A RESEARCH ON THE ECONOMIC FEASIBILITY OF THE K.E.K. PROJECT

By

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My thanks to all, who have willingly presented the information and I needed to prepare this thesis.

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CHAPTER

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VI. LONG RUN EFFECTS OF THE PROJECT AND CONCLUSIONS

LIST OF TABLES

LIST OF ILLUSTRATIONS

Definition of the Problem: The problem involved in this thesis is the analysis of the economic feasibility of a polyester synthetic fiber production process. Since this thesis involves the background of technical and economical knowledge, it can be considered as ideal for Industrial Management studies.

In chapter I. an overall world survey ofthe product is carried out, while in the second part ofthis chapter the product specifications are given in detail. In chapter II a brief summary a of textile industry in general and the share of various synthet: fibers in this sum is analyzed. Chapter III is one of the most important parts of this study, whereby a complete market survey and analysis is constructed, to find out the future potential need for polyester fibers in Turkey. Chapter IV. informes read as to the technical background of the process. Chapter V whic constituets the bulk of this thesis analyzes the economic feasibility of the project, considering the plant site and location, investments, break-even analysis constructed as a result of decision-making matrix and finally a cash-flow analysis. Throughout the thesis, in defining and analyzing the problems as in suggesting the possible changes and improvements, the statements on evaluating the project was supported by factu data as much as possible.

Consequently in Chapter VI the long run effects of the project are studied, giving recommendations in the conclusion phase. The project was found to be economically feasible at the end this analysis.

Methodology: The methodology utilized in Chapters I, II, and IV is mainly library research. This part necessitated the use of some very special books and periodicals about Textile world. In chapter III. a forecast process for the product is carried out on a model constructed by me.

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While constructing this model paralel guide-lines were used as the Turkish Industrial Development Bank. In writing Chapter V and VI the chief guide-lines are company's records, project proposal, revision studies on the project by the Turkish Industrial Development Bank and mainly interviews.

In any research work, complete information is hard to attain and there are certain aspects of every organization which are intentionally or unintendently kept secret by the members. The above statement holds exactly true for the Textile industri where a keen competition prevails. So in mycase, at instances where only partial information is available, analysis is based on the limited data and information available and subjective evaluation is avoided as much as possible.

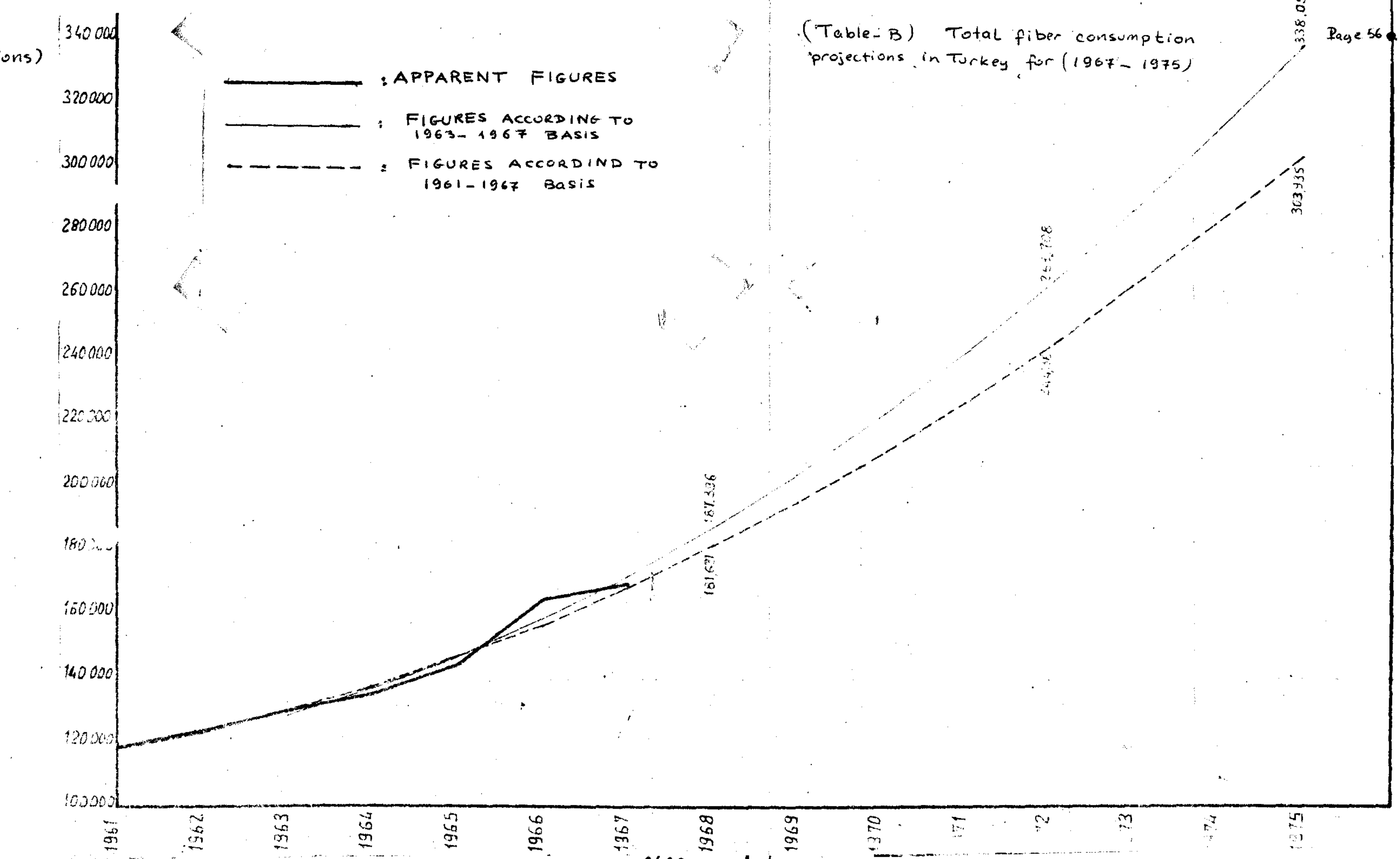
CHAPTER I - A WORLD - WIDE ECONOMIC AND TECHNICAL SURVEY OF SYNTHETIC POLYESTER FIBERS

Part I - Synthetic Fibers in the World

- Introduction
- Terminology and general Information
- Fiber Properties
- Data on the Development of Synthetic Fibers
- Appendix

Part II- The Position of Polyester Fibers in the Synthetic Fiber Industry (A world wide survey)

- Applications of Polyester Fibers
- World Production of polyester fibers by economic areas
- Technical Data on Polyester Fibers
- Physical Properties of the Polyester Fibers



(Table-B) Total fiber consumption projections in Turkey for (1967 - 1975)
(tons)
: APPARENT FIGURES
: FIGURES ACCORDING TO 1963 - 1967 BASIS
: FIGURES ACCORDIND TO 1961 - 1967 Basis
340 000
320 000
300 000
280 000
260 000
240 000
220 000
200 000
160 000
140 000
120 000
100 000
1961
1962
1963
1964
1965
1966
1967
1968
1969
1970
1975
161,671
303,335

PART I - SYNTHETIC FIBERS IN THE WORLD

Introduction

Textile materials are of interest to everyone, for they play a most important role in civilized life as we know it today. Throughout the past centuries a few simple fibers, particularly linen, cotton, wool and silk, have been used mainly for purposes of clothing. Today these fibers, with the possible exception of silk on account of its scarcity and high price, are being widely utilized for industrial purposes. Cotton is used for reinforcing motor-car tyres and plastic materials, with linen wing coverings on aeroplanes, and the use of wool felts as heat and sound insulating materials in building construction.

Of the many fibers available from natural sources (all plants contain fibers), only a very small number have proved useful or durable enough to satisfy our requirements. Actually there is scarcely any other fiber which can compete in usefulness with cotton, wool, linen and silk. It is surprising that just these four fibers "fit the bill" for modern textile purposes.

Yet all these natural fibers have short comings of one kind or another and so, during the past fifty years, has arisen the rayon industry by which man has sought to manufacture fibres better than those mentioned above. Starting from a humble background this industry has attained great importance.
At least half a dozen man-made fibres are now in large-scale production and with such success that one of natural fibres, silk, is being pushed into the background.

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The advantages to be obtained from man-made fibres are obvious. They can be made in the size and shape best adapted to the machinery available to convert them into yarns and fabrics. The natural fibres vary considerably and are affected dry climate conditions over which man has no control, but the rayon fibres can be produced with uniform dimensions, having strength, lustre, handling and dyeing properties as desired. Moreover, the cost of these new fibres has been kept low and materials made from them are well within the reach of everyone of average means.

One significant feature about the manufacture of viscose, cuprammonium and acetate rayons, is that the raw materials have to be obtained from natural sources. Thus, cellulose, which forms the basis of manufacture of viscose, cuprammonium and acetate rayons, has to be made from cotton or wood. So these man-made fibres are not quite independent of nature. To remedy this, the latest developments in the manufacture of textile fibres have been concerned with new fibres made from substances capable of being synthesised from air, coal and oil. In this way have come the latest man-man fibres known as nylon, Vinyon and Saran. Their discovery has opened up a new and attractive scope in the manufacture of textile fibres. New raw materials and new methods of production have been involved and it is difficult to foresee the many further developments along these lines which must inevitably take place.

While all this great progress in the creation of new and improved types of textile fibres has been going on there has, by contrast, been but little change in the production of yarns, fabrics and garments beyond the necessitated by the use of the new fibres.

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Surely the methods and machinery involved in spinning yarns and weaving and knitting fabrics have been improved but not fundamentally changed. However, there has been great progress made in the art of improving the serviceability and attractiveness of textile materials by dyeing, printing and finishing methods. Now textile materials can be softened, stiffened, water-proofed, made water-repellent and given a degree of lustre varying from a matt appearance to very bright Textile materials can also be made more durable, and resistant to shrinkage and creasing.

The result is that, today, although we have available for our use a wide variety of textile materials, further improvements can be anticipated, perhaps at a rate greater than ever before

Terminology and general Information

Fibres are the fundamental units used in the fabrication of textile yarns and fabrics. As the classification chart on Table I. shows, textile fibers are divided into four large groups, according to the substance from which they are made: namely, cellulose, protein, thermoplastic resins, and mineral. The thermoplastic group of fibers is also referred to as the synthetic (except for acetate which is semi-synthetic) or chemical fibers.

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CLASSIFICATION OF COMMON TEXTILE FIBERS[1]

- CELLULOSE
  - Natural
    - Cotton - Seed Hair
    - Flax - Stem
    - Ramie - Stem
    - Jute - Stem
    - Hemp - Stem
  - Manufactured
    - Rayon - Pure cellulose, Viscose
    - Cuprammonium
    - High- Tenacity Rayons
- PROTEIN
  - Natural
    - Silk - Silkworm
    - Wool - Sheep
    - Mohair - Angora goat Cashmere and other Speciality Wools
  - Manufactured
    - Vicara - Zein of Corn
    - Caslen - Casein of Milk
- THERMOPLASTIC
  - Manufactured
    - Acetate - Cellulose Ester
    - Nylon - Polyamide
    - Dacron - Polyester
    - Orlon - Acrylic
    - Dynel - Acrylic
    - Acrilan - Acrylic
    - X-51 - Acrylic
    - Saran - Vinyl
    - Teflon - Vinyl
- MINERAL
  - Natural
    - Asbestos
  - Manufactured
    - Fiber Glass

1 Norma Hollen and Jane Saddler, Textiles, Mac Millan Compan New York, 1958. Page: 6

Fibres may come from natural sources or they may be man-made. Of the many fibers found in nature, only cotton, flax, silk and wool have been used extensively. Each of the natural fibers is produced in several varieties which differ in quality Pima cotton and Merino wool are examples of good quality varieties that are sometimes mentioned on labels.

"Trade names" for man-made fibers designate the producer. The trade names Dacron, Dynel, Orlon, Acrilon and Vicara are the only trade names for these fibers, since at present each fiber is manufactured exclusively by its respective company. On the other hand, viscose rayon is a fiber produced by several companies, so it has several trade names. Trade names are always capitalized. The value of knowing trade names is debatable. To a certain extent they may serve as a guarentee of the product.

Natural fibers are subject to each of uniformity due to weather conditions, nutrition or soil fertility and disease. Because it is possible to control the entire production process, man-made fibers are more uniform in size and in other characteristi

There are two classes of fibers according to length;

(a) Filament

(b) Staple

(a) Filaments are of a continious length measurable in yards or meters. The only filament fiber that occurs naturally is silk. All other filament fibers are man-made. Yarns made from filament fibers are of two types; multifilament and monofilament.

Multifilament yarns are made of a number of tiny filaments twisted together. The size and number of the filaments

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can vary. Yarns of this type give pleasent surface texture, softhess and luster. They are used in blouses, lingerie, and silk type dresses.

Monofilament yarns are composed of a single, solid strand of great strenght and smoothness. Sheer blouses, veils, and gowns are other examples of monofilament use. Large monofilaments are used in car-seat covers, screenings, webbing for furniture and similar materials.

(b) Staple fibers are short in length, measured in inches, and range from three-quarters of an inch to 18 inches in length. During World War I, Germany began the practice of cutting "artificial silk" into short length for use in cotton and wool-type fabrics, since there was a shortage of these fibers. The word "staple" was applied to these cut fibers, and is now a standard term for any fiber of a length expressed in inches. All the natural fibers, except silk, are staple fibers. Any filament fiber can be cut into staple of a length determined by the end-use desired.

Man-made fibers are spun out through very fine holes in a spinnerette. Man-made filament and staple are not spun on the same equipment. To make staple fiber, several thousand filaments are spun out of on spinnerette in a long rope-like strand called "tow". Stretching or drawing, heat-setting and crimping are after-treatments that can be used to control the size, shape, and strength of the fiber. Crimping of staple fibers gives straight fibers a wool waviness that makes more cohesive, so that they hold together better in the yarn. Filament tow may be crimped by running the fiber through fluted rollers on by putting very high twist in the wet tow and allowing it to dry. The crimp is set by steam and the tow is then untwisted.

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Fiber Properties

A serviceable fabric is one which is properly designed for an intented use. This intended use is spoken of as the "end-use". To make such a fabric the manufacture chooses fibers, yarns, weaves, and finishes with a combination of properties which will give the type of serviceability the consumer wants. The consumer, for his part, needs a knowledge and understanding of these properties so he can succesfully select, use, and care for the article he buys.

i) Physical Properties Related to Hand and Appearance

The "Physical structure" of a fiber includes length, diameter, surface contour, crimp and shape. These properties help determine the roughness, smoothness, softness and soil-resistance of a fabric.

"Crimp" refers to the waves or bends that occur along the length of a fiber. Wool has natural crimp. Manufactured fibers may be given a permanent crimp. Fiber crimp increas cohesiveness, resiliency, and resistance to abrasion. It helps fabrics maintain their "loft" or thickness.

"Luster" is the shine or brightness of a fiber caused by reflection of light. Smooth fibers reflect more light than rough fibers, round fibers reflect more light than flat fibers. Filaments which are laid together with little or no twist reflect more light than short fibers which must be twisted together to form yarns.

"Density" or "Specific gravity" are measures of the weight

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of a fiber. Density is the weight in grams per cubic centimer. Specific gravity is the ratio of the mass of the fiber to the mass of an equal volume of water at 4°C. The weight of a fabric is determined by the density or specific gravity of the fibers in it. For example: Orlon is lighter in weight than wool. Thus an orlon fabric will weight less than a wool fabric of the same thickness.

"Strength" of a fiber is the ability to resist strains and stresses. It is expressed as tensile strength which is measured in pounds per square inch (p.s.i.) or as tenacity which is measured in grams per denier. Some fibers gain strength when wet, some lose strength, and some are unaffected by water.

"Abrasion resistance" is the ability of a fiber to withstand the rubbing or abrasion it gets in everyday use. Inherent toughness, natural phability, and smooth filament surface are fiber characteristics that contribute to abrasion resistance.

"Cohesiveness" is the ability of fibers to cling together. This is important in staple fibers, but unimportant in filament fibers.

"Pliability" or "Flexibility" is the ease of bending or shaping. Pliable fibers are easily twisted to make yarns. They make fabrics that resist splitting when folded or creased many times in the same place.

"Stiffness" or "regidity"is the opposite of flexibility. It is the resistance to bending or creasing. Rigidity and weight together make up the body of a fabric.

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"Elasticity" means the ability of a strëched material to return immediately to its original size.

"Resiliency" is the ability of a fiber or fabric to recover over a period of time, from deformation such as stretching compressing, bending or twisting. A resilient fabric has good crease recovery, hence requires a minimum of ironing. Resilient fabrics also retain high bulk and do not pack down in use.

"Soft" is a term used in relation to compressional resiliency. When pressure is put on a fabric, if it springs back to its original thickness it is maintaining its loft.

ii) Physical Properties Related to Stability, Care and Comfort

"Stability" is the retention of size, shape, or form. A stable fiber does not stretch, shrink, beyond stated limits with moisture, heat or strains.

"Absorbency" is the ability of a fiber to take up moisture and is expressed as percentage of moisture regain, which is the percentage of moisture that a bone-dry fiber will absorb from the air under standard conditions of temperature and humidity. Staple fibers hold more water than filament fibers since they pack less compactly and create a sponge like condition in the yarn and fabric. For this reason staple fibers fabrics require a longer drying time.

"Chemical resistance" The chemical reactivity of each fiber depends on the arrangements of the elements in the molecule and the reactive groups it contains. Not all chemicals are harmful.

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Alkali strengthens cotton, alkali and chlorine may be used to make wool, shrink resistant, and chemicals that under ordinary conditions might be harmful can be used under scientifically controlled conditions to produce designs and beneficial finishes

Data on the Development of Synthetic fibers

The synthetic fibers have been called " Magic fibers" and "Easy Swing fibers".[2] There are many ways by which they have made living easier. The time required for washing, drying, and ironing clothes has been reduced to a minimum and ironing is sometimes unnecessary.

The production of man-made fibers, that was started at about the beginning of the century, accounted in 1965 for more than one quarter of the world's fiber production (Table I.)

Noncellulosic fibers, first introduced to the market in the market in the early 1940'ies, have during only 25 years gained a share of 38% of the total man-made fibers production (Table I

The significance of these figures is effectively shown when one examines their real extent. For instance, the volume of world natural fiber production that in 1900 amounted to 8.62 bill. lbs(3.9 mill. tons) had only been able, by 1965, to be increased to 28.5 bill. lbs (12,9 mill. tons). If one compares this relatively small growth with the world population explosion (1900 : 1.55 bill. 1965 : 2.33 bill; 2000 : expected 6.3 bill. and with the even faster progress of industrialization (world oil production in 1913:25 mil. tons, 1964:1.403 mill. tons)[3]

2 - Hollen and Saddler Page 53

3 - R. Norris Shrene, The Chemical Process Industries , Mc Graw Hill Book Company Inc. New York 1964 Page 121

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it becomes evident that new raw material sources had to be found for the production of textile fibers in order that the challenge of the growing demand could be met.

Reviewing the development of the last 60 years shows that in general three periods can discerned:

1920 - Natural fiber production only
1920 - 1940 - Natural and cellulosic fiber production
1940 - Advancement of synthetic fibers

The introduction of the cellulosic fibers represented the first, and still significant, step to overcoming nature's limits for world textile supplies. Thanks to the introduction of synthetic fibers - representing the second attempt of increasing the total fiber supply - the world has become, for the first time, and in a steadily increasing manner independent of natural raw material reserves.

Initial research for the production of synthetic fibers began in 1920. In 1935 IG. Farbenindustrie succeed in marketing the first synthetic fiber, the so-named Pe-Ce fiber on the basis of polyvinyl chloride. The development of the four main types of fibers which today account for most of the world's output, was running as follows: Nylon-6.6 : Development by Carothers, first Commercial production in 1935 by Du Pont. Nylon 6 : Development by Schlack, first trial production in 1939 by IG. Farbenindustrie.

Polyester: Following the first developments by Carothers in the 1920'ies, Whinfield and Dickson of the firm Calico Printer' Association carried on the work in the years 1941-1944. First Commercial production in 1949 by I.C.I.

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Acrylics: Developed during the 1940'ies by, and independent of each other, IG. Farbenindustrie (Rein) and Du Pont (Houtz). First commercial production in 1950 by Du Pont and almost simultaneously in West and East Germany.

With the production of synthetic fibers in 1964 being of a volu of 3.72 bill. lbs (1.69 mill. tons), the world wool production of 3.37 bill. lbs (1.53 mill. tons) was surpassed for the first time. The 1964 to 1965 growth of world production for syntheti fibers of approximately 20% to 4.47 bill. lbs (2.03 mill. tons represents an absolute volume of 750 mill. lbs (341.000 tons) and thus accounts for 58% of the total increase of all textile fibers (1.29 bill. lbs).

This record output was reached by the combined efforts of the main synthetic fiber producing countries as listed below.

Production of Synthetic Fibers (mill. lbs)

	1965	1963	Increase
U. S. A.	1.776.9	1.560.0	+53 %
Japan	836.9	527.4	+59 %
West Germany	390.1	241.3	+62 %
Great Britain	326.3	232.3	+40 %
Italy	230.4	170.6	+35 %
France	192.0	179.0	+ 7 %
TOTAL	3.752.6	2.506.6	+50 %

Source: A report prepared by Vickers-Zimmer Aktiengesellschaf

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In addition to these figures, tables 2 and 3 tabulate in geographical areas the world production and capacity of synthetic fibers for the year 1955 to 1965 as well as estimated data of world capacity for 1967.

As has been evident for several years the shifting of market shares of the different synthetic fibers, measured by their combined output, also continued in 1965. Polyamide fibers, although maintaing their leading position and widening their absolute production by 11%, settled at a market share of 49% (1960 : 58 %). Acrylic fibers, growing by about 32%, improved, kpein xobikioh ko 20 % (1960 : 16 %). On the other hand, polyester fibers which expanded by 36 % between 1964 and 1965 improved their share to 23 % (1960 : 17 %) of the synthetic fiber market (Table 4)

It is expected that the world production of synthetic fibers will have already approached the 10 bill. lbs (4.5 mill. tons) mark by 1970 (Table 5.) That would mean that their part in total world textile fiber production will have risen to approximately 19 % from the 1964 figure of 9 %. And it can be reckened that, by 1970, world capacity of the four main types - nylon-6, nylon-6,6, polyester and acrylics - will have more than doubled to about 11 bill. lbs (5 mill. tons) beyond the 1965 figure (Table 6). Also in 1970, polyamid fibers will be a dominating position with an estimated 42 % of the total production. Their probable total output of 4.1 bill. lbs (1.85 mill. tons) might include 50% nylon-6,6. This trend is shown by the following table:

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	Nylon-6	Nylon-6,6	Others
1958[2]	34	66	-
1961[2]	40	60	-
1964	47.5	52.5	-
1965	50.5	49.2	-
1966	47	50.5	2.5
1967	46	51	3
1970[3]	47	50	3

Source: Vickers-Zimmer Report

1 - Mainly nylon - 4,4
2 - Share of output
3 - Based on plans and projects for expansion as far as known today.

