
1966	21,132	9,168
1967	22,433	11,031

In 1968 there were 108,108 insured male and female workers, and their average wages were 26.60 T.L. for male workers and 20.37 T.L. for female workers.

Mersin: In the Mersin region, the skilled worker situation is promising since it has a refinery and Akdeniz Gubre Sanayi and other industries. According to a statement of the labour office in Mersin, the labour situation was as follows between 1960 and 1967:

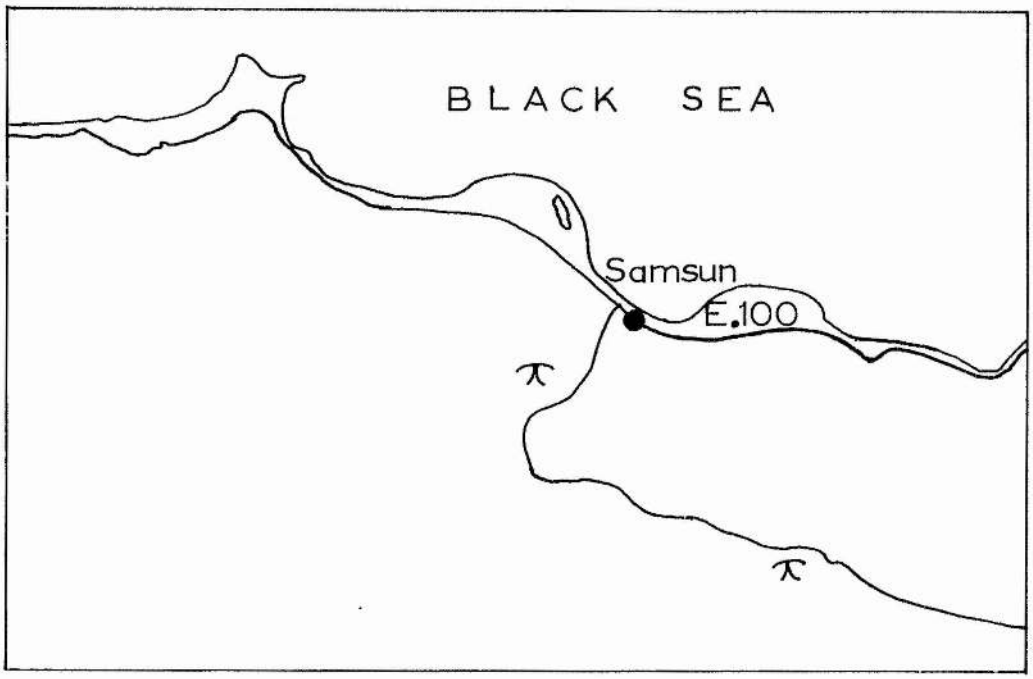
Year	Applied for Employment	Actually Employed
1960	11,718	10,935
1961	4,646	3,818
1962	8,267	5,564
1963	7,726	5,498
1964	8,388	4,518
1965	6,727	3,962
1966	5,567	3,849
1967	7,856	4,567

Samsun: Samsun industrially is not as big as the other centres, so for this reason the number of skilled workers is smaller. However, it has been becoming one of the major industrial centres recently. According to a labour office statement between 1960 and 1967 the situation was:



MERSİN REGION

Power Station Δ Mersin Refinery



SAMSUN REGION

Power Station

Year	Applied for Employment	Actually Employed
1960	10,362	6,872
1961	6,808	3,633
1962	7,745	4,223
1963	8,175	5,379
1964	8,206	5,314
1965	8,618	4,444
1966	6,254	1,689
1967	13,400	12,181

In terms of labour force in the three centres, İzmir has a stronger position than Mersin and Samsun.

7. RELATIONSHIP BETWEEN THE SECOND COMPLEX AND LAND COST

Owing to its capacity, the second petro-chemical complex will cover 9,400,000 m^2 of land surface. It seems that land costs are higher in İzmir than in the other two places, but it depends, of course, on precise location. If it is in a very industrial place, obviously it is expensive in Mersin and Samsun. Since the refinery does not exist in Samsun, it is very difficult to say anything about land cost for this city, but since Aliağa is 42 km away from İzmir, land cost should not be much more than in Mersin and Samsun. For this reason land cost may not be a discouraging factor for the Aliağa (İzmir) region.