Polyester and acrylic fibers, by 1970, might have gained market shares of approximately 31 and 20 %.

This extremely vigorous expansion will also continue similar strength in the years following 1970. An understanding of the large potential of the fiber sector is gained when some data on the consumption per capita of textile fibers in various parts of the world are considered (see Table 7).

These data show quite clearly the extent of the present - and parly even widening-gap in consumption if one takes as a standard factor the figure of 18-24 lbs (8-11 kg) per capita, as it might well be taken as an average for the more highly developed countries. The danger of this situation becomes more clearly evident when one bears in mind that in 1963 32 %

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of the world population consumed approximately 70 % of the world fiber yield; this in comparison with, at that time, only 30 % of the world fiber production being supplied to 68 % of the world population in the developing countries (Aprica, Latin America, Near and Far East.)

For the synthetic fibers the disproportions in consumption are similarly apparent in a somewhat larger degree. Whereas in the industrialized countries in 1963 the average amounted to about 2,2-4,4 lbs (1.0 - 2.0 kg) per capita, the figure was only about 0.2 - 0.3 lbs (0.1 - 0.15 kg) for developing nations

Quantitative assessments for the years following 1975 will be problematic due to the so many uncertain factors to which they would be subjected. However, an attempt was made to give a rough estimate of the expected textile fiber consumption in the year 2000. By then, according to U.N. data, the world population will have grown by about 3 bill. to 6.3 bill representing an almost doubling of the 1965 figure. With the per capita consumption figure remaining the same - the 1965 world average amounted to about 11 lbs. (5.0 kg.)-then, by the year 2000 about 33 bill. lbs. (15.0 mill. tons) of textile fibers will have to be provided in addition to the quantity of 40 bill lbs (18.3 mill. tons) produced 1965. An increase of the average consumption per capita to 18 lbs (8.2 kg.), this corresponding to half of the USA 1965 consumption figure, would represent an almost trebling of the world 1965 fiber output to about 113 bill. lbs (51.5 mill. tons)

As the output of natural fibers is restricted by the limitation of natural resources, this requirement will only be able to be met by man-made fibers, in fact principally by the synthetic fibers.

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APPENDIX

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Table 1 World production of natural and man-made fibers

	Natural fibers[1] 10^6 lbs	%	Cellulosics[2] 10^6 lbs	%	Non-cellulosics 10^6 lbs	% of total	% of man-made fibers	TOTAL textile fibers 10^6 lbs
1900	8,620	100	2	-	-	-	-	8,622
1910	11,082	99.9	12	0.1	-	-	-	11,094
1920	12,031	99.7	32	0.3	-	-	-	12,063
1930	15,407	97	458	3.0	-	-	-	15,865
1940	17,998	87	2,485	12.0	12	-	0.5	20,495
1950	17,026	82	3,553	17.3	153	0.7	4	20,732
1955	23,779	81	5,023	17.0	587	2.0	10	29,389
1960	25,584	78	5,731	17.3	1,548	4.7	21	32,863
1961	24,996	76	5,914	18.5	1,830	5.5	24	32,740
1962	26,353	75	6,298	18.0	2,380	7.0	27	35,031
1963	27,442	74	6,728	18.1	2,936	7.9	30	37,106
1964	28,256	72	7,230	19.0	3,772	9.0	34	38,979
1965	28,456	71	7,343	18.2	4,474	11.1	38	40,273
1970+	32,000	63	9,000	18.0	9,800	19.0	52	50,800

1 - cotton, wool, silk + - own and Farbwerke Hoechst estimates
2 - rayon, acetate

Table 2 World production of non-cellulosics by geographical areas (mill. lbs)

	Western Europe	Eastern Europe and China	North America[1]	South America	Japan	Others	TOTAL WORLD
1955	122.8	36.9	391.6	1.2	34.7	0.2	587.4
1957	216.0	51.1	536.2	4.5	93.4	0.3	901.5
1959	334.6	67.9	674.9	9.9	178.1	5.1	1,270.2
1960	472.7	77.4	714.6	15.9	260.7	6.4	1,547.7
1961	558.9	109.1	793.5	23.1	337.6	7.4	1,829.6
1962	763.0	144.6	1,023.3	35.9	403.1	10.1	2,380.0
1963	950.3	178.6	1,214.0	47.6	527.4	18.3	2,936.2
1964	1,168.5	224.6	1,472.3	71.8	753.6	31.6	3,722.4
1965	1,346.3	285.4	1,877.3	77.7	836.9	50.0	4,473.6

1 - USA, Canada and Mexico

Table 3 World capacity of non-cellulosics by geographical areas[1] (mill. lbs)

	Western Europe	Eastern Europe and China	North America[2]	South America	Japan	Others	TOTAL WORLD
1961	663.6	126.0	1,054.8	23.5	337	13.2	2,218.1
1962	809.7	163.7	1,245.6	41.8	400	12.3	2,673.1
1963	1,038.2	216.4	1,431.4	58.3	484	20.3	3,248.6
1964	1,231.8	251.1	1,664.2	73.2	664	30.6	3,914.9
1965	1,576.3	342.7	2,014.1	120.6	887	62.7	5,003.6
1966	2,094.2	406.3	2,619.7	135.0	981	75.7	6,311.6
1967[3]	2,927.2	534.6	3,687.7	187.6	1,092	144.3	8,573.4

1 - March figures 3 - December figures
2 - USA, Canada and Mexico

Table 4 World production of non-cellulosics by type of fiber (%)

	Polyamide	Polyester	Acrylics	Others
1950	80	-	4	16
1955	70	6	11	13
1960	58	17	16	9
1961	57	18	15	10
1962	56	19	16	9
1963	55	20	16	9
1964	53	20	18	9
1965	49	23	20	8
1970+	42	31	20	7

V I C K E R S - Z I M M E R AKTIENGESELLSCHAFT
Planung und Bau von Industrieanlagen

T a b l e 5 — World production of non-cellulosics by filament and staple and by type of fiber

		TOTAL WORLD 10^6 lbs	%	Polyamide 10^6 lbs	%	Polyester 10^6 lbs	%	Acrylics 10^6 lbs	%	Others 10^6 lbs	%
1961	filament	1,095	60	936	89	99	30	1	-	59	34
	staple	735	40	119	11	234	70	267	100	115	66
	total	1,830	100	1,055	100	333	100	268	100	174	100
1964	filament	2,154	59	1,794	90	233	31	5	1	122	38
	staple	1,568	41	198	10	512	69	658	99	200	62
	total	3,722	100	1,992	100	745	100	663	100	322	100
1965	filament	2,444	55	1,978	89	302	30	6	1	158	43
	staple	2,030	45	236	11	711	70	870	99	213	57
	total	4,474	100	2,214	100	1,013	100	876	100	371	100
1970	total	9,800		4,100		3,000		2,000		700	
1975	total (estimated)	15,000		6,000		4,500		3,000		1,500	

T a b l e 6 — World capacity of non-cellulosics by filament and staple and by type of fiber[1]

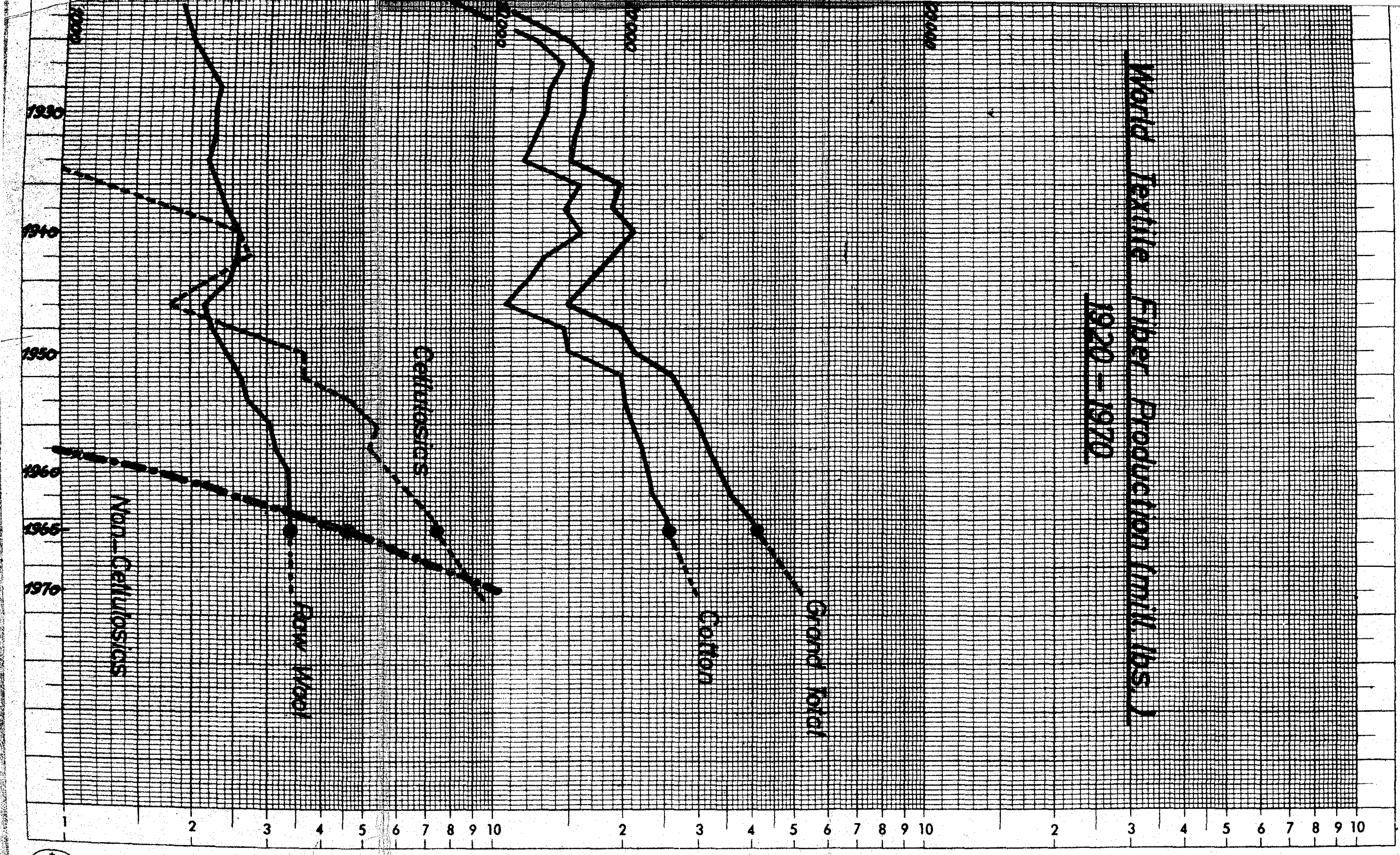
		TOTAL WORLD 10^6 lbs	%	Polyamide 10^6 lbs	%	Polyester 10^6 lbs	%	Acrylics 10^6 lbs	%	Others 10^6 lbs	%
1961	filament	1,227	55	994	89	110	27	0	-	123	47
	staple	991	45	119	11	290	73	442	100	140	53
	total	2,218	100	1,113	100	400	100	442	100	263	100
1964	filament	2,244	57	1,797	90	227	28	16	2	204	47
	staple	1,671	43	214	10	583	72	640	98	234	53
	total	3,915	100	2,011	100	810	100	656	100	438	100
1965	filament	2,803	56	2,284	90	293	28	13	1	213	45
	staple	2,201	44	249	10	754	72	938	99	260	55
	total	5,004	100	2,533	100	1,047	100	951	100	473	100
1966	filament	3,476	55	2,728	90	435	29	17	1	296	49
	staple	2,836	45	300	10	1,052	71	1,170	99	314	51
	total	6,312	100	3,028	100	1,487	100	1,187	100	610	100
1967[2]	filament	4,569	53	3,551	91	618	27	27	2	373	47
	staple	4,005	47	370	9	1,668	73	1,554	98	413	53
	total	8,574	100	3,921	100	2,286	100	1,581	100	786	100
1970	total[3]	11,000		4,400		3,300		2,200		1,100	
1975	total[3]	16 - 17,000		6,500		5,000		3,500		1,600	

[1] - March figures [2] - December figures [3] - estimated

T a b l e 7 — Per capita consumption of textile fibers (lbs)

	textile fibers			synthetic fibers		
	1961	1962	1963	1961	1962	1963
USA	33.9	36.5	36.5	3.67	4.78	5.65
EEC	22.0	22.2	23.6	1.78	2.42	2.93
Japan	27.0	22.8	25.4	3.29	3.60	4.10
Developed countries	25.4	25.6	26.5	2.56	3.07	3.73
Developing countries	5.5	5.7	5.5	0.09	0.11	0.13
Latin American	9.1	9.3	8.8	0.24	0.33	0.35
Near East	8.4	8.6	8.2	0.11	0.13	0.20
Far East	5.1	4.9	4.9	0.04	0.07	0.09
Africa	2.9	3.1	3.1	0.07	0.07	0.07
Centrally planned countries[1]	9.1	8.6	8.4	0.11	0.13	0.20
Eastern Europe[2]	21.0	21.0	21.0	0.57	0.68	0.99
WORLD	11.3	11.0	11.0	0.62	0.75	0.93

[1] - China, USSR and Eastern European countries [2] - excluding USSR


World Textile Fiber Production (mill. lbs.)
1920 - 1970
Grand Total
Cotton
Raw Wool
Cellulosics
Non-Cellulosics
1930
1940
1950
1960
1965
1970

I. Applications of Polyester Fibers

A - Textile Sector

Polyester fibers for textile purposes find widespread applications in form of staple fiber and filament, blended or unblended.

Most important types are:

for textile filaments		60-110 den
for staple fibers		
	Cotton type	1.2 - 3 den
	Wool type	3 - 12 den
	Carpet type	10,12,14 den

(a) Filaments

100 % polyester filaments are employed primarily for production of curtain fabrics demanding good resistance to light, high stability of shape and easy care properties.

Pure polyester filaments in the apparel sector have found wide application for neck tie clothes because of their silky luster, "wash and wear" possibilities and dimensional stability.

Underwear, bathing suits light women's wear, summer, and evening dresses made from % 100 polyester are of minor importance. Some disadvantage of these pure polyester products, despite of their easy care properties, is given by the fact that they get soiled very quickly. An additional application is represented by the combination of filament in warp and staple fiber yarn. By this method used by weaving mills the appearance of the goods may be modified favorably.

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(b) Staple Fibers

Polyester staple fibers are processed mainly in the apparel industry where they have proved best as a component for fiber blends. Due to the wide range of crystallization of polyester fibers, staple fibers with different stress-elongation characteristics can be produced by changing the drawing ratio. This advantage and the fact that the staple lenght can be varied as desired enable the assimilation of polyester staple to a variety of synthetic and natural fibers. Thus, it is possible by suitable blending ratios to combine the properties of polyester fibers with those of the blending component and to change the quality of textiles within certain limits. Considering stress-elongation behaviour, principally, two different types of staple fibers must be regarded. According to their specific application they are denoted "cotton-type" and "wool-type". Which of these types will be employed at times, depends chiefly on spinning method and product (worsted system, cotton system etc.)

I. Wool Type: These fibers are characterized by an elongation behaviour widely adjusted to wool. Moreover, fixation during the production process imports a stabilised crimp to the material the effect of which is a surface structure similar to wool. Staple length at 3 to 12 den is 80 mm. to 120 mm. Mostly these wool type is employed for men's wear requiring a certain loftness and good bundle as well as highest crease resistance.

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II. Cotton Type: The material is assimilated to the properties of cotton i.e. elongation is lower and tenacity higher than with the wool type. For reason that this staple fiber is employed where strenght, not bulking is the primary goal, it is not or only little crimped. The liter in general is rather fine, ranging about 1.4 den in average. Staple lenght at 1,2 - 2,75 den is 40 to 0 mm.

III. Fiber blends: In the following compilation the most interesting and best tried blends are demonstrated.

67 % polyester / 33% / cotton : Cotton type fabrics for rain-coats, men's shirts, outer wear, pyjamas, porous and absorptive underwear, strand and sport dresses, cord.

55 % polyester / 45 % wool : Used for women's and men's outer wear like summer and winter overcoats, women's suits and shirts and jerse fabrics for hard wear made from pilling resistant staple fibers.

80 - 85 % polyester / 20 - 15 % flax : Employed for light and comfortable women's and men's wear preserving the character of a linen fabric.

70 % polyester / 30 % rayon staple : Hygroscopic fabric mainly for underwear.

75 % polyester / 25 % acetate : For light outer-men, leisure dressing, pyjamas and decorative fabrics.

70 - 80 % polyester / 30 - 20 % polyamide fibers :
For fashionable tricot fabrics, men's shirts, blouses and leisure dresses.

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50 % polyester / 50 % acrylics: For men's suits, coats and trousers, light overcoats, furniture cloth.

IV. Blends made of three components: Fabrics consisting of three and more fiber materials are finding entrance in the textile sector mainly in the U.S.A. By choosing the most suitable blending ratio producers they try to combine the different fiber properties for optimum quality of the woven goods. Besides the standard blend made of polyester / acrylics / wool (50/25/25 %), especially blends made from polyester / acrylics / rayon staple and polyester / rayon staple / acetate have performed well and - under some points of view better than blends oftwo fiber components.

The following table indicates the estimated end use pattern for polyester fiber in the U.S.A. taking 1000 tons as the basis.

B - Technical Sector

Polyester fibers for technical purposes are employed mainly in form of unblended fabrics. Most important usage areas of the polyester fibers in this are as follows: tubes, tires, conveyor belts, belts, ropes and nets, insulation material, truch, railroad and tent canvas, life-boats, containers, filter cloth.

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Estimated end-use pattern for polyester fibers in the USA (1,000 tons)

	Apparel				Household			Industrial			
	Blends	100% Poly.	Fiber-fill	Total	Blends+100% Poly.	Fiber-fill	Total	Tire cord	Other uses	Total	Grand total
1956	15.9	0.5	-	16.4	0.5	-	0.5	-	0.5	0.5	17.4
1958	18.2	0.5	0.2	18.9	0.9	0.2	1.1	-	1.4	1.4	21.4
1960	27.3	1.4	1.4	30.1	1.8	1.4	3.2	-	3.2	3.2	36.5
1961	31.8	2.3	1.8	35.9	2.3	1.4	3.7	-	3.6	3.6	43.2
1962	45.4	3.2	3.2	51.8	4.5	2.7	7.2	0.5	4.1	4.6	63.6
1963	59.0	4.5	3.6	67.1	5.9	3.2	9.1	0.9	4.5	5.4	81.6
1970[1)]	136.0	9.1	9.1	154.2	22.7	6.8	29.5	11.3	9.1	20.4	204.1
1970	(Revised estimate)										450

1/ Original estimate made by A. Kastens: "Synthetic Fiber Markets to 1970

2/ Revised total from recent forecasts

II. World production of polyester fibers by economic areas (tons

	Year	Yarn		
Western Europe	1959	14.100	19.100	33.200
	1960	20.400	29.100	49.500
	1961	23.200	35.800	59.000
	1962	28,200	48.600	76.800
	1963	33.000	57.000	90.000
	1964	47.000	68.000	115.000
	1965	n.a.	n.a.	152.000
Americas	1959	11.800	28.600	40.400
	1960	13.600	35.900	49.500
	1961	14.100	36.900	51.000
	1962	15.400	58.600	74.000
	1963	20.400	80.300	100.700
	1964	29.500	96.000	125.500
All others	1959	900	13.200	14.100
	1960	2.300	21.300	23.600
	1961	7.800	33.200	41.000
	1962	14.500	38.100	52.600
	1963	20.400	49.600	70.000
	1964	29.500	68.000	97.500
Total world	1959	26.800	60.900	87.700
	1960	36.300	86.300	122.600
	1961	45.000	106.000	151.000
	1962	58.000	145.400	203.400
	1963	74.000	168.700	260.700
	1964	106.000	232.000	338.000
	1965	n.a.	n.a.	455.000

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III. Technical Data on Polyester Fibers

Processes for the production of polyester fibers

The general routes which are in use today for producing polyester fibers are represented as follows.

a) Production of monomers:

Terephthalic acid (TA) or dimethylterephthalate (D.M.T.) are the important intermediate raw materials. Processes start from p-xylene, toluene or phtalic anhydride. Para-xylene is oxidized is one or more steps to TA or DMT by use of air or nitric acid (Amoco, Witten, Dupont, Montecatini processes). Processes starting from toluene or phtalic anhydride represent an entirely different technique (Bergbauforschung, Henkel I and II.)

1. Air oxidation of p-xylene

-Amoco process (Mid Century): The Amoco process uses acetic acid as solvent for the catalyst needed. It represents a one-stage oxidation to TA. Purification problems are mainly due to influence of catalyst and acetic acid on formation of by-product.

-Witten Process: The process consists of a two-stage oxidation each followed immediately by esterification. In the first stage p-xylene is oxidized to solvic acid and esterified with methanol to the monoethylester. In a second step, monomethyterephthalate is produced and esterified to D.M.T.

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2. Nitric acid oxidation of p-xylene

The processes used by Du Pont and Montecatini comprise two steps: In a first one, p-xylene is oxidized by means ofnitric acid to alhylated benjoic acid. Subsequently, by a second oxidation TA is formed. The product must be separated from nitro-compound by-products.

3. Bergbav-Forschung process

The route developed by them starts with toluene, formalschyde and hydrochloric acid, which are processed to chloromethyl-toluene in a first stage. Addition ofnitric acid at elevated temperature results in a mixture of solvic acid and nitric acid, by an oxidation step TA is obtained, centrifuged and washed.

4. Henkel processes

1. Henkel process: Phthalic anhydride is hydrolyzed and converted to potassium -o- phthalate by the addition of potassium hydroxide. By means of catalytic isomerization under inert gas atmosphere potassium terephthalate is formed.
2. Henkel process: Toluene is oxidized with air The benjoic acid formed is converted to potassium benzoate and then to potassium terephthalate.

b) Ester interchange and polycondensation

Reaction formulas

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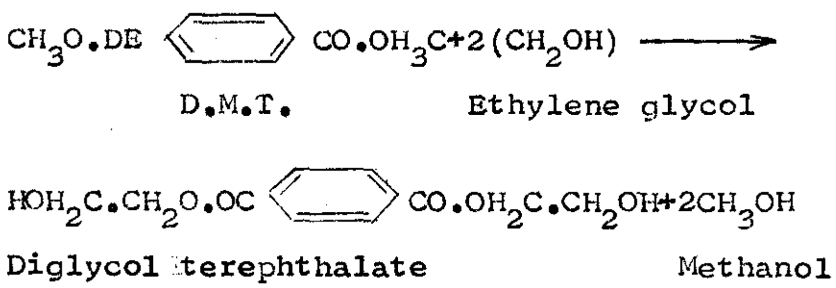
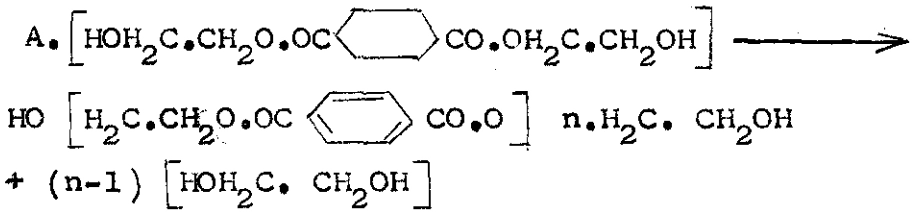
Ester interchange



Polycondensation



IV. Properties of polyester fibers

When examining the properties of polyester fibers it is of main interest to show clearly what characteristics amd applications are specific for polyester in comparison to other synthetic materials. For this reason a compilation of the most important properties for textile and technical use will precede the detailed discussion.

A - Textile Sector

Advantages:

Outstanding high crease resistance and dimensional stability (permanent press)

Easy care properties (wash and wear)

Pleasing handle of wool-blended fabrics

Low shrinkage tendency.

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Disadvantages:

Pilling tendency (to be overcome by pilling resistant polyester fibers) Relatively poor dyeing affinity.

B - Technical Sector

Advantages:

High tenacity and 100% met srenght, outstanding high modulus of elasticity and low elongation, high resistance to chemicals, high thermal stability.

Disadvantages:

Complicated processing for tire cord use (problem of rubber adhesion to fiber)

In the following section the most essential physical properties are discussed in detail.

a) Tenacity: The tensile strenght of polyester fiber are almost on the same level with nylon-6, nylon-6,6 and polyprophyene. By special spinning and drawing techniques, it is possible to create a type of staple fiber distinguished by very high tenacity at low elongation.

b) Elongation Characteristics: Elongation will generally be lower than for the most other synthetic fiber. The poor elongation of polyester fibers at low tension favours significantly processing of the material and properties of use of the fabrics. The initial nodulus of elasticity of polyester fiber is 3 to 5 times higher than that of polyamide fibers and two times that of cotton and rayon. This fact, being one of the chief advantages of polyester.

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fiber, is most important for determining the various applications of polyester, e.g. for technical purpose. The elastic behaviour of the staple fiber is very similar to wool.

c) Abrasion resistance: Polyester fibers exceed cellulosics and other synthetics except polyamide fibers in abrasion resistance.

d) Shrinkage and Thermo setting: Polyester textiles are not s... shrinking significantly. Even this shrinkage can be further decreased by thermal treatment (fixation). Materials improved in this way will not shrink even when being treated with boiling water. Shrinkage of unprepared material under these conditions would amount to 6 to 7 %.

Stability to light: These show highest stability against the influence of light among nearly all types of fiber (e.g., after exposure to sunlight for 600 hours the average loss is strenght amounts to only 60%. Polyamide fibers would be completely destroyed under these conditions. Some reduction in quality - nevertheless - occurs when polyester fibers are exposed to very short - waved light as to be found in tropical regions. Under such conditions figures for polyester will decline to those of nylon materials.

Stability to heat: Polyester fibers have the highest melt Temperature among all synthetic fibers, as compiled below.

Type of fiber	Melting point (°C)	Fusion point (°C)
Polyester	248-256	245
Nylon-6	215-218	180
Nylon-6,6	245	220
Polyethyene (Low pressure)	124-138	115-125
Polypropylene	165-175	140-165
Polyacrylonitrile	Decomposion	235-250

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Correspondingly, stability to heat of polyester material ranges beyond all other matural and synthetic fibers. After heating to 150^{o}C during 1000 hours, tensile strength of polyester will be reduced to 50 %, whereas all other fibers would be totally destroyed after already 200 to 300 hours at the same temperature.

Resistance to Chemicals: Polyester fiberk are resistant to rather all mineral acids, hydrofluorie acid included, better than nylon-6 and nylon 6,6 which would be decomposed by H_2SO_4, Hcl (cold) HNO_3,HAC depending for cover. Besides being acidproof, its resistance to bleaching and exidizing agents reperesnts another obvious advantage of polyester material. On this field only polyethylene, and polyacrylonc-trile fibers can compete, also organic solvents are of no influence to polyester fiber.

Dyeing possibilities: These may be dyed with common dispension dyes, vat dyes or ajo-compounds applying carriers or elevated temp. with regard to the uniformity, depth and strength of the coloration and also its resistance and atmospheric effects, high-temperature dyeing is more economical and does not involve the use of harmful and unpleasant smelling carriers.

Wash and Wear properties: The easy care properties which favour polyester fiber's application in men's and Women's outwear have been substantially improved by the development of the permanent press technique.

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CHAPTER II - A GENERAL OUTLOOK TO TEXTILE INDUSTRIES IN TURKEY

- Textile Industry in Turkey in general
- Total Textile fiber consumption patterns in Turkey
- A polyester industry project (K.E.K.)

Textile Industry in Turkey in general

This chapter aims to give the reader some broad concepts about the conditions of textile industries in Turkey. It is going to be a broad outline of the break-down of textile fibers amongst themselves in terms of value and quantity. As a matter of fact this very short chapter is written as a quide to the following chapter.

Being a genuine characteristic of developing countries textiles have always been quite an important forerunner in Turkey's industrial growth. According to the latest available statistics there are 2539 companies in seven different chief industrial branches[1]. (These are the firms which are the members of Chamber of Industry) These described areas and their relative production areas are given below.

Industrial areas:	% Production of Total National income
1. Food - stuffs	19.50
2. Textiles	27.39
3. Metal Manufacturing	20.07
4. Chemicals	11.34
5. Printing and Paper	3.60
6. Glass and Geramics	4.79
7. Others	13.88

Source: Published by the Istanbul Chamber of Commerce No 6 1962

1 Metin Göker and Ahmet N. Koç, "A Report on Current Problems of Turkish Industry in Production Management and Marketing" not published, September 1966, Pg. 13

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Although those figures are derived from a source that is not very current, it points out the important role of textiles in the industry roughly. In our country the private textile plants are gathered mostly in Adana, Istanbul and İzmir. It is unfortunate that only a few of these plants were formed according to scientific productivity requirements. According to the international productivity standards a textile establishment should at least possess 30.000 spindles and 800 looms in order to be considered as economic. With this fact in hand; only a very few private textile plant fulfill those necessary requirements. The reason for that low standards is easily traceable. Import of industrial textile equipment was constantly stimulated by the government. The potential local demand to textile end-products being a developing country was rather high. Coupled with these points, bank credit was easily attainable. So many entreprenuers indulged in the textile business without giving profound considerations to the future. The consequences were the expected severe business failures of the inefficient ones, leaving the market to the rather effective ones in the field.

Today textile industry has reached more or less a mature stage in Turkey.[2] Presently there exist a large pool of workers, technicians, engineers and managers trained in this area. Some thirty years ago at the peak of "Etatism", public sector has established many textile plant in various parts of the country. In this respect public sector plants have acted as training grounds in this field and made the capable personnel available to new firms which are in need of such personnel. Textile industry has the earliest settlement date in Turkish industry. Being the first establiblished branch it has matured through the years. To stay in business and to be competitive

2 Göker and Koç Pg. 75

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textile firms today have to pay attention to their efficiency problems, such as raising labor productivity, decreasing waste, streamlining the inventories.[3]

Total textile fiber consumption patterns in Turkey

The total textile yarn and fiber consumption figures in Turkey ranging from 1951 to 1965 are given in (Appendix-1) in detail. Here in that Tableau consumption figures in wool, cotton, artificial, silk and synthetic fibers are given in detail.

In the following Tableau the share of synthetic fibers consumption in the total consumption are given in the years 1961-1965.

Years	Total Fiber and yarn consumption (Tons)	Synthetic Fiber and yarn consumption (Tons)	The share of Synthetics in the Total (%)
1961	118.663	1.034	0.8
1962	124.089	3.857	3.1
1963	130.154	4.009	3.2
1964	135.192	6.207	4.6
1965	144.350	8.363	5.8

Source: Turkish Industrial Development Bank Textile Statistics

Apart from the above classification synthetic fibers can further be classified among themselves in three major groups.

1) Polyamides (Nylon, Perlon etc...)
2) Polyesters (Terylene, Trevira, Dacron etc...)
3) Acrylics (Orlon, Dralon, Acrylon etc...)

The names in the parentheses are the trade marks of textile products of different firms. To make sound forecasts in

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future developments in synthetic textiles in Turkey, world figures showing the distribution of those three main categories are included in Appendix-II. Here the share of each product as a percentage total is shown for a period ranging from 1950 to 1968.

Finally the complete the brief outline of Turkey's situation with respect to synthetic fibers Appendix-III is included in the picture. Here import figure of synthetic fibers and yarns are given for a period ranging from 1961 to 1966 both in quantity (kg's) and money terms (T.L.)

A Polyester industry project (K.E.K.)

Like most of the countries in the world textile industry's demand to synthetic fibers and especially to that of polyester fibers are rapidly accelerating. Believing that the importation of these types of fibers will strongly distant the balance of payment structure of Turkish industry in the undesired direction and that the import difficulties presently encountered will increase even more in the future the establishment of K.E.K. (Chemical Indusrty Combination) have been planned. K.E.K. is planning to produce polyester chips which can be considered as the semi-finished form of polyester fibers, together with dimethylterephthalate the main raw material. There is another project coming in the picture soon by a competitive firm. But since their existing capacity seems far away from satisfying, the country's overall demand; a plant that will produce 5.000 tons (chips included) of polyester fiber and a second plant that will produce 16.000 tons of D.M.T. which will satisfy the total of domestic demand is proposed. The details of the K.E.K. project are as follows.

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1. The investor firms are demanding $ 9.360.000 of credit from Industrial Development Bank. (In all coming discussions the monetary basis is taken as 9.08 TL = 1 $ and 2.4 = 1 D.M. the figures used by I.D.B. to evaluate projects with foreign capital participation) The total of external payments (machinery, know-how, engineering) sums up to 37.000.000 D.M. The first factory will produce polyester chips and by processing those chips will obtain 5000 tons polyester fibers per year.

2. The potential investors in the K.E.K. project are as follows:

   a) Mensucat Santral T.A.Ş.
   b) Akfil Sanayii ve Ticaret A.Ş.
   c) Koç Holding A,Ş.
   d) Bozkurt Mensucat Sanayii A.Ş.
   e) Altınyıldız Mensucat Fabrikaları T.A.Ş.
   f) Pensoy Mensucat ve Sanayii Limited

   A capital of 30.000.000 TL have been guarenteed by the above investors. 50% of the above capital is planned to be supplied by selling stocks to the public, and this is a firmly determined policy of the project group.

3. The plant having a capacity of 5000 tons polyester fibers will stem its operations in the year 1970. In 1967 on the other hand polyester import figures surpass the 5000 tons annum mark. In 1968 polyester fiber consumption figure is around 4000 tons and the price is rather high (28 TL/kg). Even if it can be assumed that this potential demand will be satisfied with the plant that will start its operations towards the end of 1968 with a 4200 tons per year capacity, still the need for the K.E.K project becomes apparent.

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Because the potential demand will climb to 7.000 tons per year with the current prices and will jump to 9-10.000 tons per year with a much lower price of around 20TL/kg. with the establishment of K.E.K. plants.

4. Plants having 5.000 tons capacity per year are very economic according to world standards. Two plants having almost this some capacity of 5.000 tons will provide all the essentials of competition in this field. It will be economic on one hand while bringing the advantages of competition to the country. Thus avoiding the possibility of a monopoly in this era. To give a general idea countries all over the world possessing 5.000 tons capacity polyester plants are outlined in the following Table.[4]

Country	# of Polyester P.	Country	# of Polyester P.
France	2	Brazil	3
West Germany	9	Chile	3
Italy	7	Colombia	3
Holland	3	Peru	1
Austria	1	Venuzuella	3
Portugal	1	Australia	1
Switzerland	2	Chine	1
U.K.	3	India	4
Spain	2	Japan	9
East Germany	3	Korea	1
Poland	2	South Africa	2
Romania	1		
Russia	7		
Canada	1		
Mexico	3		
U.S.A.	2		
Argentine	1		

4 Textile organon, June 1967, Textile Economics Bureau, Inc. 10 East 40'th Street, New York Pg. 96 ./..

5. K.E.K. project will be carried out only by domestic capital, there will be no foreign capital participation.

6. Bearing in mind the limited foreign currency potentials of Turkish economy a step-wise procedure to carry out the project is designed, so as to minimize the extent of idle resources tied up to this project.

In the following chapters of this thesis basing our judgement on a thorough market survey and research of polyester fibers in Turkey a critical project evaluation phase taking into consideration the production process in detail with its problems, capital investments and financial decisions, structure of the capital, profitability calculations are discussed.

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Appendix-I

TOTAL TEXTILE FIBER CONSUMPTION IN TURKEY (Tons)

Years	Wool	Cotton	Silk	Artifical	Synthetic	Total
1951	8.832	32.940	37	514		
1952	10.772	37.530	85	500		
1953	11.872	52.997	148	588		
1954	12.412	59.195	135	823		
1955	13.628	67.685	105	799		82.218
1956	13.793	63.502	157	1.584	383	89.399
1957	13.959	81.584	211	2.426	832	99.012
1958	15.668	94.320	104	3.206	1.330	114.628
1959	12.237	90.027	104	3.068	1.983	107.419
1960	12.306	92.895	125	2,104	951	108.381
1961	18.532	93.511	115	5.471	1.034	118.663
1962	19.937	94.100	105	6.090	3.857	124.089
1963	20.087	96.768	95	9.195	3.009	130.154
1964	20.405	100.077	85	8.418	6.207	135.192
1965	21.000	105.000	75	10.036	8.239	144.350

Source: Industrial Development Bank

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Appendix-II

THE DISTRIBUTION OF SYNTHETIC FIBERS AMONG THEMSELVES

(World figures)
(%)

Years	Polyamide	Polyester	Acryclics	Other
1950	80.3	0	4.7	15.0
1951	81.1	0	4.0	13.1
1952	79.2	1.0	5.1	14.7
1953	75.7	2.7	5.1	16.5
1954	72.9	3.7	6.7	16.7
1955	69.1	6.1	10.5	14.3
1956	68.4	7.6	12.0	12.0
1957	62.8	10.7	13.4	13.1
1958	62.6	10.9	14.8	11.7
1959	60.3	15.1	15.5	9.1
1960	59.9	17.5	15.5	9.2
1961	57.7	18.1	14.6	9.6
1962	56.6	18.7	15.5	9.2
1963	55.8	19.7	15.8	8.7
1964	53.3	20.0	17.8	8.9
1965	49.0	22.2	19.8	8.2
1966	48.7	23.8	18.5	9.0
1967	45.3	26.5	18.4	9.8
1968	43.0	27.9	19.0	10.1

Source: Industrial Development Bank.

Appendix-III

A-Synthetic Fiber Imports

	1961		1962	
	Quantity kg.	Value TL	Quantity kg.	Value TL
56.01.10[x]	225.929	1.905.372	299.458	4.387.150
56.02.10	981	16.014	14.221	298.883
56.03.00	688	10.650	2.618	43.358
56.04.10	1.599	55.439	49.126	1.171.378
	229.177	1.987.475	365.413	5.900.769

	1963		1964	
	Quantity kg.	Value TL	Quantity kg.	Value TL
56.01.10	509.793	7.630.612	678.083	10.330.378
56.02.10	89	1.049	14.205	148.761
56.03.00	-	-	15	381
56.04.10	387.125	9.047.320	721.683	12.274.890
	897.007	16.678.981	1.413.986	22.754.410

	1965		1966	
	Quantity kg.	Value TL	Quantity kg.	Value TL.
56.01.10	1.106.970	14.902.113	2.464.228	22.102,349
56.02.10	1.370	24.517	-	-
56.03.00	-	-	-	-
56.04.10	1.570.357	19.447.094	2.516.067	25.408.242
	2,678.697	34.373.724	4.980.295	47.510.591

x These figures on the left column indicate the identification of customs law.

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B-Synthetic Yarn Imports

	1961		1962	
	Quality kg.	Value TL.	Quality kg.	Value TL.
51.01.22	640.376	27.269.911	1.787.203	48.602.330
51.01.32	159.139	6.277.143	481.348	16.475.251
51.01.42	6.716	290.092	20.379	573.802
51.01.52	-	-	3.247	189.797
51.03.25	203	8.452	8	451
	806.434	33.845.598	2.292.185	65.841.631

	1963		1964	
	Quality kg.	Value TL.	Quality kg.	Value TL.
51.01.22	1.303.170	43.738.591	1.846.397	29.156.389
51.01.32	1.068.818	22.078.542	1.299.017	34.194.475
51.01.42	30.563	1.377.821	48.924	1.050.155
51.01.52	3.378	170.191	3.420	131.516
51.03.25	3.717	109.130	1	49
	2.409.646	67.474.275	3.197.759	64.532.584

	1965		1966	
	Quality kg.	Value TL.	Quality kg.	Value TL.
51.01.22	1.273.306	25.080.933	1.080.526	15.319.175
51.01.32	1.121.741	24.239.810	1.343.898	19.153.475
51.01.42	74.559	1.913.646	182.729	2.551.137
51.01.52	9.397	168.363	11.152	153.811
51.03.25	-	-	494	19.257
	2,479.003	51.402.752	2.618.804	37.196.855

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CHAPTER III

MARKET ANALYSIS FOR THE ESTABLISHMENT OF A POLYESTER INDUSTRY IN TURKEY

A) Selection of the forecasting method.

B) A general survey of the utilization of polyester fibers in Turkey.

C) Comparison of per capita incomes, synthetic and polyester fiber consumption patterns with countries similar to Turkey.

D) Determination of the Potential markets for staple polyester fibers and D.M.T. in Turkey.

E) Conclusion

The future is always uncertain. Unforeseen future events can overturn carefully prepared forecasts. Therefore, if management had a choice between forecasting and not forecasting it would do well to choose the latter alternative and avoid the necessity of "crystal-ball gazing". Unfortunately, management has no choice but to forecast constantly, for any decision that requires an appraisal of the future involves a forecast. Indeed,

.... the choice for businessmen is not to either "forecast" or "not forecast". The lack of a forecast in most cases actually implies a dangerous type of forecast-that conditions will not change much. The choice is whether the affairs of the business will be based upon hunches and intuition or whether decision making will be given an assist by systems for the regularized marshalling of as many pertinent facts as possible and by the systematic application of as much good judgement about those facts as can be brought to bear upon them.[1]

There is much evidence that modern management has come to depend more and more upon formal forecasting systems, rather than upon hunches, intuition or "feel" about future prospects. The increasing complexity of modern business, the lessening of direct contact between the producer and the consumer, and the use of modern mass production techniques which involve close scheduling of raw materials, component parts, and other factors, are but a few of the causes which have led management to utilize formal forecasting procedures to an increasing extent in recent years of business life.

1 Edmund R. King, "Analysis and Forecasts of Company Sales" The American Statistican, June-July 1952, Pg. 5

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After this brief survey of the importance of forecasting in business, a method of merket research will be selected and will be carried out to attain results for the future.

A - Selection of the (Forecasting method)

For the time being the evaluation of the K.E.K. project pertains to the period ranging from 1968 to 1975. This research aims at estimating the potential demand for polyester fibers and the market for D.M.T. in the mentioned period. Three different forecasting methods have been reviewed and critically analyzed in this phase.

1) Trend extrapolation based on past figures

A trend curve projection relates only to the smooth, long term component of a time series.[2] According to this method the first step is to determine the dimension of consumption in the previous years and sales accordingly in order to reach a sales figure for the company in the desired future. To pinpoint future sales, one must forecast not only the trend component of the sekies but also the position of the fluctuating component around this trend.

It generally is impossible to project accurately the fluctuating component of a business or economic time series very far into the future. The choices of a relevant time period which the extrapolation will hold true and the appkopriate type of trend curve (growth curve, Arithmetic straight-line trends etc...) are greately affected by the assumptions which are made-explicitly on implicitly-regarding the future course of events. One must not forget that these assumptions underlying a forecast are in themselves a forecast of conditions which are believed

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most likely to prevail during a given future period.

So the essence of tkend extrapolation technique is based upon previous data. These together with such givens as National income of the country, population growth are taken into consideration with respect to the existing correlation and a trend line is drawn.

But the utilization of synthetic fibers in Turkey are almost quite new and consumption patterns not even exist except for the very last 3-4 years. Therefore in our research this method has been abondoned, only the data of previous periods were used.

2) Correlation analysis between consumption of synthetic fiber per person and Per Capita Income in Turkey in order to reach a forecast figure:

It is an accepted fact in the Textile world that exist a certain degree of correlation between per capita income and per person textile fiber consumption. But this existing correlation coefficient was different in different countries. Hence a direct correlation coefficient could not be obtained for Turkey, but the analysis of this correlation in countries similar to Turkey gave some guide-lines in the choice of the forecasting method.