8. RELATIONSHIP BETWEEN THE SECOND COMPLEX AND CLIMATIC CONDITIONS

As we indicated before, the climatic conditions are important from the point of view ofawllowing outdoor erection of the complex. It is interesting therefore to compare the climatic conditions of the three regions:

İZMİR

°C.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Maximum Temperature	21.3	23.9	29.9	32.8	39.5	40.3	42.4	42.7	38.7	35.9	30.6	27.7
Minimum Temperature	-8.2	-7.5	-3.8	0.2	4.3	9.5	11.2	11.5	5.8	3.6	-2.9	-6.3
Average High Temperature	12.2	13.5	15.9	20.8	25.9	26.3	27.6	27.3	26.0	24.3	18.5	14.0
Average Low Temperature	8.6	8.9	9.1	9.8	14.1	18.2	21.0	21.0	17.4	13.7	10.3	9.2
Average Rain mm.	141.2	100.2	71.6	42.5	38.9	8.2	2.9	2.5	10.9	40.5	92.9	140.9
Maximum Wind m./sn.	29.3	28.9	31.2	28.9	22.0	25.9	19.3	21.0	21.3	26.6	24.5	26.3
Wind	NWE	NW	W	S	W	W	N	N	NW	WSW	S	SW

Maximum Snow Level 32 cm.

Earthquake Zone : 3

Level of Frost - 15 cm.

M E R S İ N

	°C.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Maximum Temperature		20.5	22.9	27.5	32.7	36.2	39.2	41.4	44.2	39.0	36.6	30.0	24.4
Minimum Temperature		-1.2	-4.7	1.3	7.3	9.6	14.2	16.5	16.3	13.6	10.4	4.0	0.7
Average Rain	mm	217.9	189.1	109.6	29.5	25.0	5.2	0.4	0.8	10.2	77.1	113.7	236.4

Low temperature : 0.7°C

Earthquake zone : 3

S A M S U N

	°C.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Maximum Temperature	°C.	23.4	26.3	33.4	37.0	37.4	36.2	36.1	39.0	35.3	35.4	32.4	26.9
Minimum Temperature		-8.1	-9.8	-6.4	-2.4	2.8	7.4	13.4	12.4	6.8	3.3	-2.8	-5.0
Average Rain	mm	80.6	72.5	73.5	54.2	43.7	39.4	35.9	29.5	36.8	70.3	83.6	79.4

Low temperature : - 8,1°C

Earthquake zone : 3

It can be seen clearly from the three tables of climatic conditions that İzmir, Mersin and Samsun have the same advantages for the out-door installation. The three places have also the same chance regarding earthquakes and do not need to build specially strong, earthquake-resistant buildings.

9. RELATIONSHIP BETWEEN THE SECOND COMPLEX AND OTHER FACTORS

We will consider educational advantages and health services under this title.

Educational advantages:

Aliağa (İzmir): In this region there are considerable possibilities for the employees of the second complex to educate themselves and their children. Primary, secondary and high schools, various kinds of technical schools and a university all exist in this region.

Mersin: In this region, primary, secondary and high schools and technical schools are available, but there is no university, and the nearest one is in Adana.

Samsun: In Samsun, as in Mersin, all kinds of schools exist, except a university. The nearest university is situated in Trabzon.

Regarding the educational possibilities, İzmir has more advantages than Mersin and Samsun because it has a University and a larger number of other schools.

Health services;

As must obviously be accepted, a health service is very important for everyone.

Aliağa (İzmir): In İzmir there are 20 hospitals and a good number of health services for people.

Mersin: In Mersin there are 9 hospitals.

Samsun: In this region of the country 7 hospitals are available. Therefore, regarding the health service, İzmir has obvious advantages over Mersin and Samsun.

10. DESTRUCTION OF THE HAZARDOUS RESIDUES OF THE SECOND COMPLEX

Aliağa (İzmir): In this region there is a possibility of taking advantage of the special installation of the refinery for pumping dirty water under the sea and cleaning the air before it leaves the complex. There is also a possibility of erecting its own cleaning installations for both pumping water under the sea and cleaning the air.