3. Analysis of the share of synthetic fibers in Total fiber consumption pattern of Turkey. Determination of the market potentials from such an analysis:

The process outlined above is a break-down analysis going from the very general to the specific. Each step's results are evaluated before beginning the second one. The process is cakried out in four steps.

a) Tracing the place of synthetic fibers in "Total world fiber consumption", and the development of this share and adopt a suitable growth rate for Turkey based on such a judgement.

b) Determination of "Total Fiber consumption in Turkey" and its developmental trends.

c) Projection of the results obtained in a) to b) to obtain the "Projection of synthetic fibek consumption in Turkey"

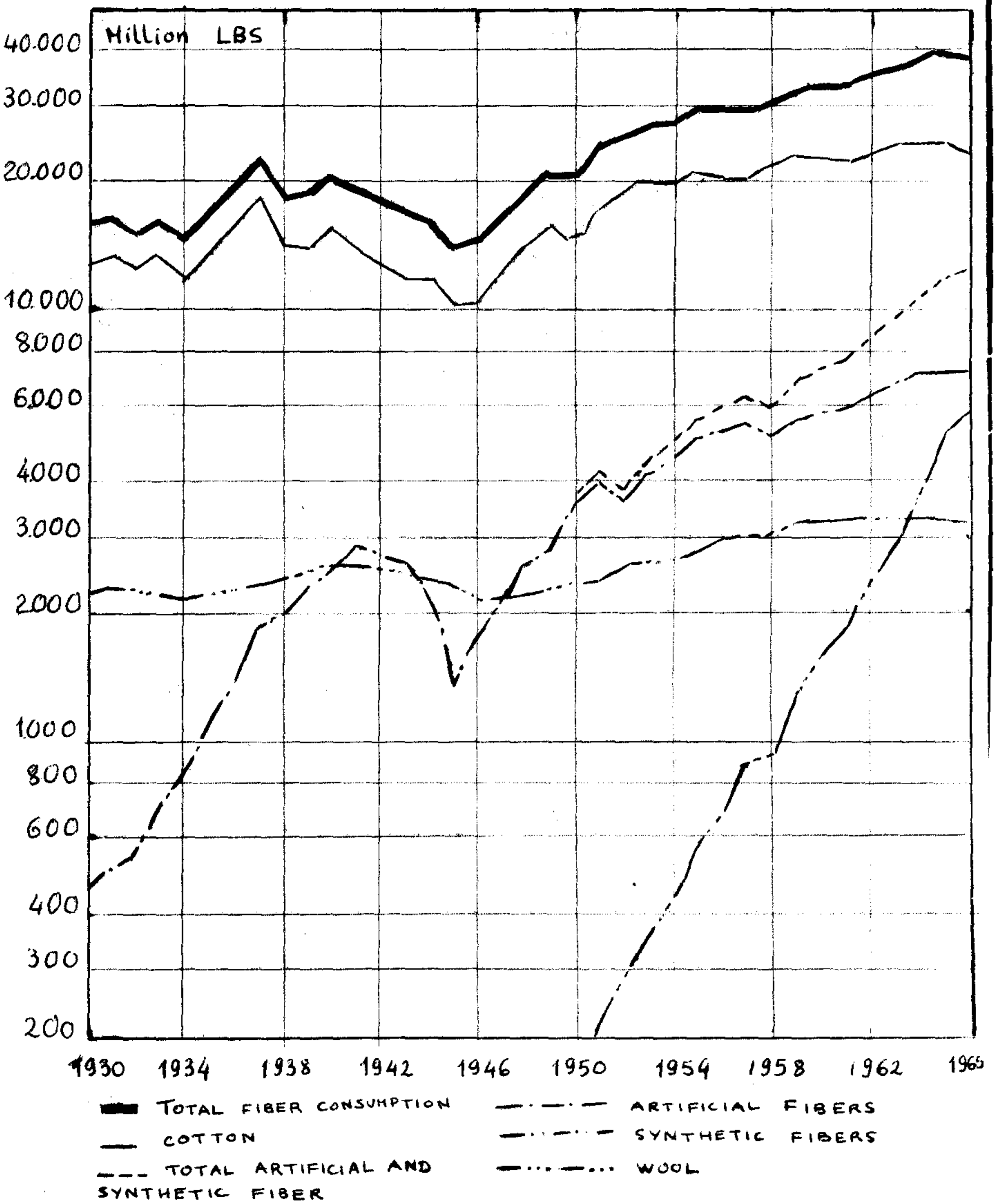
d) Determination of the share of polyesters in synthetic fiber consumption to reach a projection pattern of polyesters in Turkey.

This four stepped process briefly described, in our system, goes hand in hand with the accepted correlation in the tex tile world between per capita income and per person fiber consumption. Having these two tools in hand it was possible to construct a forecasting model for the polyester industky in Turkey.

The per capita income figures given as the world average between 1960-1966 periods is accepted to be reached almost similarly between 1967-1972 in Turkey. The break down of total textile consumption date and the place of synthetics and the share of polyester fibers in synthetics information is completely available in hand with every minute detail. Consumption pattern in Turkey up today followed paralel lines to world consumption patterns in a wide range ./..

WORLD FIBER CONSUMPTION

(Table - A)



of product-line. This may seem to be a very broad generalization, but nevertheless it is a true one. So having the detailed fiber consumption world-trends between 1960-1966 I have tried to make a projection to that trend to Turkey in the periods 1968-1975 where the per capita incomes are accepted to follow similar lines of development. The method is an easy and straight forward one which bases its strong points to two correlation assumptions. My defence points to criticism can only be that consumption patterns of other fibers like cotton, wool, silk, nylon etc... have followed similar lines of that the world.

The application of this outlined method was possible and sound results have been obtained. This method, then, constitutes the basis of our marketing research.

B - A general survey of the utilization of Polyester Fibers in Turkey

The utilization of synthetic fibers in textile industry is quite recent in the world. As can be seen from graph-A from 1950 on synthetic fibers have become a major raw material of textiles. Their development was extremely rapid. Today, the demand for synthetic fibers is exceeding the demand for woolen fiber, while having almost an equal value with that of cellulosic fibers.

The most rapidly developing fiber amongst the synthetics has been polyester. Polyester, is the most appropriate fiber for textile industry, it can be used in both woolen and cotton industries as a contrast to other synthetic fabrics whose mixed usage is limited, giving them durability and appearance to a large extent. ./..

The utilization of synthetics, especially that of polyester is very recent in Turkey. Initially they were imported from England by "Bozkurt Mensucat Sanayii" towards the end of 1964. Out of these files 30.000 metres of rain-proof cloth (% 67 terylene, % 23 cotton) have been produced. The finishing process ofthe cloth was not carried out in Bozkurt due to the lack of necessary machinery but rather in a curtain factory. In 1965 production in Bozkurt was raised from 30.000 metres to 350.000 metres. Recently this quantity has increased especially in 1967. This developmental trend in Bozkurt has widely effected other textile firms on the same line. After the trial period of 1964-1967, polyester fibers have gained considerable importance in the market. At the initial stages polyester fibers were only used in the manufacture of rain-coat cloths. Later in the production women and men's wear and marvellous results have been obtained. Today in textile industry, besides their complete lines in woolen fabrics and finishing units, firms like Bozkurt, Bossa, Güney Sanayii, Mensucat Santral, Akfil Tekstil possess machines for producing synthetic cloths from the files. Besides their available machines loads those firms have the necessary "know-how" in the field. But since almost all of those units have been completed in 1966-1967 their real influence on polyester demand can only be detected after 1968.

For the recent two years polyester fibers have entered the market as a tow material in the woolen industry. Especially coloured woolen polyester tow is a very desired raw material in the woolen industry. Polyester fibers possess some advantageous points in the woolen industry. Wool is very dear fiber. Polyester fibers can be mixed with woolen fiber in the ratio 55/45. Polyester being a cheaper product than wool

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at the first instance results in cost reduction, while on the other hand gives better stability characteristics to the product.

Such a mixing process results in drastic price reductions in cloths. By such decrease in price a larger number of people can wear woolen fabrics, while on the other hand Merinos woolen tow which is an important export item of our industry can be restored to a larger extent.

In 1967 Turkish Textile Industry used nearly 4.000 tons of staple polyester fibers. If it weren't for the restricted quota system this production would have been utilized in a muc broader scope. The general idea in the market is that this figure would have been around 5.000-5.500 tons, if the fibers were imported freely. Polyester prices in the market reflect this very fact. While the world price level was around $ 1.20/kg. in the world, due to various custom laws and abnormal profit mark-ups of the importers, those fibers were sold for 25-29 TL./kg in Turkey in 1967.

Another virgin field that will accelerate the polyester consumption in the country is the tricotage industry. Up today Turkish tricotage industry has utilized solely acrylics as the only synthetic fiber. The world trend is an evident shift from acryclics to polyesters in this field due to their multifold advantages. Fortunately our domestic industry is pacing rather rapidly with world standards, completing its necessary equipment and "know-how" in this field.

Apart from the outlined facts, the following criteria are quite indicative that polyesters will have rapid development in the country.

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a) The income elasticity of demand for clothing is very high in Turkey. This is a queer characteristics of our economy, but a conventional one in all kinds of developing industries. The incremental increases in individuals income is chiefly spent on clothing items.

b) Urbanijation trends is very rapid in Turkey. This criterion strongly stimulates the demand for "white shirts" and "Woolen clothes."

c) Amongst its prospective competitor fibers polyesters possess multified advantages in terms of durability, lightness, appearance etc... thus becoming the fiber that will satisfy the unbeliavably increasing demand in men's and women's wear.

d) Grand promotion campaigh conducted on such brand names like "Terrylene", Trevira" and "Dacron" which are not different from polyesters, apart from its economic nature and practical use have created "mode-image" before the eyes of the consumers.

C - Comparison of per capita incomes, Synthetic and Polyester fiber consumption patterns with countries similar to Turkey.

1) According to 1964 statistics the per capita incomes and respective synthetic fiber consumption of some countries are indicated in the following table.

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	Per Capita Income ($)	Synthetic fiber consumption per person (gram)
Brazil	220	168
Peru	270	200
Colombia	270	100
Portugal	340	670
Mexico	430	214
Greece	510	310
Spain	530	660
Uruguay	540	703
Argentine	650	520
Turkey (1967)	318	367
Turkey (1972)[x]	396	(?)
Turkey (1975)[x]	432	(?)

2) According to 1966 statistics , the synthetic fiber and yarn consumption figures of some countries are tabulated below with their rekpective populations.

	Population (million)	Consumption 1965	Cons.1966	C.1967
Portugal	9.2	23.5	24.5	
Spain	32	69.5	102.8	
Italy	51.6	144.5	222.1	
Greece	8.6	7.4	8.3	
Mexico	41	27.7	33.0	
Argentine	23	30.7	33.5	
Brazil	85	32.7	34.8	
Israel	2.6	8.9	9.9	
Turkey	32	13.5	17.5	26.6

Source: "World Man Made Fiber Survey", Textile organon, Textile Economic Bureau Inc., Volume XXXVIII. No: 1, July 1967

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3) The population, per capita income, polyester consumption figures of more developed countries, including Turkey in the picture is given in the following table.

Countries	Population (Millions) 1966	Per Capita Income ($) 1965	Polyester consump. (000 ton) 1964	1965	1967 X	1970 X	Per person polyester consumption (kg./year) 1964	1965	1967 X	1970 X
U. S. A.	198	2.860	112	162	300	500	0.58	0.83	1.5	2.5
West Germany	60	1.502	42	60	90	150	0.70	1.0	1.5	2.5
Argentine	23	726	2.7	3.4	5.[illegible]	9	0.12	0.15	0.22	0.39
Brazil	85	254	3.15	3.0	6.5	10	0.04	0.04	0.08	0.12
Mexico	41	412	1.35	1.8	3.5	6	0.03	0.04	0.08	0.14
Venezuella	9	699	-	0.7	1	3	-	0.08	0.11	0.33
Spain	32	493	5	8.0	17	30	0.17	0.26	0.53	0.90
Turkey	32	242	-	2.48	3.5	?	-	0.08	0.11	?

Source: Hercules N.V. The Hague Holland Textiles Bulletin

X Forecasts

4) Conclusion: A critical analysis of the above tables shows the fact that there is not much possibility to reach to future demand conclusions for polyester fibers simply by analyzing the trends in various countries. But still the following general conclusions can be reached.

a. Polyester consumption trends in the analyzed countries is rapidly increasing.
b. Especially this trend is showing accelerated behavior in the years 1964-1970.
c. The indicated developments are more pronounced in countries having developed textile industry than the others.

D - Determination of the potential markets for Staple Polyester Fibers and D.M.T. in Turkey.

The share of synthetics in the Total fiber consumption pattern of the world (cotton, wool, silk, artifical and synthetic fibers) was % 5.93 in 1960 and % 12;45 in 1965. The latter corresponding figure is 5.96 % in Turkey. So Turkey's condition in 1966 is similar to that of the world in 1960 as was pointed out before Forecast method selection. It is a fact that there is a correlation between per capita income and synthetic fiber consumption. Thus one can trace the period where the total consumption of synthetic fibers w will hit the 12,45 % mark by following such a process.

The average per capita income of the world in 1965 was 420 $. Per capita income is expected to reach a level of $ 396-400 only in 1972 in Turkey according to the planned economic period. Considering the rapid developments of synthetics we can readily state that the ratio of synthetics will reach the % 12.45 in 1972. ./..

According to such series, the share of synthetic fiber consumption in the total can be predicted as in the following table.[5]

Years	Ratio of Synthetics to the Total
1965	5.96
1966	6.37
1967	7.12
1968	7.93
1969	8.88
1970	9.92
1971	11.08
1972	12.45
1973	14.53
1974	16.56
1974	18.65

Those above ratios include the rubber cord, that is utilized in the tire industry. The synthetic fibers used in Turkey in the year 1967 are given by the following table.

	Ton	Ton
1 - Imports for the first 10 months:		
Synthetic continious filaments	3.592	
Synthetic staple fiber	3.228	
Synthetic staple tow	2.769	9.589
2 - Import coefficient for the last two months[6].		x 1.2
		10.740
3 - Annual import of synthetic		1.340
4 - Şifaş Production (Source:Ind. Dev. Bank)		2.520
5 - Cord (Source (Source:Ind. Dev. Bank statistics on tire industry)		
Total Consumption for 1967		14.600

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In 1966 the Total fiber consumption in Turkey was around 164.9 tons. 1967 was a rather stagnant year in textile world. So if we assume that consumption figures will increase at the same rate with population-3%- we reach a figure of 169.9 tons. Following such an approach yields a 8.53 % share for synthetics amongst the total fibers. So it is clearly seen that the utilization of synthetics is showing a more rapid development than the world average. One must also bear in mind that the available statistics do not reflect the real demand for consumptions since there exist severe import limitations on them. Therefore if we assume that the end figure we have obtained for 1975 namely 18.65 % as in the previous series and this newly determined figure 8.53% for 1967 being true we obtain a new serie as shown below.

Years	Share of Synthetics in Total Fiber consumption (%)
1967	8.53
1968	9.75
1969	11.06
1970	12.32
1971	13.59
1972	14.85
1973	16.12
1974	17.38
1975	18.65

This new series have the following advantages:

a) It reflects a more dynamic point of view in the analysis of textile industry and its developmental direction.

5 Source : Turkish Industrial Development Bank. A report prepared by Mr. Namık Ayarcı to be submitted to Project Evaluation Bureau of the Bank, March 1967 ./..

b) Gives a clearer picture of the economy by freeing it from the pressed demand considerations for synthetic fibers. This is a very realistic approach when we consider the possibility ofbecoming a member of the European Common Market. These series indicate the price elasticy of the synthetics more profoundly since a decrease in their prices is anticipated.

2 - Total Fiber Consumption Projections in Turkey

Total fiber consumption (cotton, wool, silk, cellulose, synthetic) in Turkey between the years 1961-1966 have been determined by the Industrial Development Bank as shown in the following table. The 1967 figure was calculated by assuming a 3 % growthe rate as previously explained.

Years	Total Consumption (000 Ton)
1961	118.7
1962	124.1
1963	130.2
1964	135.2
1965	144.4
1966	164.9
1967	169.9

Source: A report prepared by Mr. Namık Ayarcı to be submitted to the Project evaluation department of Turkish Industrial Development Bank, March 1967

The above figure for consumption shows a parabolic increase, thus while making the projections for 1968-1975 period the general formula for parabolic increase, that is, $y=a+bx+cx^2$ has been employed Projections are

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calculated in two different series.

a) Assuming that better results pertaining to the incremental increases between years can be obtained, the first series starts from 1961,- the year that economic stagnation began to fade away to 1967.

b) The second series is prepared for the planned period of 1963-1967 which is expected to show similar developmental trends as that of 1968-1975.

Following such a procedure graph - B is obtained.

Total Fiber demand in Turkey For the years 1968 - 1975 ('000 Tons)

Years	According to 1961-1967	According to 1963-67
1968	186.3	187.4
1969	195.2	204.0
1970	210.3	222.2
1971	226.6	242.2
1972	244.1	263.7
1973	262.9	286.9
1974	282.8	311.6
1975	303.9	338.1

The second series for the period 1963-1967 shows tremendous increase for Total fiber demand. It assumes that there will be an almost % 100 increase in demand in 9 years (1967-1975). Thus following the more conservative approach, my calculations are based on the figures obtained from the first series.

6 A Coefficient obtained by past years experience; (This belongs to page 53 of the thesis)

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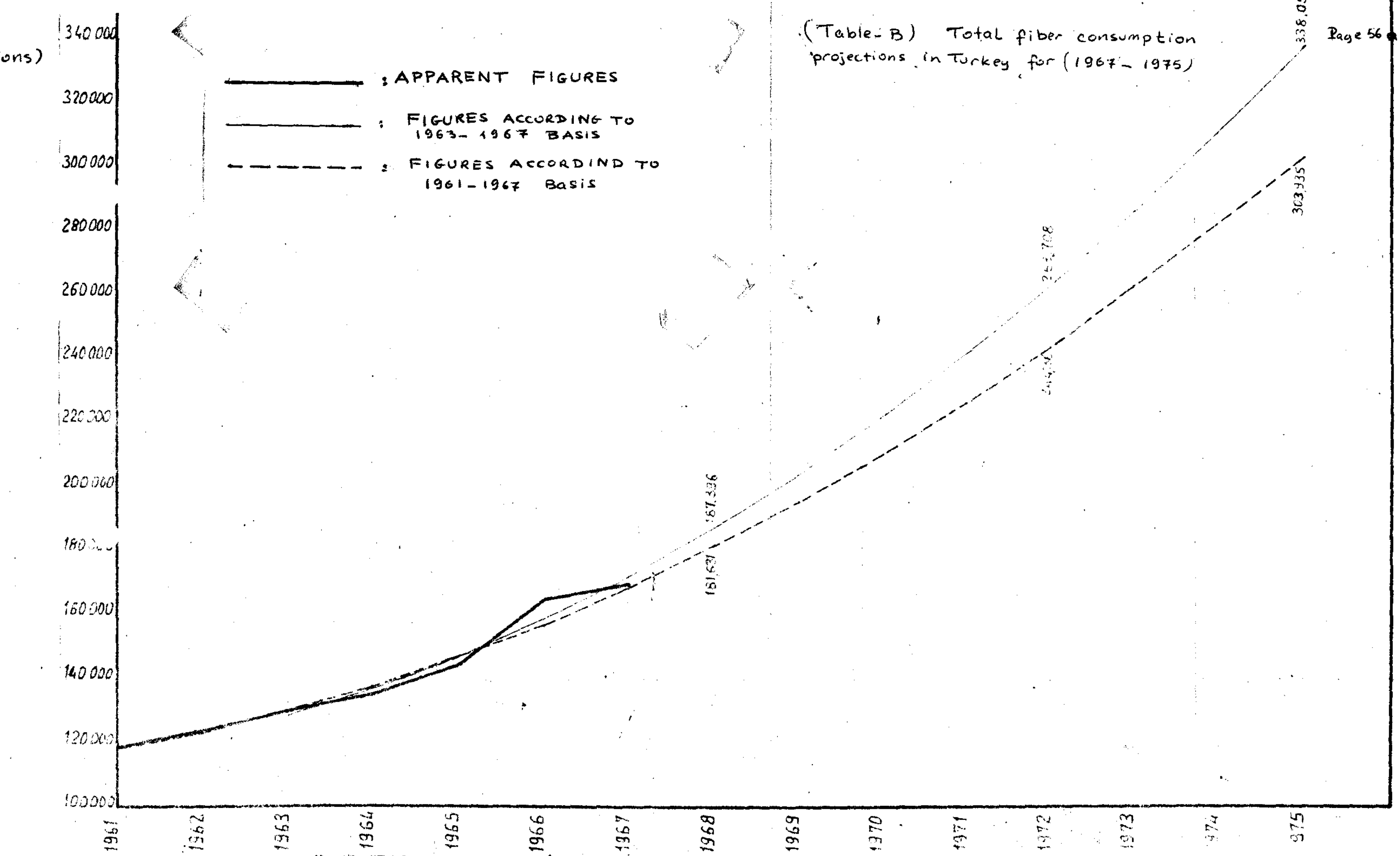
(Table-B) Total fiber consumption projections in Turkey for (1967-1975)



3 - Turkish Textile Industry's Synthetic Fiber Demand Projections

Applying the synthetic fiber ratios previously determined in Turkey to the Total fiber demand projections obtained in the latter table, and deducting the figures for tire cord demand (since tire cord is not a textile product and since replacement demand ofpolyester fiber will be analyzed in detail later), one can obtain Turkish Textile Industry"s demand for Synthetic fibers as shown in the following table.

Year	Total Fiber consumption ('000 Ton)	Ratio of Synthetic %) Fibers	Demand for Synthetic Fibers %	Tire Cord Demand[x] (Tons)	Textile Industry's Demand (T)
1968	186.3	9.75	18.164	2.676	15.488
1969	195.2	11.06	21.589	2.842	18.747
1970	210.3	12.32	25.909	3.018	22.891
1971	226.6	13.59	30.795	3.205	27.590
1972	244.1	14.85	36.249	3.404	32.845
1973	262.9	16.12	42.379	3.615	38.764
1974	282.8	17.38	49.151	3.839	45.312
1975	303.9	18.65	56.708	4.077	52.631

[x]: Considering the various investments in the industry, it is assumed by Industrial Development Bank that demand for tire cord will by applying this yearly percentage to the available figure of 2520 tons for 1967.

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4 - Demand Projections for Polyester Filaments and Staple Fibers in Turkey

a) Utilization of Synthetics fibers in the world

Synthetics fibers can be categorized in four groups.

1) Polyamides
2) Acrylics
3) Polyesters
4) Others (primarily fiber glass)

As can be seen from graph-c the relative significance of each type has shown serious fluctuations with respect to total synthetic fiber usage. Polyamides being the first developed synthetic fiber have shown serious increases in the total, remained still important for a time, but have shown some significant drops recently. Acrylics are generally used in woolen and tricotage textile industries and are pacing ahead relatively slowly. Recently, polyesters seem to be the most desirable fibers in the market due to their easy mixability with cotton, wool and tricotage fibers. The patent right which belonged to I.C.I. till 1965, is now open to competition. Thus the production of polyester fibers are spreading all-over the world coupled with continuous cuts in prices.

The consumption figures for other synthetics is rather limited. It is expected that the share of polyamides which was 57.9% in 1960 will fall to 43.0 % in 1968. This approach also predicts the levels of polyamides as being 29.5 % in 1975.

Acrylics, being 15.6% in 1960 is expected to climb to 19.0 % in 1968 and to 25 % in 1975.

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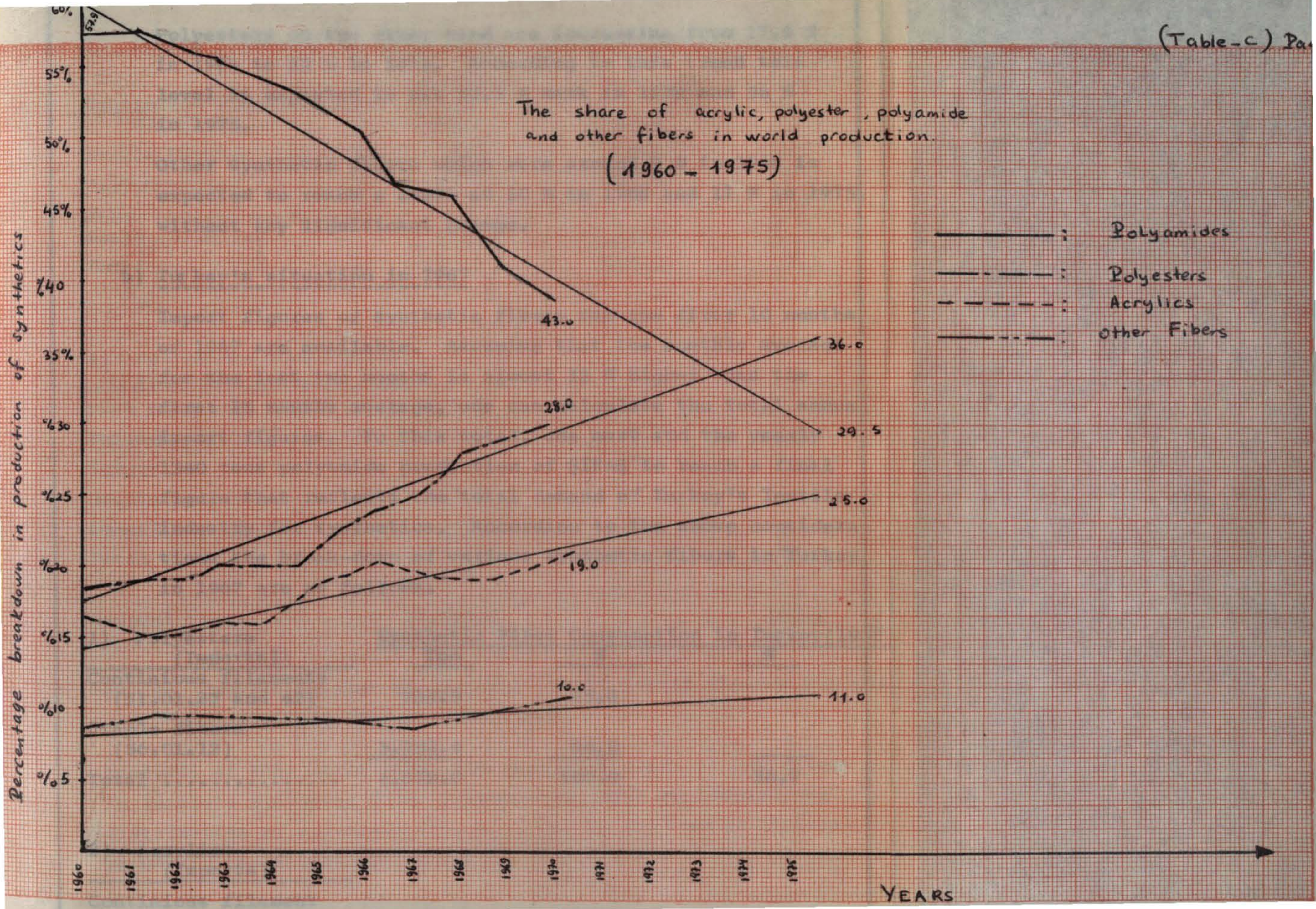
(Table-c) Pa



The share of acrylic, polyester, polyamide and other fibers in world production.
(1960 - 1975)
Polyamides
Polyesters
Acrylics
other Fibers
Percentage breakdown in production of synthetics
60%
55%
50%
45%
%40
35%
%30
%25
%20
%15
%10
%5
57.9
43.0
28.0
19.0
10.0
36.0
29.5
25.0
11.0
1960
1961
1962
1963
1964
1965
1966
1967
1968
1969
1970
1971
1972
1973
1974
1975
YEARS

Polyesters on the other hand are increasing from 17.5 % in 1968 to 28 % in 1975. According to this trend this level is expected to hit 32.5 % mark in 1972 and 36 % in 1975.

Other synthetic fibers which were around 9 % in 1960 is expected to reach a level at 10 % in 1968 and 11 % in 1975, without any significant change.

b) Turkey's situation in 1967

Import figures of synthetic fibers for the first 10 months of 1967 are available. Assuming that the monthly average for the last two months is almost 12 % higher than the first 10 months average, one can calculate the total annual import figures. To this total, one must add the yearly 1340 tons polyamide production of ŞİFAŞ to reach a final figure that reflects the total demand of Turkey's Textile industry for synthetics. According to the above considerations the break-down of various synthetic fibers in Turkey in 1967 are as follows.

Synthetic Fiber Consumption in Turkey(1967)

1) Polyesters (Imports)	Ton	%	%
Continious filaments (51.01.22 and 42)	739.5	15.8	
Staple fibers (56.01.12)	3.932.4	84.2	
Total	4.672.0	100.0	38.7
2) Acrylics (Imports)			
Continious filament (51.01.24 and 44)	10.6	0.5	
Staple fibers (56.01.14 and 300% of 19)	1.925.2	99.5	
Total	1.935.7	100.0	16.0

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3) Others (Imports)	Synthetic Fiber Consumption in Turkey Ton	%	%(1967)
Continious Vinylic (51.01.23 and 43	78.7	57.3	
Staple Vinylic (56.01.13)	9.0	6.5	
Polypropylene (56.04.11)	28.2	20.5	
Other continious filaments (51.01.29)	21.4	15.7	
Total	137.3	100.0	1.1
4) Polyamides (Continious filaments-Imports)			
Fish nets cord (51.01.01)	168.0	3.1	
Polyamide (51.01.21 and 41)	2.599.6	48.7	
Others (51.01.29)	406.7	7.6	
Staple polyamides(55.01.11)	822.0	15.4	
Domestic production(ŞİFAŞ)	1.340.0	25.2	
Total	5.336.3	100.0	44.2
General Total	12.081.3		100.0

Source: Turkish Chamber of commerce yearly static figures for the year ending 31. December 1967.

Analysis of this table shows the important share of polyesters in Turkey's synthetic fiber consumption, when we compare the distribution of synthetic fibers in Turkey with world figures we obtain the following Table.

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	Turkey (%)	World (%)			
	(1967)	(1967)	(1968)	(1972)	(1975)
Polyester	38.7	26.6	28.0	32.1	36.0
Polyamide	44.2	45.3	43.0	36.0	29.5
Acrylic	16.0	18.5	19.0	22.3	25.0
Other	1.1	9.7	10.0	10.4	11.0
Total	100.0	100.0	100.0	101.0	101.5

The world figures for 1968, 1972 and 1975 are the results of graph-C. This Table yields the following conclusions.

1) Ratios for polyamides and acryclics are not too far from world averages. Considering the easy mixability and machinability of acryclic fibers a faster growth in their field can be expected.

2) Fibers under the category of "others" are almost not utilized at all in Turkey. Anyway the major portion of this category belongs to "fiber glass" production when we analyze the world. So one should not expect an important development in this field for the short-run.

3) In Turkey polyesters have reached a level in 1967 that is the world the world's expected to reach in 1975. While acrylic prices are constantly dropping in the market, large polyamides inventories are accumulated. On the other hand demand for polyester are still increasing, in spite of its very high price of 27 TL./kg. due to continious increased mark-ups of the importers on the sales price. So one can conclude that, if the importation of polyesters were set free, this ratio would be much higher than the one reflected in the above Table.

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C - The Share of Polyesters in the Total Market Demand for Synthetic fibers in the period 1968-1970

Basing one's judgement on the previous factors discussed and results obtained, there emerges two possibilities to determine the share of polyesters in Total synthetic fiber demand:

1) Polyester prices will fall, thus consumption will increase,
   - Since the development of "others" category seems rather misty for Turkey, one can assume that the distribution will still be between polyamides, polyesters and acrylics and,
   - foreseeing that the share of polyamides will follow the falling trend of world figures, the ratio of polyesters will bit the 40 % level in 1968-1975 period.

2) Considering the 38.7 % level of polyesters today under the consideration of;
   - Acrylics will show a vast development
   - There won't be any drop in polyamides
   - Others category may show some kind of development

   one can assume that this level will gradually drop to 38 % in 1968, 37 % in 1970 and finally to 36 % in 1973 to reach on equlibrium with the world level.

While doing the projection analysis the first approach is considered to be an "optimistic" one while the second one constituting a "conservative" alternative.

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d - The Share of Staple Polyester fibers in the Total demand for polyesters in the period 1968-1975

According to Namık Ayarcı of Industrial Develöpment Bank - Chief executive of "Textile Projects Evaluation Bureau one can roughly state demand for polyester continious filaments is around 25 % and polyester staple fibers 75 % presently. It is assumed that these ratios will shift to 15 % polyester filament and 85 % staple fibers in 1975. Essentially this is a sound statement, since staple consumption ratios are continiously increasing all-over the world. This ratio is 84.2 % in Turkey in the year 1967 as shown by the "Synthetic Fiber Consumption in Turkey 1967" Table. So I have assumed this fixed rate of 85 % staple fiber demand in my coming analysis, since there wasn't any indication that this ratio will increase.

e - 1968 - 1975 Staple Polyester Fiber Demand in Turkey

The "optimistic" and "conservative" demand forecasts as was reached according to sections c and d are tabulated below.

Optimistic Approach

Year	Synthetic Fiber Dem. (Ton)	Poly. (%)	Poly. Dema. (Ton)	Staple Poly. fi. (%)	Staple P.fi. (Ton)
1968	15.488	40	6.195	85	5.266
1969	18.147	40	7.499	85	6.374
1970	22.891	40	9.156	85	7.783
1971	27.590	40	11.036	85	9.381
1972	32.845	40	13.138	85	11.167
1973	38.764	40	15.506	85	13.180
1974	45.312	40	18.125	85	15.406
1975	52.631	40	21.052	85	17.894

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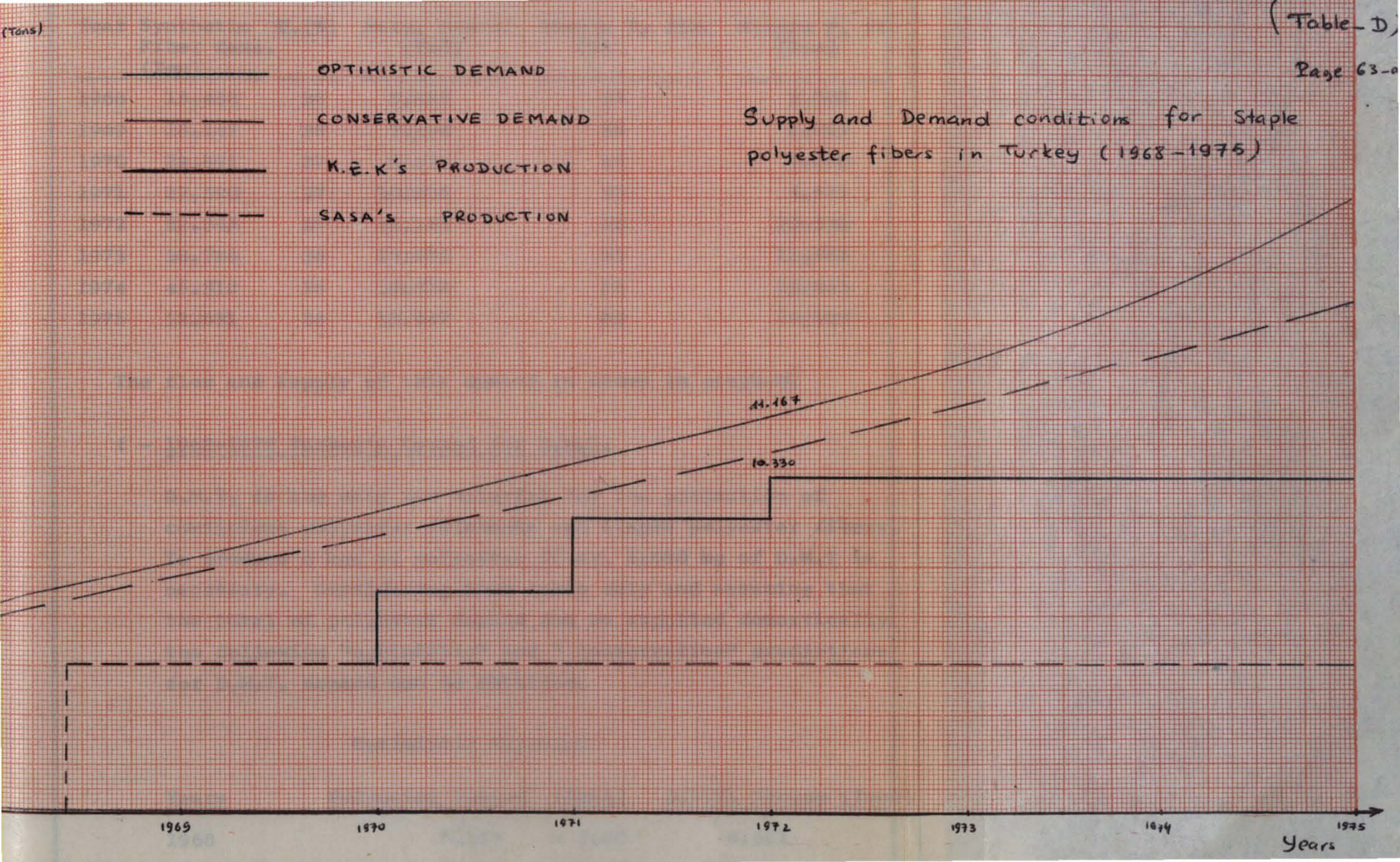
(Table-D)
Page 63-a
(Tons)
OPTIMISTIC DEMAND
CONSERVATIVE DEMAND
K.E.K's PRODUCTION
SASA's PRODUCTION
Supply and Demand conditions for Staple polyester fibers in Turkey (1968-1975)
11.167
10.330
1969
1970
1971
1972
1973
1974
1975
Years

Conservative Approach

Year	Synthetic Fiber dema. (Ton)	P.(%)	Poly. Deman. (Ton)	Staple P. fib. (%)	Staple P. fi. (Ton)
1968	15.488	38	5.885	85	5.002
1969	18.147	38	7.124	85	6.055
1970	22.891	37	8.470	85	7.200
1971	27.590	37	10.208	85	8.677
1972	32.845	37	12.158	85	10.330
1973	38.764	36	13.955	85	11.862
1974	45.312	36	16.312	85	13.865
1975	52.631	36	18.947	85	16.105

The flow and supply of this demand is shown in graph-D.

f - 1968-1975 Turkey's Demand for D.M.T.

D.M.T. is the main raw material for the production of continious polyester filaments and staple polyester fibers. To produce 1 kg. of polyester fiber, 1.080 kg of D.M.T is necessary. Considering this ratio only and assuming that the total of polyester demand can be supplied domestically the following "optimistic" and " conservative" predictions for D.M.T. demand can be obtained.

Optimistic Approach

Years	Polyester Demand (Tons)		D.M.T. Demand (Tons)
1968	6.195	x 1.08	6.691
1969	7.499	x 1.08	8.099
1970	9.156	x 1.08	9.888
1971	11.036	x 1.08	11.919
1972	13.138	x.1.08	14.189
1973	15.506	x 1.08	16.796

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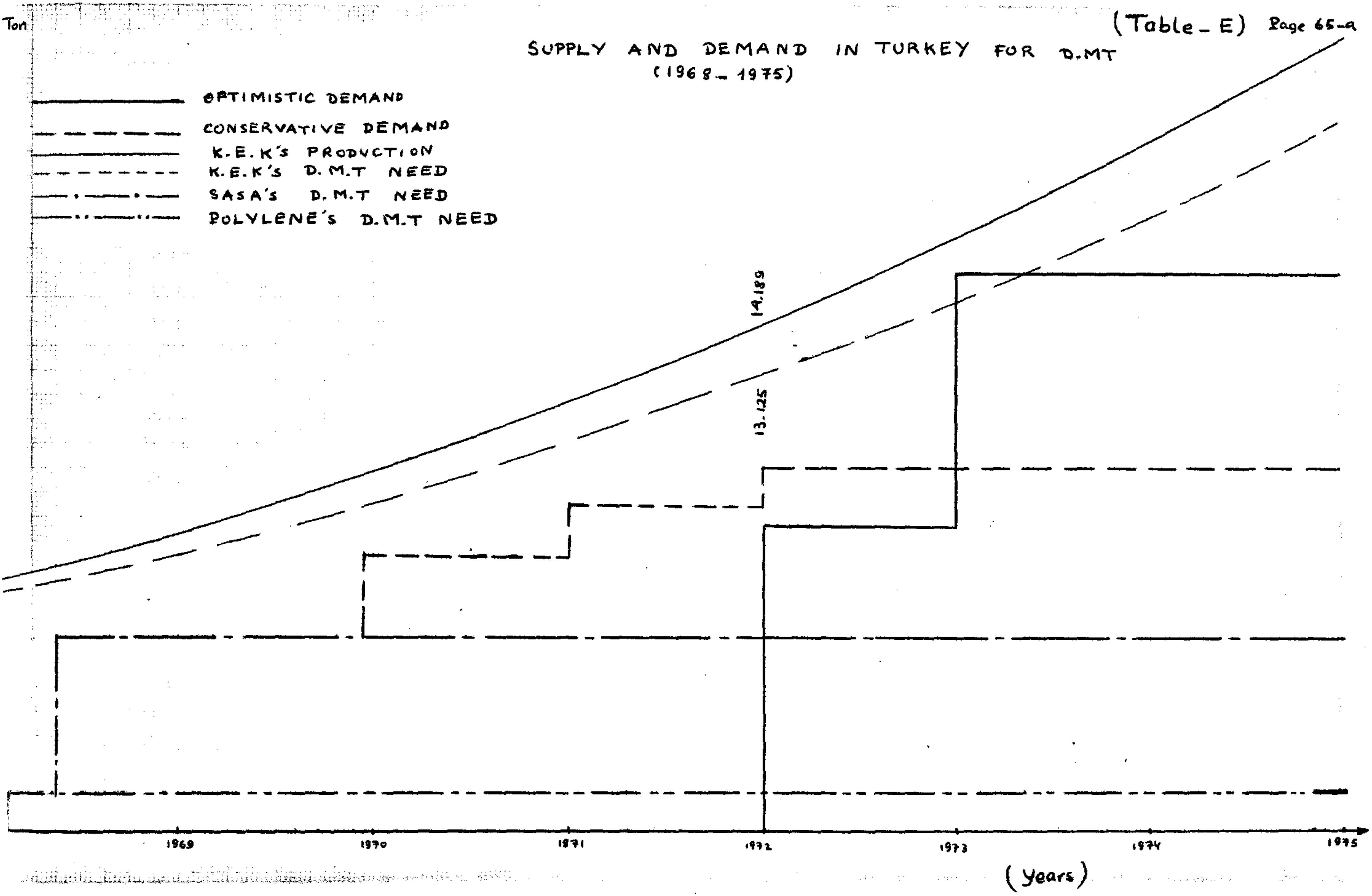

Ton
SUPPLY AND DEMAND IN TURKEY FOR D.MT
(1968 - 1975)
OPTIMISTIC DEMAND
CONSERVATIVE DEMAND
K.E.K's PRODUCTION
K.E.K's D.M.T NEED
SASA's D.M.T NEED
POLYLENE's D.M.T NEED
14.189
13.125
1969
1970
1971
1972
1973
1974
1975
(Years)

Optimistic Approach

Years	Polyester Demand (Ton)		D.M.T. Demand (Ton)
1974	18.125	x 1.08	19.575
1975	21.052	x 1.08	22.736

Conservative Appkoach

1968	5.885	x 1.08	6.356
1969	7.124	x 1.08	7.694
1970	8.470	x 1.08	9.148
1971	10.208	x 1.08	11.025
1972	12.153	x 1.08	13.125
1973	13.955	x 1.08	15.071
1974	16.312	x 1.08	17.617
1975	18.947	x 1.08	20.463

The flow and supply of those demand patterns are shown on graph E.

E - Conclusion

The method utilized in our study was a choice due to its availability and practical application. The method is primarily based upon the following correlations existing in textile economy.

a) There is a relation to some extent between per capita income and per capita fiber consumption.

b) The second relation is between the distribution patterns of synthetics amongst themselves and per capita income.

c) There is a third correlation which is a tertiary one. This is the three-way relation between per capita

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income, per person fiber consumption and the distribution patterns of synthetics amongst themselves. It is true that the method employed involves ample amount of forecasts. But keeping in pace with the world patterns together with careful considerations for Turkey increases the reliability of the method. This point especially became pronounced when the actual first month import figures were obtained for 1968. The forecasted figures in this thesis almost exactly fits the apparent figures obtained recently.

To sum up the following results may be obtained from this market analysis.

1. Demand for polyesters will reach to 5900-6000 ton in 1968, 8500-9.150 ton in 1970, 12.100 - 13.100 ton in 1972 and to 19.000-21.000 ton in 1975. Those figures may be considered as being the rather optimistic figures of the investor companies. S.A.S.A. which seems to be the main competitor for the K.E.K. producers will start his operations towards the middle of 1969. It has a capacity of approximately 4000 tons. Presently this capacity of S.A.S.A. seems incapable of satisfying the domestic demand. If the outlined predictions about the polyester demand hold true K.E.K. even together with S.A.S.A. will not be able to satisfy the domestic demand in 1975. Both factories may have to double their capacities by then. In the conclusion part of this thesis, a thorough analysis pertaining the respective market shares of this two companies will be given.

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2. Considering the D.M.T. demand, this is hoped to reach to 6.350 - 6.700 tons in 1968, 9.150 - 9.900 tons in 1970, 13.100 - 14.200 tons in 1972, 20.500 - 22.750 tons in 1975. D.M.T. production unit which is going to be the first one in the country aims to satisfy to total ofthe demand in the near future. K.E.K. basis is 16.000 tons per year. Domestic sales af the product especially to S.A.S.A. and even import possibilities are foreseen in this field. The chief competition that may come in this branch is from the Petro-Chemical Industries. Again a critical analysis of this possibility will be carried out in the conclusion part of this thesis.

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CHAPTER IV

1) Technical Background of the Process

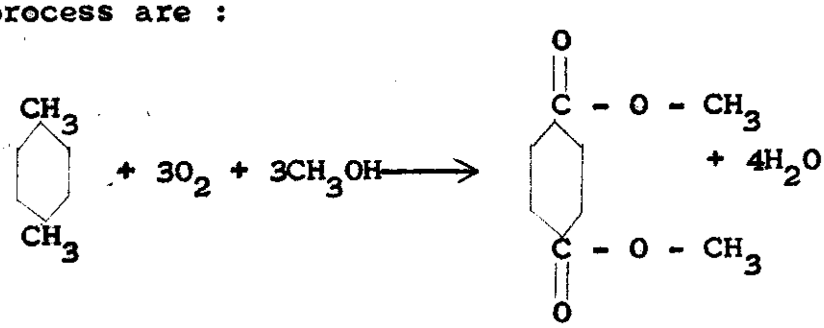
2) Process description

3) Production method of the polyester fibers

4) Selection of the Production process
D.M.T. vs. T.P.A.