Mersin: In this region special installations must be erected for pumping dirty water under the sea and for cleaning the air.

Samsun: Samsun also needs to erect special installations for pumping dirty water under the sea and for cleaning the air before it reaches the atmosphere.

As can be seen, the İzmir region has an advantage over Mersin and Samsun regarding the elimination of petro-chemical residues. Of course, there is always the possibility of erecting special installations, but it obviously affects expenditure in a negative way.

Conclusion

In the light of the domestic and the external market demand, Turkey needs a second petro-chemical complex to produce more and more varied petro-chemical products.

Petro-chemical complex construction in other parts of İstanbul is impossible owing to various economic and social problems. So the second complex should be located in some other part of the country. As a result of the explanations above, the Aliağa (İzmir) region has advantages over Mersin and Samsun regarding raw materials, their distance to the complex, to the market, to the water supply, port facilities, labour force, and in relation to the destruction of hazardous residues of petro-chemicals and to the supply of social services.

POSTSCRIPT

In 1971 and 1972, while this research was being prepared, the price of oil was relatively stable, but in December 1973 it started to increase very rapidly. This situation tends to make oil expensive and uneconomic as a source of energy, but in the petro-chemical industry it is an essential raw material, and the use of alternatives is not feasible in the foreseeable future. However, the rise in prices and the possibility of constraints on the supply of oil may play an important role in the location decisions for future petro-chemical complexes. But it is rather difficult to say how this situation affects Turkey, for the time being. Quite recently the Turkish national press announced that Turkey had reached an agreement with Iraq over oil. According to this agreement, Iraq will export oil to Turkey, and in return, Turkey will build a sugar refinery, cement factory, oil refinery and pipe-line for Iraq. If ever this agreement came into effect, Turkey might not be affected by the sharply increasing oil prices. But this may affect, to a certain extent, the location decisions for petro-chemical plants in Turkey in the future.

Turkey may locate a refinery-petro-chemical plant in East and South East Anatolia near the Iraqi border for the Iraq market, because if the agreement comes into effect, Iraq will not only be the source of the chief raw material but its traditional demand for Turkish petro-chemical products may well be strengthened. This would help the Government's industrialisation policy of East and South East Turkey which so far has not been very successful. There is still quite a big difference between the West and East and South East of Turkey as far as socio-economic problems are concerned.

Some Problems of East and South East of Turkey

Although the unifying forces of Government administrative machinery seem to shape the contemporary image and political features of peasant lives, the gulf between the world of the peasant people and the Government is still so

wide that within Eastern and South Eastern Anatolia there are innumerable peasant societies grossly separated from the rest of Turkey.

It is very difficult to establish industries in the East and South East of Turkey because of poor communications and poor transportation to and from these regions resulting in very high transportation costs. At the same time the purchasing power of people living in those regions is low.

The character of crops and the nature of the peasant's economic activities in the isolated peasant societies have been considerably shaped and hampered by the lack of roads which has compelled the peasants to produce only what they can consume and consume what they can produce. Another characteristic of Eastern and South Eastern Turkish agriculture is that the utilisation of fertilisers is extremely limited, and this greatly affects agricultural incomes which are the most important source of earnings because the degree of industrialisation is very low in this part of the country. In fact, according to 1963 figures, 18 provinces of East and South East Turkey had only 26 State, 75 private and, in total, 101 industrial establishments, against 257 State; 2,775 private and a total of 3,102 industrial establishments for the other 49 provinces of the country. In the same year, the total number of manufacturing workers was 17,036, against 326,000 for the rest of the country.