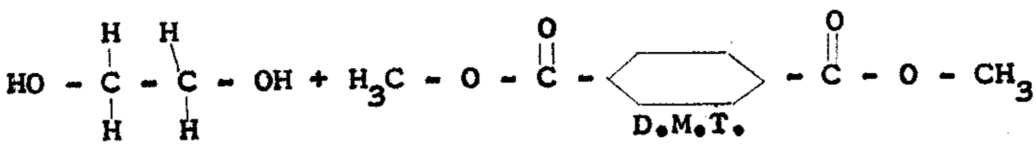
1 - Technical Background of the Process

Polyester is a condensation product of dimethyl terephthalate and ethylene glycol. D.M.T. is oxidized directly from p-xylene in the presence of (nitric acid and) methanol. About 0.31 lb. of glycol and 0.86 lb of ester are added to the reactor for each pound ofpolyester. Polymerzation is carried out at high temperative using a vacuum. A polymer chain containing about 80 benzene rings is formed. After filtering this material it is melt spun. The filaments are streched about four times their original lenght. The general scheme of the process is given in (Chart - 1). Major reactions involved in the process are :

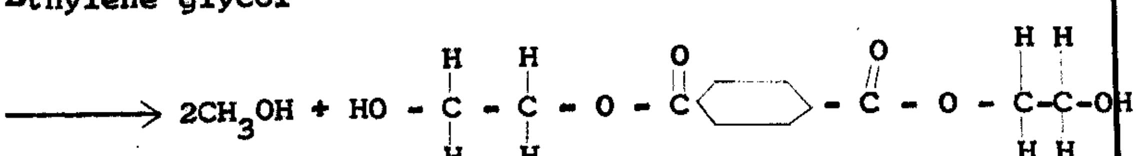


P - xylene

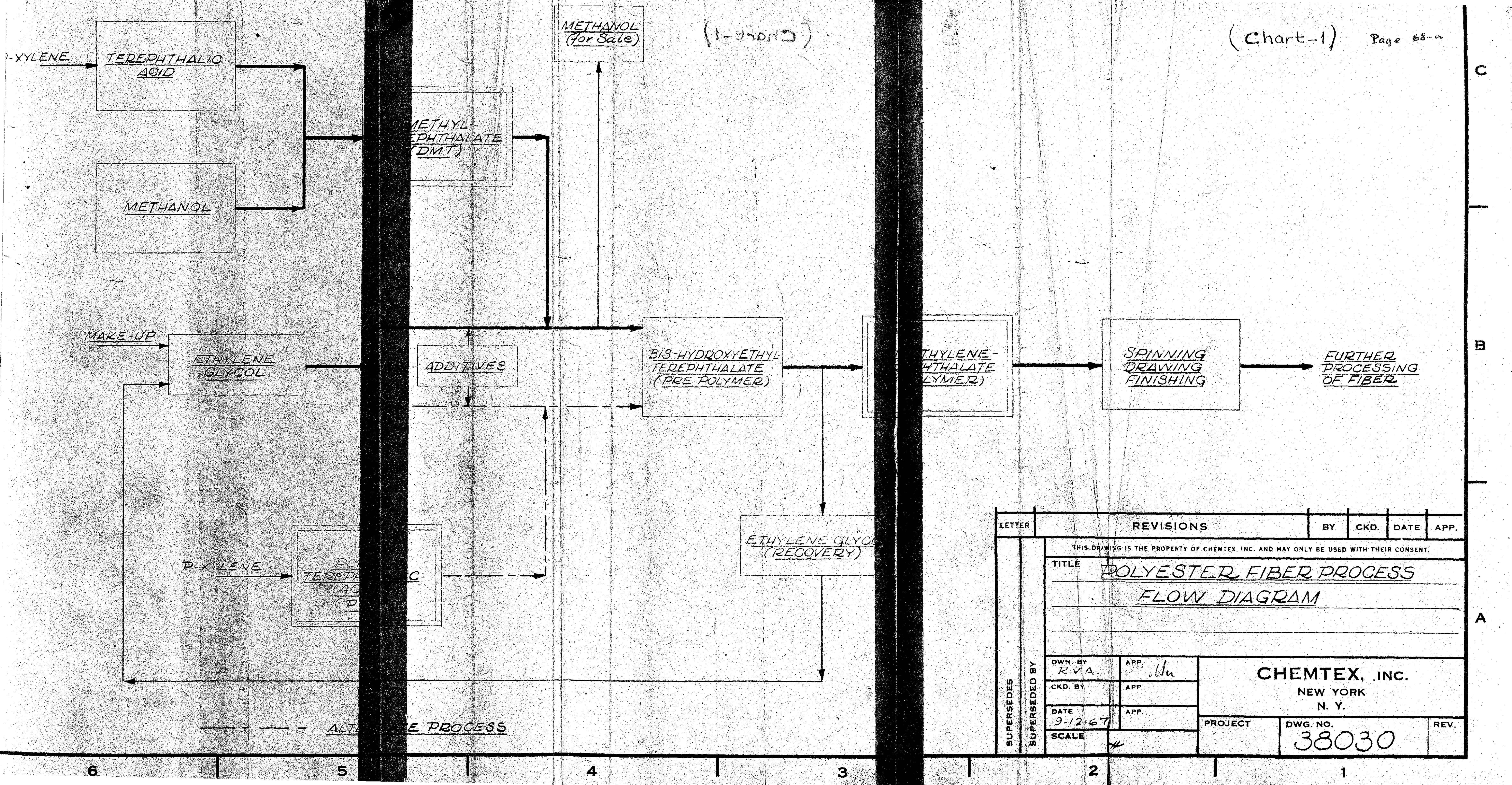
Catalyst: Cobalt Naphthenate or the organic salts of CO, Mn, Pb, Cr, Fe, Ce,. All this can be used for the initiation ofthe reaction.



Ethylene glycol



bis -2-hydroxyethyl terephthalate
di glycol terephalate ./..


METHANOL (for Sale)
P-XYLENE
TEREPHTHALIC ACID
METHANOL
MAKE-UP
ETHYLENE GLYCOL
ADDITIVES
BIS-HYDROXYETHYL TEREPHTHALATE (PRE POLYMER)
SPINNING DRAWING FINISHING
FURTHER PROCESSING OF FIBER
P-XYLENE
ETHYLENE GLYCO
(RECOVERY)
PROCESS
LETTER
REVISIONS
BY
CKD.
DATE
APP.
THIS DRAWING IS THE PROPERTY OF CHEMTEX, INC. AND MAY ONLY BE USED WITH THEIR CONSENT.
TITLE POLYESTER FIBER PROCESS
FLOW DIAGRAM
SUPERSEDES
SUPERSEDED BY
DWN. BY R.V.A.
APP.
CKD. BY
APP.
DATE 9-12-67
APP.
SCALE
CHEMTEX, INC.
NEW YORK
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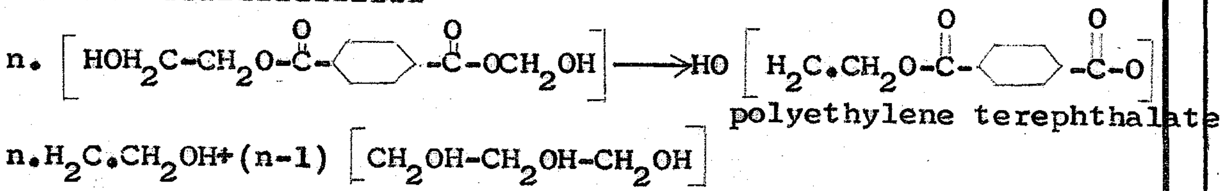
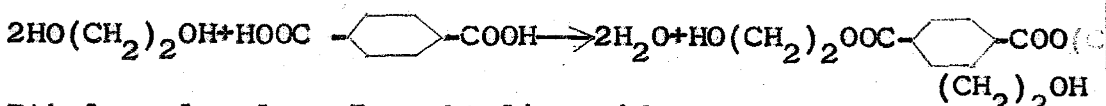
Polycondensation phase

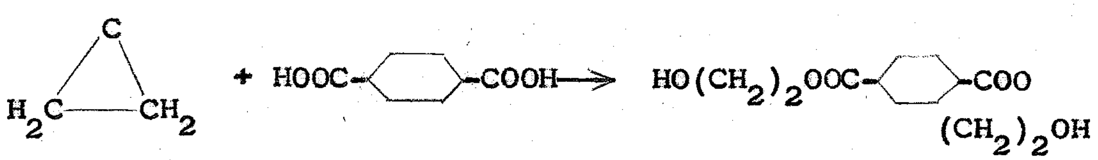


glycol

Formation of this mixed monomer is also possible according to the following equations:

1) 

Ethyleneglycol Terephtalic acid

2) 

Ethylene oxide

2 -Process description

A - Discontinious process

In a mixing vessel D.M.T. is dissolved in the preheated glycol. After the addition ofcatalysts, stabilizes and delusterants the mixture is filtered and transferred to the ester interchange vessel. The vapour mixture formed during the reaction passes a column mounted on the reactor for condensation of glycol and D.M.T. vapours. Methanol vapours are drawn off overhead into a subsequent indirect condenser.

The subsequent polycondensation process is carried out in an autoclave at increasing temperature. During a residence time of several hours the autoclave is continiously evacuated up to a maximum.

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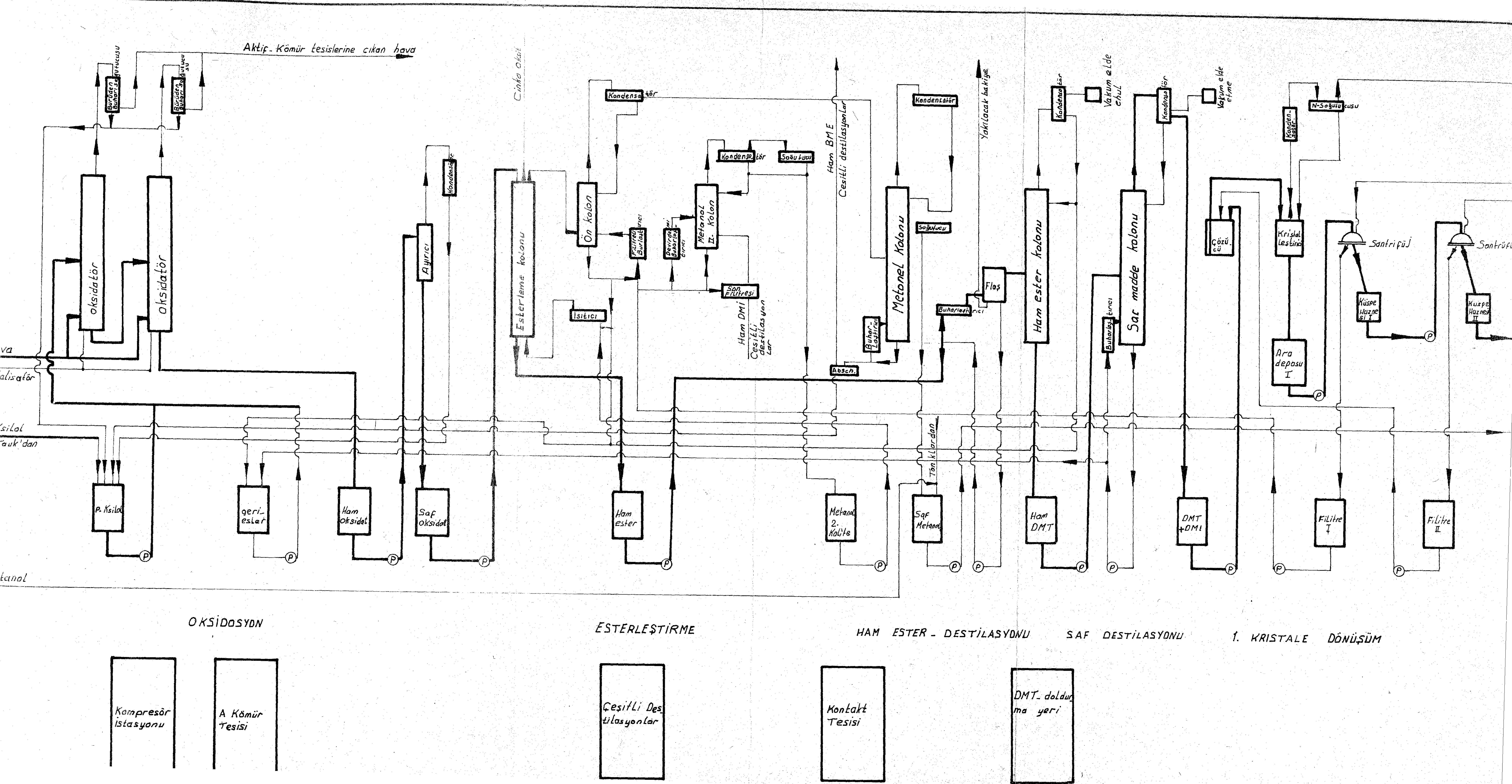
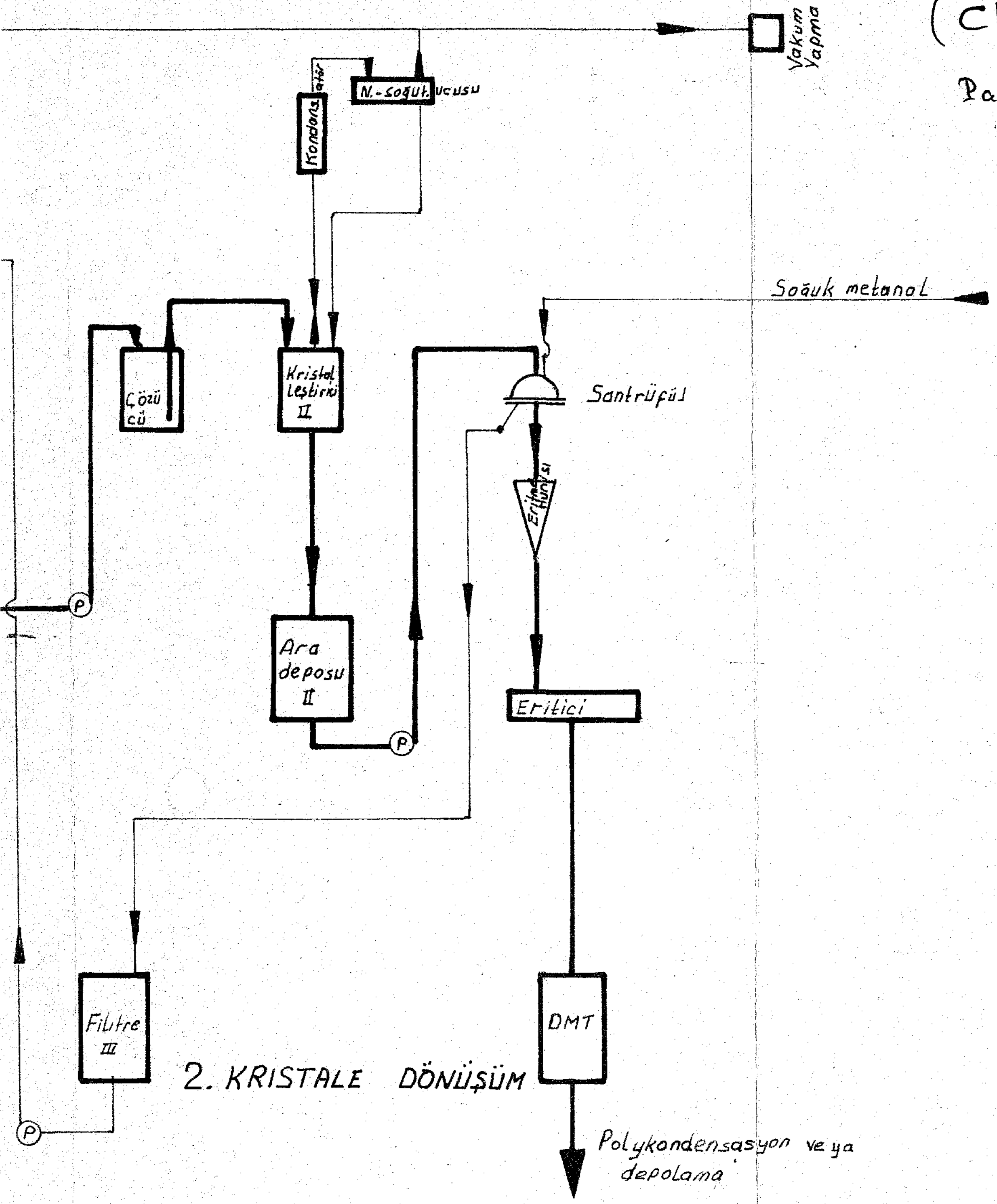


Aktif- Kömür tesislerine cıkan hava
Cinko oksit
oksidatör
oksidatör
Ayırıcı
Kondensatör
Esterleme kolonu
Kondensatör
Ön kolon
Isıtıcı
Kondensatör
Soğutucu
Metanol II. Kolon
Son Filitresi
Ham DMI Çeşitli destilasyonlar
Ham BME Çeşitli destilasyonlar
Kondensatör
Metanol Kolonu
Soğutucu
Absch.
Yakılacak bakiye
Flaş
Ham ester kolonu
Vakum elde etme
Saf madde kolonu
Vakum elde etme
N-Soğutucusu
Çözücü
Kristalleştirici
Santrifüj
Santrifüj
Küspe Haznesi I
Küspe Haznesi II
Ara deposu I
P. Ksilol
geri esterler
Ham Oksidat
Saf oksidat
Ham ester
Metanol 2. Kalite
Saf Metanol
Ham DMT
DMT +DMI
Filitre I
Filitre II
OKSİDOSYON
ESTERLEŞTİRME
HAM ESTER - DESTİLASYONU
SAF DESTİLASYONU
1. KRISTALE DÖNÜŞÜM
Kompresör İstasyonu
A Kömür Tesisi
Çeşitli Destilasyonlar
Kontakt Tesisi
DMT- doldurma yeri

(Chart-2)



iş Akış şeması

By product glycol is seperated. The polymer melt is spun out from the autoclave through spinnerets to ribbons, which are cooled in a water bath and then out to chips by a granulator. In order to secure a low water content the chips are dried under vacuum in a tilted drum drier. The maximum final moisture content of the chips allowed for spinning is 0.02 % by weight.[1]

B - Continious process

Via a conveyor chute powdered D.M.T. is continiously transferred from an intermediate tank into the melter. Molten D.M.T. is filtered and fed to the reacter for ester interchange via metering pumps.

From a storage tank, ethylene glycol is passed via metering receiver to the mixing vessel where catalyst is added. By metering pumps the mixture is fed to a preheater and to the reactor. Exact feeding of D.M.T. and glycol is warranted by a level controller.

Methanol vapours splitted of during the ester interchange are seperated in a distillation column from entrained by-products, glycol, and diglycolterephthalate. The vapours drawn off overhead are condensed, cooled and led to a mathamol storage tank. The bottoms of the column are recycled to the reactor. Diglycolterephthalate formed by ester interchange undergoes polycondensation in several steps at increasing temperature and vacuum. By product glycol is removed from the process by condensation of the vapors formed. The desired viscosity of the product is finally reached in a finishing reactor. By means of a discharge device the polycondensate is led from the final

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reactor stage to the spining systems. A by-pass allows chip production if wanted. The total of the process is shown in the flow-chart in (Chart 2.)

C - Productionn of the polyester fibers

Production offilament and staple fibers from the polymer melt can be furnished by two different ways.

a. Direct kspinning: The polymer in the polycondemsation plant is immediately fed to the spinning stage.

b. Chip spinning : The polymer is spun to tows and cut into chip. The dried chip is molten and fed to the spinning plant. This is the process that will be utilized in the K.E.K. project. The melting process runs as follows.

From the chip container the chip is falling via a slide and an intermediate receiver to a screw melter. The screw, rotating slowly, pick up the chip and transfers it to the melting zone and the spinning pump.

In both processes, either direct or chip spinning, the polymer melt is distributed to the individual spinning systems via dowtherm-heated pipes. Im general, 6 spinning positions together with the piping systems are combined in a so-called manifold. Each of the spinning positions disposes 1 to 4 metering pumpps which guarentee an exactly constant flow of the melt through the bores of spinning nozzles (spinnerets). Filaments emanating from the spinnerets are cooled in blow ducts. When having passed the spinning ducts the threads are running via preparation and moistening diskks and subsequent awiliary gadgets to the take up device.

For production of staple fibers two techniques are in use.

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i) Threads are drawn off in common by a draw-off machine w which precedes the tow deposit in cans. The tows taken off in cank are conveyed to the fiber processing line. This is the method used in K.E.K. project.

ii) Threads are drawn off seperately and wound on bobbins which are creeled and processed further on a fiber processing line. In fiber processing line streching, crimping, fixation and cutting are effected. The cut material is suched off and pressed and bandaged by a baling preks to bales for shipment, (Chart-3) indicates the following processes in detail.

For production of tows ("tow to yarn") technique i) is employed exclusively. For production of filaments the threads are taken up seperately on bobbins which are processed further on the draw twisters. Any strand of continious multifilament fiber of 1100-750.000 denier without twist is called tow. The majority of the tow produced is in the range 200.000 to 450.000 denier and the filament number range of 133.334 - 48.000 on a denier per filament range of 1.5 - 50.

In reducing tow to staple length two general methods can be utilized.

1) To break the filament.
2) To cut the filament by means of:
   a) Dry cutting and;
   b) Wet cutting

which gives better finishing touches and durability to the product. This second method will be used in the K.E.K. project.

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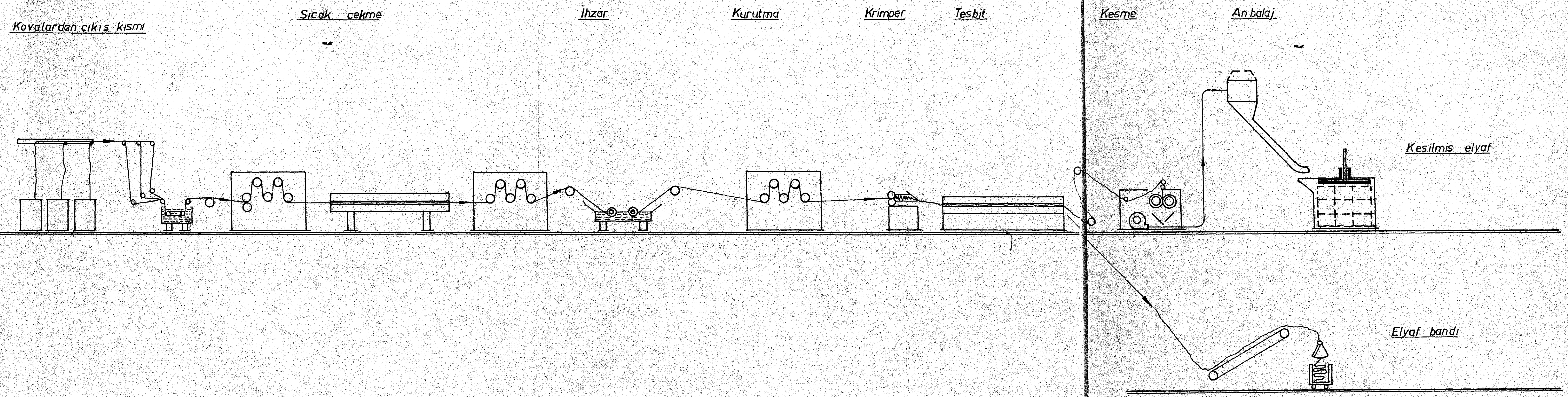
(Chart-3)

Page 72-a



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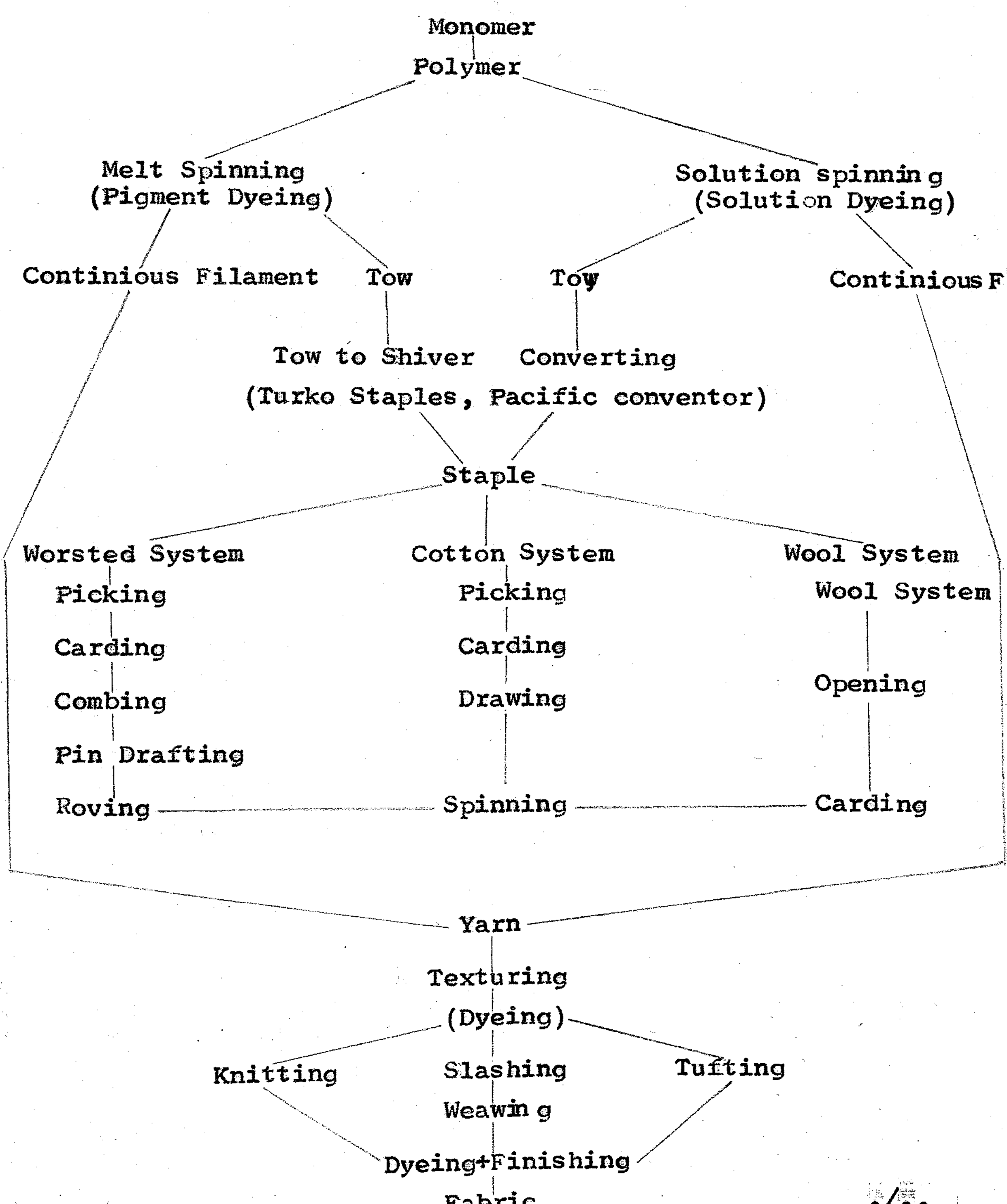
To sum up the finishing process a brief look to table 4 is adequate.

Table - 4

FLOW SHEET - FROM MONOMER TO FABRIC



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D - Selection of the Production Process

As can be seen from table - 1 of this chapter there exist two alternative processes for polyester fiber production. The first process of starting from p-xylene to produce to produce terephthalic acid and then treating it with methamol to produce D.K.T. was already discussed. The alternative process again starts with p-xylene, shifts to P.T.A. as in the first process, but omits the methanol and ethylene glycol addition phases to reach the pre-polymer phase as indicated in (Table 1). At this point the comparison of D.M.T. and T.P.A. methods is found quite appropriate.

a) D.M.T./T.P.A. capacities (1.000 tons)[1] (A world wide Survey

1966/1967

	D.M.T. producers	T.P.A. producers	D.M.T.	T.P.A.
U.S.A.	280	370	420	500
Puerto Rico	-	-	-	28
Belgium	-	-	-	90
France	40	40	40	40
West Germany	190	-	210	-
Great Britain	115	-	130	-
Italy	20	-	40	40
Holland	27	30	77	-
Total Western Europea (Round up figures)	390	70	500	170
Bulgaria	-	-	14	-
Poland	10	-	20	-
Rumania	-	-	11	-
U.S.S.R.	10	-	20	-
Total Eastern Eurepea	20	-	65	

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	D.M.T. Producers	T.P.A. Producers	D.M.T.	T.P.A.
Asia				
Formosa	7	-	5	-
India	-	-	15	-
Japan	133	150	170	200
Total Asian Capacity	140	150	190	200
World Totals	830	490	1175	598

This above described report which includes the 1969/70 capacity forecasts was the only available source which includes the world break-down of D.M.T. vs. T.P.A. in detail. In America the trend is in favor of T.P.A. processes but with little emphasis. (500.000 ton T.P.A. v.s. 420.000 ton D.M.T. production) This difference is much more pronounced in favor of D.M.T. production when one analyzes Western and Eastern Europea statistics. In most European countries T.P.A. processes are not utilized at lall.

While the expected developments in the T.P.A. production from 1966/1967 to 1969/1970 is only a tiny 3.7 % this forecasted figure is a huge 41.5 % in the case of D.M.T. World trend especially that of the more developed countkies-almost all being European - was a major indication to K.E.K. investors to indulge in the D.M.T. processes.

Source: A report prepared by Vickers - Zimmer - Synthetic Fiber Producers in July 1967 to be submitted to outside dealers.

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b) D.M.T./T.P.A. Furnishers

Aside from the world trend, data was available pertaining the major chemical industries present and future trends. The below table deals with a chemical-industry survey including nine gigant chemical firms in the picture.

I	. Amoco Chemicals Corp. U.S.A.	% 45 D.M.T. %55 T.P.A.
II	. Hercules Inc. U.S.A.	D.M.T. only
III.	Mobil Chemical Com. U.S.A.	T.P.A. only
IV	. Badische Anilin - Und Soda fabriken (BASF-West Germany)	D.M.T. only
V	. Chemische Werke witten der Dynamit Nobel AG West Germany	D.M.T. only
VI	. Amoco Chemical Belgium S.A. (Belgium)	T.P.A. till 1969, then will shift D.M.T. processes
VII	. Montecatini-Edison (Italy)	D.M.T. % 70 T.P.A. % 30
VIII.	N.V. Petrochemicals A.K.U. - Amoco - Holland	D.M.T. only
IX	. N.V. Hercules Powder Company Holland	This company hopes to shift totally to D.M.T. production by the end of 1968.

The analysis of the above table is a simple one. Most gigant chemical corporations are utilizing D.M.T. and the ones using T.P.A. are modifying their lines to shift the D.M.T. process. But one must not forget that Mobil Chemical corp. of U.S.A., Amoco company are gigants in chemical field, and their points of choosing T.R.A. is worth a critical analysis.

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c) D.M.T. vs. T.P.A.

In fact there are two main subjects to consider:

I . The manufacturing of D.M.T. according to the witten or Amoco process versus the manufacture of T.P.A. according to the Mobil and Amoco process.

II. The differences respectively in the technical performance of D.M.T. vs. T.P.A in polyester manufacture.

As was pointed out the process that will utilized in the K.E.K. process is witten's D.M.T. production method. It was claimed that Witten process is more expensive than the other alternative of Amoco process. A recent series of articles which appeared in "European Chemical News" gave sound answers to such criticisms whether D.M.T. made by Witten process is more expensive than D.M.T. made by the Amoco or Henkel process, is principally a matter of concern for the manufacturer of the product. Although this is true we can imagine that the polyester fiber producer, the customer for D.M.T. is interested to know which process in the long run is the most attractive one, in other words, how long and how far are the processes able to compete without losing money.

The following defending points can be stated in favor of the Witten D.M.T. process.

1) The Witten process is not a 4-step process. The reader at the very first look at the flow chart on (Table 1) may have such an impression. But a further detailed analysis of the total flow chart in (Table 2) clearifies this point. The two oxidation steps from para-xylene to solvic acid and from methyl paratoluate to mono methyl terephthalate are taking place in one step

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which means in one reaction. The esterification of the solvic acid and the mono methyl terephthalate also finds place in one step. To sum up, the Witten process is also a process that takes place in two realistic step as in the Amoco process.

2) In showing the cost for the Hercules Witten process, the cost for utilities has been seperated from labor, maintenance and overheads. The total of these operation cost factors amount to 4,46¢/lb which is more than double the same cost for Amoco and Mobil pure T.P.A. processes. A more realistic figure would be a slightly higher operating cost for the Witten process.

3) The conversion of crude T.P.A. to fiber grade T.P.A. is described as being carried out by recrystallization in Mobil or Amoco processes. But by such an approach it would be insufficient to remove the aldehyde acid impurity, so that it is more likely that a more expensive operation e-g hydrogenation is being used which will surely increase the cost patterns of the T.P.A. process in the unfavorable direction. Another consideration at this point is that the ones that claim that Mobil process to produce T.B.A. is cheaper than D.M.T. production neglect one important point. It is noted that oxygen is needed for the Mobil process and that investment for oxygen is not included in the cost calculations of Mobil process.

4) Processing the T.P.A. means additional problems because of plant corrosion. The neutral D.M.T. does not give any problems in this respect.

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5) In most of the considerations against the D.M.T. process no credit is given for the recovery of methanol as shown clearly by re-cycle operation in (Table 1) of this chapter. Based on the assumption that virgin methanol sells at 20 ¢ per U.S. gallon and that the rework methanol with a purity of about 95 % is credited at 3 ¢ per U.S. gallon less, it is clear that this brings a credit of at least 4 % to the D.M.T.

6) It is often stated that the disadvantage of using D.M.T. is the added complication introduced by methanol. But in fact this is a minor complication. Being a liquid product, the rework methanol is usually shipped back to the D.M.T. supplier. The polyester manufacturer in reality is handling a liquid product and cost of pumping is insignificant. For customers whose plants are not in the proximity of the D.M.T. plant, the rework methanol can be purified or sold on the local market. In less developed countries where demand for this reworked methanol in the lacquer industry is negligible, the polyester producer might add a distillation column to his plant and sell purified methanol.

7) Since the esterification and polymerisation of T.P.A. to the diglycol terephthalate or bis-(hydroxethyl) terephthalate still gives some problems, we think that D.M.T. deserves a premium. There are hardly any polyester fiber producers known with a satisfactory batch polymerization process based on T.R.A. The continious polymerization process can be used only by large producers. Furthermore, licensing cost for a T.R.A. based polymerization process must be considered by anyone contemplating using T.P.A.

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8) D.M.T. is a product which is very easy to transport in the plant. At a temperature of 140°C, it is liquid, has a low viscosity and can be pumped like any liquid. T.P.A., on the other hand, with a melting point of over 400°C has to be processed completely in a different way. It is not molten hence has to be transported mechanically. In the near future transport of D.M.T. from the D.M.T. producer to the customer will and more take place in the molten form which indeed in an appreciable saving.

Under the light of the above considerations D.M.T. process chosen for the production of synthetic polyester fibers in the K.E.K. process was found to be a very sound decision. This decision completes the discussion on the production process. The next chapter of this thesis will devoted to the analysis of the economical feasibility of this project.

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CHAPTER V

Economic Feasibility of the Project

A) Plant site and Location

B) Investment

C) Unit Cost Calculations

D) Economic Feasibility

The bulk of this theis is given in this Chapter. Under the heading of the "Economic Feasibility of the project", starting from the selection and evaluation of the plant site and location, the break-down of investments in detail are analyzed. In this part the K.E.K. project proposal given to Turkish Industrial Devëlopment Bank was taken as the basis of analysis. Various corrections and re-evaluation of some figures are done according to the norms used in the project evaluation department of the Bank, which operates within the Technical research department. After the break-through of investments the profitability and break-even conditions of the total project (aanlyzing polyester fiber and D.M.T. unit seperately) were considered for various states of nature that may occur in the future. The alternative ways of action and respective pay-offs for these states of natures are calculated and criticized. The chapter ends with a two-stepped cash flow (discounted) analysis of the project to show that net present value of the project is positive, and therefore acceptable.

A. Plant Site and Location

As was pointed out previously the K.E.K. project is a two step project. The first step is the establishement of a 5000 tons /year capacity (including chips) polyester fiber plant and the second one being a 16.000 tons/year D.M.T. plant which will satisfy the total domestic demand. While choosing the plant location and site the following factors should be considered.

a) As it is pointed out many times by the K.E.K. executing an expansion of the polyester fiber capacity from 5000 tons/year to 8.500-10.000 tons/year is

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is being considered. Bearing this fact in mind together with the consideration that this future expansion will involve the establishment of many side units and social buildings, it is concluded that a site having surface area of at least 100.000 m^2 with a minimum front of 200 metres is essential.

b) A site having a leveled-off surface with reasonable proximity to markets where construction materials will be purchased is advisable. Apart from the technical construction analysis of the site, the community near which the plant is proposed to be built should be passed from a careful screening process in order to have sound idea about the enviromental conditions. Such an analysis would give the executives an idea about their future potential work force and the enviromental attitude towards such a factory.

c) The site should be as near as possible to the main transformer station and the high voltage line for security and cost considerations.

d) Since water will be utilized in large quantities in both polyester fiber and D.M.T. processes a very careful analysis of the water content in terms of quantity and quality should be carried out in order to be safe in the future. This point is of prime importance and the basis of plant site should be based upon the future capacity of the water resource.

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e) The project considers to provide a certain percentage of machinery, material, know-how, engineering a work-force locally. The proximity and availability of those outlined human and inhuman resources to the proposed site should be subjected to comparative ranking.

f) A most important consideration is the proximity of the site to the consumer markets (cotton and woolen textile producers who are utilizing polyester fibers in the processes.)

Under the light of the preceeding considerations a plant site around Bursa or Izmit bay is found to be the most convenient place. Because of the following:

1. The main market for K.E.K's end products is primarily spread in the Marmara region, Istanbul being the center of gravity. The flow of materials and equipment to K.E.K. from foreign countries and local sources will be via Istanbul. So considering the above stated security factors the nearer the site is to Istanbul the better it is.

2. Considering the desired characteristic of the labor force and potential electrical capacity which is very important in K.E.K.'s case specialized labor force would be needed-the proposed area is still around İzmit bay or Bursa.

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B. Investments

A. Fixed Investment Totals:

	TL.	
Land	1.000.000	According to the project surface area 100.000m^2 10 TL. / m^2
Improvements of land	100.000	This is a crude guess since the land is unknown
Water Recovery and Canalization	700.000	Pump systems, wells, water towers, again a guessed figure

Buildings and other Constructions

Polycondensation unit	4.725.000		Those figures are given in the proposed made by whole in 11/11/1967 considering the factors of Turkey.
Yarn and drawing unit	2.925.000		
Climatic unit	4.275.000		
M.G.Distillation unit	675.000		
Fiber Storage	790.000		
D.M.T. Storage	790.000		
Tanks	337.000		
Side units	560.000		
Others	250.000	15.327.000	
Total	15.327.000		

Administrative and Social Buildings	600.000	Total 1200 m^2 is taken with a cost of 500 TL/m^2 including the total

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		of construction expenses
Buildings for work-force residences	1.000.000	A total of 20 residences is being considered for bey personnel 100 m^2/residence

Machine and Equipment

Machine and equipment that is going to be imported (Fob) (Appendix I-a)	$ 2.412.800
The equivalent of this sum in Turkish currency	TL 21.908.224
(Fob-Cif) Difference (Appendix I-a)	TL 1.533.576
Cif Total (Appendix I-a)	TL 23.441.800
Total Import expenses (Appendix I-a)	TL 10.123.530
Foreign Engineering fees (Appendix II)	TL 11.804.000
Local engineering, evaluation and project fees (Appendix VII)	TL 500.000
Letter of credit expenses (Appendix VIII)	TL 2.728.500
Domestic Transportation, Insurance expenses (Appendix V)	TL 965.000

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Machine and equipment that will be provided locally:

a)	Polycondensation unit (Appendix VI)	TL	10.300.000
b)	D.M.T. " (")		11.430.000

Assembly expenses:

A) For the D.M.T. unit

a) Payable in Foreign currency	TL	1.219.000
b) Payable in local currency (Appendix X.)	TL	596.000

B) For the Polycondensation unit

a) Payable in foreign currency (Appendix X)	TL	2.098.550
b) Payable in local currency	TL	954.000

C) For the converters

a) Payable in foeign currency	18.160
b) Payable in local currency	10.000

Expenses of the experimentation phase

A) For the D.M.T. unit

a) Payable in foreign currency /Appendix XI)	122.600
b) Payable in local currency (Appendix XI)	37.500

B) For the Polycondensation unit

a) Payable in foreign currency	1.041.950
b) Payable in local currency	261.000

C) Raw material expenses in the experimentation phase (Appendix XI)	1.155.000

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D) Rersonnel, Power expenses in the experimentation phase (Appendix XI)		1.662.750
Utilities and Transportation equipment (Appendix IX)		1.000.000
Contingencies (Appendix I-a)		4.068.850
	TL:	105.165.190
Interest for grace period (Appendix XII)	TL:	16.252.000
Total of the Fixed investments	TL:	121.417.190

The Break-down of Total investments
(For the Polyester and D.M.T. units taken together)

Total Fixed Investment	TL:	121.417.190
Set up expenses (Appendix XIII)		11.653.700
Working capital (Appendix XIV)		25.000.000
	TL:	158.070.890

Machine and equipment that is going to be imported — APPENDIX -I

1. Uhde-Chemical Firm believes that 20 % of the machine and equipment can be provided in Turkey. So by taking 80% of the proformo invoice prices for the fiber polycondensation unit and adding to this figure % 4 of packaging costs, freight on board costs and insurance fees one can obtain the F.O.B. prices.

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2) Since the proformo invoice, pertaining to the parts to be imported for the D.M.T. unit, was available, the prices in this was taken as the basis.

3) For the conventors the proformo invoice of the Rieter firm was taken as the basis.

APPENDIX I-a

Polycondensation and Fiber Units

	F.o.b. (D.M.)	F.o.b ($)	F.o.b. (TL)
Polycondensation unit	3.103.360	775.840	7.044.627
M.G. Distillation unit	482.560	120.640	1.095.411
Chips Transport and Storage	212.160	53.040	481.603
Chips Drying	120.640	30.160	273.853
Extruding and Spinning unit	1.622.400	405.600	3.682.848
Fiber Processing unit	2.321.280	580.320	5.269.306
Side units	1.788.800	447.200	4.060.576
Total	9.651.200	2.412.800	21.908.224

Fob-Cif Dif. (TL)	Cif (TL)	Customs Number	Customs %	Importation Expenses
493.124	7.537.751	84.17,84-18	25-10	4.801.550
76.679	1.172.090	84-17,84-18	25-10	746.625
33.713	515.316	84-22	10-10	225.710
19.170	293.023	84-17	25-10	186.660
257.880	3.940.648	84-59	50-10	3.822.430
368.850	5.638.156	84-36	30-10	3.969.275
284.240	4.344.816	84-01,84-17	40-10,25-10	3.202.130
T. 1533.576	23.441.800			16.954.380

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D.M.T. unit (According to proformo invoice of 13/2/1968

	F.o.b. (D.M.)	F.o.b. ($)	F.o.b. (TL)
Machine and equipment	5.149.160	1.287.290	11.688.593
Piping system	1.279.300	319.825	2.904.011
Measurement devices	2.345.370	586.345	5.327.013
Electrical equipment and motors	906.170	226.540	2.056.983
Total	9.680.000	2.420.000	21.973.600
6 Conventers	---------	126.650	1.150.000
Contingencies	---------	199.150	1.808.276
(Polyconol, D.M.T.unit) General Total		5.158.600	46.840.100

	Fob-Cif Difference (TL)	Cif (TL)	Costoms Number	Customs %	Importation Expenses (TL)
	818.200	12.506.793	84-17,84-18	25-10	7.966.830
	203.280	3,107.291	84-01,84-11	40-10, 25-10	2.290.075
	372.680	5.696.693	90-24,90-28	10-10, 25-10	3.064.825
	143.990	2.200.973	84-10	20-10	1.256.760
	1.538.150	23.511.750			14.578.490
6 Conv.	57. 500	1.207.500	84-36	30-10	850.080
Contingencies	126.574	1.934.850		30-10	1.362.150
Gen. Tot.	3.255.800	50.095.900			33.745.100

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Since % 70 customs reduction will be applied the real importation expenses are: (33.745.100x0.30) = 10.123.530 TL.

APPENDIX II.

Engineering Fees

The sum of the engineering activities will be carried out by the Friedrich-Uhde firm of Switzerland. Those engineering activities include the follwing: General planning of the production, power and side units, the choice of the machine and equipment according to the desired specifications of the process, the sum of the construction project and calculations in detail, controls for the plans, providing the necessary work-force for the assembly of the machines and equipment and the full responsibility of carrying out the assembly operations until the firm is readry for full capacity operations. The engineering fees for the D.M.T. unit is 3.400.000 D.M. (850.000 $) and 1.800.000 D.M. (450.000 $) for the polycondensation, fiber unit. The engineering fees will be paid as follows:

1 month after the signing of the contract	% 20
4 " " " legalization of the "	% 30
8 " " " " " " "	% 30
10 " " " " " " "	% 10
At the date when K.E.K. gets the full responsibility of the project	% 5
After three months when K.E.K. gets the full reksponsibility of the project	% 5

1.300.000 $ = 11.804.000 TL.