So, as a result of this, the disguised unemployment, coupled with relatively declining economic opportunities and absence of alternative employment outlets for channelling a part of the excess labour supply away into industrial occupations, have forced the Eastern and South Eastern people to seek employment far from home. With the increasing loss of active population to urban places, the remaining rural population struggles to balance its meagre needs and meagre efforts. East and South East peasants who occasionally leave their homes in search of employment return home after earning "enough" money and do not respond to income incentives. In fact,

according to a study conducted (D.I.E., 1969, 40) on the population structure of Turkey in terms of birth of origin, 10.7 per cent of the inhabitants of large cities were migrants from Eastern and South Eastern Turkey. The percentage of immigrants of Eastern and South Eastern origin in Istanbul was 27.4 per cent; Ankara 24.7 per cent; Adana 12.5 percent, in 1965.

The industrialisation of these regions by the Government is a major way to improve the living standards of these people.

The Establishment of the Petro-Chemical Complex in these regions:

Since the petro-chemical industry covers most of the organic chemical industry and causes other industries to develop, this industry should be considered as a basic industrial branch for manufacturing industry in terms of the industrialisation effort in East and South East Turkey. Besides, the effect of the petro-chemical industry upon agriculture from the chemical fertilisers and plant protection point of view is considerable. Therefore, the establishment of the petro-chemical complex in this part of Turkey may help to increase agricultural products and consequently to increase agricultural income. It also provides additional jobs for the Eastern and South Eastern people by attracting other industrial plants to these regions. Although there are no industrial concentrations or adequate markets for petro-chemical products in this regions at present, the Gaziantep region is a nearby PE and PVC market. The other products of any complex which might be established in this area could be sent to the other domestic markets and to external markets (especially the Middle East) until market conditions improve in these regions. Clear oil gives greater range of locational choice and of markets for products.

Since the transportation system is inadequate in this part of the country a place should be chosen for the complex which would take advantage of the Istanbul-Kurtalan railway and of a road of medium quality which extends until Siirt. The railway may be the major factor in this part of the country's

transport system affecting the choice of industrial location. Road transport may be of limited significance, chiefly because of the geographical conditions. The roads are closed during part of the winter because of heavy snow falls.

Naptha and aromatic oil, which are the raw materials of the complex, could be taken from any nearby refinery which was supplied with Iraqi oil by pipe-line. The other raw material, salt, may be brought from Erzurum - the nearest source - and benzene from the İskenderun iron and steel plant which is under construction and will be completed at the end of 1975.

The energy could be obtained from the nearby Keban Dam which came into use in September 1974 with its 10,000,000,000 kw/h capacity.

The huge demand for water by a complex could easily be supplied by the Tigris (Dicle) river which is nearby.

The skilled labour needed for the complex may be attracted from any part of the country since the labour factor is very mobile concerning the conditions of industrial establishments.

This part of the country is one of the cheapest as far as land cost is concerned.

In these regions the complex may particularly attract the household appliances industry, the tyre and tube industry, and some other industries which mostly use petro-chemical products as their raw material and have been exporting their products to Iraq, Lebanon, United Arab Republic, Kuwait and Pakistan.

Thus, the Government may decide to build a refinery-petro-chemical complex in this part of the country because of the recent changes in the international oil market and because of the need to provide additional jobs and improve the standard of living of the people in Eastern and South Eastern Turkey.

SECTION III

CONCLUSION

After investigating the geographical location, the character, and the relationship with the geographical environment of the petro-chemical industry in Turkey we can reach the following conclusions.

1. The petro-chemical industry originates from oil fields with crude oil and goes on with the refinery which produces the raw material (naptha) for the petro-chemical industry itself. This industry covers most kinds of industries; that is, the petro-chemical industry produces raw materials to be used in most other industries.

The introduction of petroleum as a chemical raw material to the industry is a recent event, but the development of this branch of the chemical industry has been very rapid.

2. As a result of the climate (which affects water supply, out-door installations, environmental pollution), the physical conditions (transport, earthquakes, water supply) and population distribution (affects market, labour) of Turkey, the main strength of the country's economic activity is centred at the coast.

The high concentration of population in the coastal regions is a result of climatic and physical conditions.

3. One place can be very suitable for a certain industry but may not be the best location for another industry. It is interesting to note here, as Estall and Buchanan say in their Book (Estall and Buchanan, 1969, p.18, footnote), "However, that even the best location will probably not be wholly ideal: no location has a complete monopoly for advantages and complete absence of disadvantages, so that even the best choice will contain some element of compromise".

Therefore we feel that the meaning of the "optimum location" which has been used very often by geographers and economists should imply that a balance

has been achieved among physical, climatic psychological, social, economical and governmental influences so that they merge smoothly and each makes its due contribution to providing the most economical conditions for production.

4. After the Turkish industry attained a certain maturity, the Turkish petro-chemical industry which uses petroleum as a chemical raw material and produces raw material for the other branches of her industry has been located in Yarimca about 85 km from İstanbul. This remains the most concentrated industrial zone in Turkey; it starts 20 km west of Istanbul and goes uninterruptedly to 150 km east of İstanbul. This zone carries more than 50 per cent of Turkey's industrial activity. In fact, 71.31 per cent of all petro-chemical products is consumed in İstanbul (1972). That is, raw material sources of industries are located nearby.

For this reason the zone offers excellent market conditions for its products. So, the first petro-chemical complex is located at the centre of the market and takes advantage of low aggregate transportation costs both for receiving its raw materials and for delivering its products to the market.

5. Turkey's petro-chemical industry has concentrated on meeting the urgent needs of Turkish industry by using domestically produced naptha as a basic raw material and importing some other subsidiary materials.

Since Turkey has only just made a start in the petro-chemical industry, almost all the equipment, as well as the complete technical know-how, has to be purchased, together with the patent rights, at very high prices.

In some classical industrial branches such as textiles, cement and metallurgy the life of a production is quite long, and once the know-how has been bought, it is possible to use the process profitably with little or no later development. Unlike these industries, the life of a process is very short in petro-chemistry, the reason being that this branch of industry develops very quickly. One certain thing is that it is impossible to develop a petro-chemical industry and to compete with others solely through buying the

know-how for every type of process from the simplest to the most complicated, and through continuing to buy any further developments. The only sure way to develop a viable petro-chemical industry is to have an independent research organisation.

All the petro-chemical firms in the world, as a result of strong competition, try to take maximum advantage of unavoidable by-products obtained during reactions, in order to reduce or stabilise production costs. But this of course entirely depends on sophisticated research organisations.

If a country does not keep its level of know-how buying to a minimum, it has no chance of developing its own industry in that particular field, and must be satisfied with a small production capacity and large production costs; it can then only serve the domestic market, and must resort to measures of tariff protection.

The Turkish petro-chemical industry is in this situation at this moment.

6. Petro-chemistry has a significant direct effect, as an individual industry, on its surrounding area; being also a source of raw materials, it tends to attract other industries.

It should be pointed out that there are certain negative effects of petro-chemistry on agricultural areas, agrarian populations, and housing conditions. However, the advantages to industry and agriculture are considerable and one may conclude that petro-chemistry can help in boosting agricultural production.

This does not mean that the problems brought to agricultural areas and agrarian populations should be ignored. On the contrary, these problems are important and remedies for them should be found.

We feel that a possible remedy might be to conserve as much good agricultural land as possible for strictly agricultural use, rather than using it for industrial establishments, and for housing purposes. Areas that are unsuitable for agriculture should be reserved for the latter purposes. This would help to relieve pressure on high density agrarian populations,

and would keep them in their environment.

7. The rapid development of market demand necessitated the establishment of a second complex having larger capacities. As was indicated before, initiation of refinery and petro-chemical construction in other parts of İstanbul is impossible owing to the expensive land and rapidly increasing population. Regarding this, it has been decided to erect a second and larger petro-chemical plant in another part of the country.

For the second petro-chemical complex, as we explained in different sections, the Aliağa (İzmir) region has obvious advantage over others (Mersin, Samsun) regarding raw materials, their distance to the complex, the market, being close to the biggest market of the country (İstanbul area), water supply, port facilities, labour force, destroying hazardous residue of petro-chemicals, education possibilities and health services. For the other things, such as energy, road facilities and climatic conditions, the rival locations were more or less equally placed.

Since some things are equal (energy, road, railway and climate), the most advantageous place to erect the second complex is where there are more possibilities.

For this reason, the Aliağa (İzmir) region will be the most profitable place to erect the second petro-chemical complex of Turkey.

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