1 $ = 9,08 TL

1.300.000 X 16,50 = 21.450.000

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APPENDIX III.

Corporations Tax:

In calculating this figure % 20 of the engineering fee that is going to be transferred in foreign currency is taken as the basis according to the following:

11.804.000 x 0.20 = 2.360.800 TL.

APPENDIX IV.

Purchase commissions:

% 10 of the total machine and equipment costs are taken. This sum will be paid to the Uhde in foreign currency in F.O.B. prices.

(2.412.800 + 2.420.000)(0.10) = $ 483.280 = 4.380.200 TL.

APPENDIX V.

Internal Transportation and Insurance fees:

This cost is made ofthe freight charges of the machine and equipment from customs to the plant site, and the insurance fees % 2 of the C.I.F. total is taken as the basis.

(23.441.800 + 23.511.750 + 1.207.500)x(0.02) = 965.000 TL.

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APPENDIX VI.

Machine and equipment that will be locally provided

A) For the polycondensation and fiber unit: According to Uhde's economic evaluation % 20 of the machine and equipment can be provided locally. To be on the safe % 50 excess of the proformo invoice prices are taken as the basis.

Polycondensation and fiber unit	7.900.000 TL.
Overhead power-lines (1500 kva), Transformers, internal electrical system	1.400.000 TL.
9 Ton/hour capacity reactor system	1.000.000 TL.
	10.300.000 TL.

B) For the D.M.T. unit: Again according to Uhde's project % 20 of the machine and equipmemt can be provided locally, % 50 excess of the proformo invoice prices are taken.

D.M.T. unit	7.730.000 TL.
12 Ton/hour steam providing reactor	1.500.000 TL.
1500 kva. supplementary transformer and system	1.300.000 TL.
Dyeing and Isolation	900.000 TL.
	11.430.000 TL.

Analysis, Project and Engineering Fees

APPENDIX VII.

The analysis, project and engineering servises that will be provided in the lead time (The figures given by the K.E.K. project is taken exactly).

For the Polycondensation and Fiber unit	TL. 400.000
D.M.T. unit	TL. 100.000
	TL. 500.000

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APPENDIX VIII

Credit expenses:

% 4 of the machine prices that will be paid on F.o.b. basis plus the engineering, assembly and purchasing fees that will be paid in foreign currency is taken as the basis.

2.728.500 TL.

APPENDIX IX.

Utilities and Transportation

For the Polycondensation and fiber unit	TL.	700.000
For the D.M.T. unit		250.000
For the conventors		50.000
	TL.	1.000.000

APPENDIX X.

Assembly Expenses

A) For the D.M.T. unit

1. Payable in foreign currency: According to Uhde's report on 25/November/1967 the following specialized personnel is required: 4 engineers, Head of the Assembly Department, 1 assembly supervisor, 7 assemblers. The total fees:

537.000 D.M. = 134.250 $ = 1.219.000 TL.

2. Payable in local currency:

Round-trip transportation fees of the specialized personnel (3500 x 13)	TL.	45.500
Nutrition and residence fees of the personnel (150 TL/days basis)		310.500
Domestic assembly work-force		240.000
	TL.	596.000

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B) For the Polycondensation and Fiber unit

1. Payable in foreign currency:

Round trip transp. fees of the personnel (12 x 3500)	TL.	42.000
Nutrition and residence fees of the " (150 TL/day)		499.500
Domestic assembly work-force		412.500
	TL	954.000

C) For the conventors → toplayıcı

1. Foreign currency ($ 2000)	TL.	18.160
2. Local "		10.000
		28.160

APPENDIX XI.

Expenses of the Lead Time

A) Fees for foreign specialists (D.M.T. unit)

1. Payable in foreign currency: Two Textile specialists and one engineer from Uhde will carry out the activities in this period. Total of their fee:

54.000 D.M. = 13.500 $ = 122.600 TL.

2. Payable in local currency:

Round trip expenses (3 persons)	TL.	10.500
Nutrition and residence (150TL/day basis)	TL.	27.000
	TL.	37.500

B) Fees for foreign specialists (Polycondensation and fiber unit)

1. Payable in foreign currency: 8 engineers from Uhde for

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6 months, and one chemist for 3 months will be employed. Total of their fees:

459.000 D.M. = 114.750 $ = 1.041.950 TL.

2. Payable in local currency:

Round-trip expenses (9 persons)	31.500 TL.
Nutrition and residence expenses (150 TL/day)	229.500 TL.
	261.000 TL.

Raw material expenses in the Lead Time

Raw material scraps in the grace-period

1. D.M.T.

F.o.b.	TL.
$ 50.000	770.000

(Customsfee, Internal transportation and insurance included)

2. Polycondensation unit

F.o.b.	TL.
$ 25.000	385.000

Work-force power, personnel expenses in the grace period.

1. D.M.T.

$$(1.246.100 + 366.800 + 8.455.200)\frac{1}{12} = 874.250 \text{ TL.}$$

2. Polycondensation unit

$$(988.100+1.296.000+366.800+1.296.800+414.400+5.100.000)\frac{1}{12} = 788.500 \text{ TL.}$$

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APPENDIX XII.

Letter of credit expenses

The equivalent of the total $ 8.325.000 foreign currency credit in local currency is 75.591.000 TL. The interest rate is calculated for 6 month's period (Period from it's acceptance to its utilization) with a % 1 interest rate.

$(75.691.300 \times \frac{6}{12} \times 0.01)$ TL. 377.900	377.900
Interest ofthe foreign credit for 24 months:	
$(75.591.000 \times \frac{24}{12} \times 0.01)$	15.874.100
	TL. 16.252.000

APPENDIX XIII

Set up costs

1. Know-how fees: According to the know-how act reached with Hoechst at the date 20/11/1967, Hoeschst will provide all the necessary technical information, will introduce the technological improvements in this field, part of K.E.K. personnel will be trained in Germany and will quarentee the quality of the product. The duration of the know-how act is 5 years. For those services the following payments will be made to Hoeschst firm: 3.500.000 D.M. ($ 875.000) for the polycondensation and fiber unit as the know-how fee. Although a know-how agreement has not yet been reached for the D.M.T. unit the K.E.K. executives hope to have act similar to that ofthe polycondensation unit. Therefore to sum up:

   The total amount of the know-how fees is 7.000.000 D.M. ($ 1.750.000). % 50 of this sum will be paid at the signature date of the act, and the rest will be paid in three year installements. The first portion of the know-how

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fees will be provided with the foreign currency credit by the Industrial Devëlopment Bank. Currency for the remaining portion will be provided from other sources. The portion of the know-how fees that are included in the set-up costs are:

$ 875.000 = 7.945.000 TL.

2. Training Fees: For the polycondensation and fiber processes 5 technical executives ofK.E.K. (4 weeks), 9 technicians and four men(8 weeks) will pass a training period in Hoeschst facteries.

Transportation fees (14 x 3500)	TL.	49.000
Foreign currency needs		56.750
(350 $/month for the executives, 250 $/month for the technicians)		
Total transportation fee for training		98.000
Total foreign currency outflow $ 12.500		113.500

3. Transfer expense of the know-how and training fees

(7.945.000 + 113.500) 0.04 = TL. 322.340

4. Corporations Tax to be paid for the know-how fee

7.945.000 x 0.20 = 1.589.000 TL.

5. Organization expenses

100.000 TL.

6. Administrative costs in the grace time

450.000 TL.

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7. Contract and Mortgage expenses

$ 8.325.000 = 75.591.000 TL.

75.591.000 x 0,015 = 1.133.860 TL.

APPENDIX XIV

Working Capital

A) Polyester fiber unit (Chips included) 5000 ton/year

		1000 TL.	Brief Explanation
1.	Raw and supplemantary material stock	1.600	The importation of these materials will provided by petro-Chemical industries. 15 days avarage stock is taken as the basis.
2.	Semi-finished materials stock	2.500	The half of the product cost (less depreciation) for an average of 15 days is taken as the basis.
3.	Stock of the finished product	7.000	Basis was 1.5 months. Average cost of the product (less depreciation) for this period.
4.	Other material needs	900	This is guessed figure based upon previous experience.
5.	Other cash needs	3.000	
	Work in Capital	15.000	

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B) D.M.T. unit , 16.000 ton per year

		1000 TL.	
1.	Raw and Supplementary material stock	1.600	Same as above
2.	Semi-finished materials stock	2.400	"
3.	Stock of the finished product	4.800	Basis 1 month
4.	Other material needs	200	
5.	Other cash needs	1.000	
		10.000	

C) Unit cost Calculations

Annual operational expenses and the corresponding average cost figures pertaining to the polyester fiber unit and the D.M.T. unit are calculated seperately.

A) Polyester Fiber unit

While calculating average polyester fiber cost per kilogram three possible capacity levels, namely; % 60, % 80 and % 100 of 5.000 ton per year planned capacity are being considered. The calculated average cost and the basis of this calculation is given in detail in (Table 1). In these calculations the raw and supplementary materials costs, fuel and electrical expenses are taken from Uhde's proposal exactly. While calculating the overall payroll (labor and administrative expenses) a more conservative approach than the one utilized by Uhde is taken. (Uhde calculates administrative payroll as % 50 of the labor expenses, while % 64 of this figure is assumed in the

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TABLE-I

K.E.K PROJECT ANNUAL OPERATIONAL EXPENSES

A. POLYESTER FIBER UNIT (Including Chips)

Capacity: 5000 Tons fiber per annum

Types of expenses	3000 Tons per year (%60 capacity)			4000 Tons per year (%80 cap.)			5000 Tons per year (100 %)			Explanatory notes
	Local component of money	Foreig comp. of money	Total	L. C	F. C	Total	L. C	F. C	Total	
	1000 T.L	1000 T.L	1000 T.L	1000 T.L	1000 T.L	1000 T.L	1000 T.L	1000 T.L	1000 T.L	
1. Raw and supplementary materials - D.M.T	6.160	11.660	17.820 ~~8.210~~	8210 ~~15.550~~	15.550 ~~23.760~~	23.760 ~~10.260~~	10.260 ~~19.440~~	19.440	29.700	C.i.f 1600 D.M /ton = 3600 TL/ton Customs 5500 T.L/ton, 1,08 kg DMT/kg Fiber
a. glycol	2.500	2.180	4.680	3.330	2.910	6.240	4.160	3.640	7.800	Cif 780 DM/ton = 1750 T.L/ton Customs 3750 T.L/ton. 0,416 kg glycol/kg fiber
b. other supplementary materials	870	—	870	1.160	—	1.160	1.450	/ —	1.450	130 D.M = 290 T.L
2. Fuels	1.040	—	1.040	1.390	—	1.390	1.730	—	1.730	Steam 1.150 kg/T.L and Fuel oil 300 T.L/ton.
3. Electricity	1.710	—	1.710	2.280	—	2.280	2.850	—	2.850	2300 kwh/ton and 0.25 TL/kwh.
4. Wages	520	—	520	520	—	520	520	—	520	Including social insurance 40.000 T.L/month, 13 months
5. Work force	3.950	—	3.950	3950	—	3.950	3.950	—	3.950	Social expenses included 1600 T.L/worker, 190 workers, 13 months.
6. Administrative expenses	2. 500	—	2. 500	2.500	—	2. 500	2.500	—	2. 5000	guesswork (500.000 T.L Building tax and 400.000 T.L insurance included.)
7. Repair and Maintenance	1. 100	500	1. 600	1.100	500	1. 600	1.100	500	1. 600	Machine and equipment over F.o.b %4
8. Rents	100	—	100	100	—	100	100	—	100	Sales office in town
9. Depreciation expenses										
Buildings	680	—	680	680	—	680	680	—	680	17. million and %4
Machine & Equipment	7200	—	7200	7200	—	7.200	7.200	—	7.200	48 " " %15
Fixed assets and Transp.	200	—	200	200	—	200	200	—	200	1 " " %20
Know-How	1.960	—	1.960	1.960	—	1.960	1.960	—	1.960	9.8 " " %20
Set-up expenses	400	—	400	400	—	400	400	—	400	2 " " %20
10. Interest expenses	3.500	—	3. 500	3. 500	—	3. 500	3. 500	—	3. 500	Investment 85 million, T.L = Capital 50 million T.L + Investment credit (35 million T.L (Interest %10)
	2.250	—	2. 250	2. 250	—	2. 250	2. 250	—	2. 250	Working capital 15 mil. T.L Commercial credit (Interest %15)
11. Sales expense	200		200	250		250	600		600	
Annual Total of operational expenses	36. 840	14. 340	51. 180	40. 980	18. 960	59. 940	55. 410	23. 580	68. 990	
Average unit cost of polyester fiber (T.L/kg)			17.30 T.L/kg			15.00 T.L/kg			14.00 TL/kg	

1) Notes: Tax that is paid at the import of D.M.T and glycol (796 T.L/ton for D.M.T and 388 T.L/ton for glycol) increases the polyester cost by 1.02 T.L/kg. If tax exemptions can be provided there will be a 14.00 - 1.02 = 12,98 T.L/kg reduction in fiber cost when operating in %100 capacity.

2) Note: At the end of the fifth year set-up and know-how expenses will be totally cleared. Hence while operating at 5000 ton/year capacity cost will drop by 2360/5000 = 0,48 T.L to 13.50 TL/kg.

Table due to safety reasons.) This 64 % is based on actual calculations of the administrative expenses and it is found to be more realistic. The depreciation method is straight line while the useful life of the items included vary. In calculating the sales expenses I made use of the valuable experience of the K.E.M executives in this field.

As a result the respective operational expenses and the corresponding average unit cost in three different capacity levels are as follows:

	Unit	3000 ton (% 60)	4000 ton (% 80)	5000 t. (%100)
Annual operational expenses	1000 TL.	51.180	59.940	68.990
Average fiber cost	TL/kg.	17.30	15.00	14.00

So the average cost falls from 17.30 TL./kg. when working in % 60 capacity to 14.00 TL/kg. while utilizing % 100 capacity. At this stage utilization of % 100 cpacity is found to be most beneficial. Assuming that 100 % capacity will be reached in future operations the following points are of interest:

1. .A certain anount of customs tax is paid on the raw materials (glycol etc.) that are imported. The share of this sum in average unit of 1 kg. polyester fiber is 1.02 TL/kg. So if it will be possible to provide customs-tax exemption the average cost of polyester fibers falls to 14.00 TL/kg.-1.02 TL/kg = 12.98 TL/kg.

2. This newly obtained 12.98 TL/kg. cost figure is a highly competing one both internationally and domestically. The domestic competition analysis

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B. K.E.K ANNUAL OPERATIONAL EXPENSES , D. M. T UNIT, (16.000 ton / annum D.M.T.)

Types of expenses	9600 Ton/ year (%60 capacity) Local compo. of money 1000 T.L	Foreign compo. of money 1000 T.L	Total 1000 T.L	13500 Ton / year (%80 cap.) L.C 1000 T.L	F.C 1000 T.L	Total 1000 T.L	16.000 Ton / year (100% capacity) L.C 1000 T.L	F.C 1000 T.L	Total 1000 T.L	Explanatory notes
1) Raw of supplementary material a-) P-xylol	5.250	12.270	17.520	7.000	16.360	23.360	8747	20.448	29.195	Cif 800 D.M / t = 1.800 T.L / ton Custom 2.750 T.L / ton, 0.710 kg P-xylol / kg D.M.T
b) Methanol	2.390	3.000	5.390	3.200	4.000	7.200	3.970	5.015	8.985	Cif 290 DM / ton = 653 TL / ton, custom 1,170 TL / ton, 0,480 kg metha. / kg D.M.T
c) others	610	—	610	810	—	810	1.010	—	1.010	25 DM = 63 T.L / ton
2) Fuels	2.220	—	2.220	2.960	—	2.960	3.700	—	3.700	For steam production, 770 kg / ton Fuel oil, 300 TL / ton.
3) electricity	2.400	—	2.400	3.200	—	3.200	4.000	—	4.000	1000 kwh / ton and 0,25 T.L / kwh.
4) wages	325	—	325	325	—	325	325	—	325	Including social insurance, 25.000 T.L / month for 13 months.
5) Work force	2.400	—	2.400	2.400	—	2.400	2.400	—	2.400	Including social expenses 1600 TL / worker 115 workers for 13 months.
6) Administrative exp.	1.000	—	1.000	1.000	—	1.000	1.000	—	1.000	
7.) Repair and maintenance	1.600	400	2.000	1.600	400	2.000	1.600	400	2.000	over machine and equipment a rate of %4
8) Rents	—	—	—	—	—	—	—	—	—	Sales office already present.
9) Depreciations:										
a) Buildings	320	—	320	320	—	320	320	—	320	8 million and %4
b) Mach & Equipm.	7.500	—	7.500	7.500	—	7.500	7.500	—	7.500	50 " " % 15
c) Fixed assets & transport.	100	—	100	100	—	100	100	—	100	0,5 " " % 20
d) Know-how	1.960	—	1.960	1.960	—	1.960	1.960	—	1.960	9,8 " " % 20
e) set-up expenses	200	—	200	200	—	200	200	—	200	1 " " % 20
10) Interests	4.000	—	4.000	4.000	—	4.000	4.000	—	4.000	Investment 73 million T.L = 35 million capital + 40 million investment credit (Interest %10)
	1.500	—	1.500	1.500	—	1.500	1.500	—	1.500	working capital, additional 10 million T.L commercial credit (%15)
11) Sales expenses	300	—	300	500	—	500	600	—	600	
Annual Operational Expense Total	34.075	15.670	49.745	38.575	20.760	59.335	42.932	25.863	68.795	
Average per unit cost for D.M.T (T.L/kg)			5.20 TL/kg			4.55 TL/kg			4.30 TL/kg.	

of the polyester fibers-if produced at this price with other conventional textile fibers - stress will be on cotton - will be analyzed in detail in the coming chapter of this thesis

B) D.M.T. unit

The some type of calculations to arrive a unit cost for the manufacture of D.M.T. are carried out in detail in (Table 2) the results of these calculations can be summarized as follows.

	Unit	9000 ton (% 60)	13.000 ton (% 80)	16.000 ton (100 %)
Annual operational expenses	1000 TL	49.745	59.335	68.795
Average D.M.T. cost	TL/kg	5.20	4.55	4.30

The following conclusions can be drawn from the critical analysis of (Table 2)

1. Shifting from % 60 capacity to 100 % capacity results in a 0.90 TL/kg. reduction in unit cost of D.M.T.
2. The main ingredient in D.M.T. production is methanol which is imported. The share of customs-tax on methanol importation is around 70 TL/ton. If tax exemption can be provided the cost of D.M.T. falls to 4.230 TL/ton.
3. Since the know-how and set-up expenses will be totaly cleared 5 years after the active operational date of the factory, there will be a 135 TL/ton reduction in D.M.T. production cost after this elapsed time period. So the new cost would be 4230 TL/ton-135 TL/ton = 4.195 TL/ton.
4. Another prime consideration in this calculations is Turkey's

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possible entrance to the European common Market. If this is realized all the customs walls will be removed. This removal will result in a 800 TL/ton reduction in unit D.M.T. costs. Because all raw and supplementary materials utilized in D.M.T. process will be free of customs. Hence this future prospect results in a 4195 TL/ton-800 TL/ton = 3395 TL/ton unit average cost for D.M.T. This possibility is not a misty one. Our entrance in the future is considered to be must by all the speakers in the "European Common Market conferences" held in Istanbul, September 1967.
If we enter the European Common market, the imported D.M.T. free from all custom walls will enter the country with a price 3600 TL/ton. Even if it is assumed that the calculations D.M.T. unit price is carried out on a rather optimistic basis, there still exists the possibility of competing in foreign markets. Besides international market possibilities, the existence of S.A.S.A. the competitor firm in Adana must be considered. Presently S.A.S.A. having a capacity of 4200 ton polyester fiber / year and planning a jump to 5500 - 7000 ton Fiber / year in the coming years is importing the chief raw materials D.M.T. Although the two firms K.E.K. and S.A.S.A. will be competitive in their end-products S.A.S.A. may find it convement to purchase D.M.T. from K.E.K suppliers. Although the trends of S.A.S.A. will be predicted in the Competitive Analysis part of this thesis, there is ample justification for keeping K.E.K's D.M.T. capacity, at 16.000 ton/year, a figure higher than the volume of current domestic demand.

5. When custom walls will be removed completely this domestically produced D.M.T. will be channelized to the polyester fiber unit as the chief raw-material. This very process

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will result in a 2.48 TL/kg cost of fiber. Thus the newly reached figure is 10.60 TL/kg of polyester fiber. This reduced figure is reached by the K.E.K. investors. While trying to analyze the profitability of this project this same figure will be used. The relevancy of this forecast will be critically analyzed in the competitive analysis phase of this thesis.

D) Economic Feasibility ofthe Project

In order to evaluate the economic feasibility of the project the concept of "profitability" or "percent return on investment" is taken as the basis. While carrying out the calculations the present value of money is not taken into consideration. The analysis is simply conducted to give the reader a general idea as to the economic feasibility of the project. The cost of capital and the present value considerations will be discussed at the "Cash Flow analysis" part of this chapter. This part includes a "Break-even analysis analysis" of the two seperate items ofthe total project; namely for the polyester fiber unit and D.M.T. unit. While doing this study two broad alternative conditions that the company may face are considered. These are:

1. According to the production capacities (% 60, % 80, %100) as was seen in the previous parts ofthis chapter.

2. Conditions that may prevail;

   a) First five years according to the present custom laws.

   b) Assuming that conditions pertaining to the custom laws will not change in the years following the first five years period.

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c. The complete removal of custom walls according to European Common Market regulations when our full enterance is granted.

The analysis will be carried out seperately for the Polyester and D.M.T. unit to arrive at two different Break-even charts.

A) <u>Polyester Fiber Unit</u>

Calculations pertaining to the profitability of the polyester unit are given in (Table A) in detail. Analysis of (Table A) is carried out in the existence of two possibilities; namely the persistence of the present custom regulations and the total removal of these limitations. The following conclusions are obtained from (Table A)

1. <u>According to present custom regime</u>:

The sales price for polyester fiber is predicted to be 18 TL/kg by the K.E.K. executives. Under the present conditions this figure is found quite appropriate both by the S.A.S.A. and K.E.K. decision-makers, bearing in mind that polyester fibers were sold for 28 TL/kg. in 1968. The capital is approximately 50 million liras. So the annual in- and outflows are:

a. <u>In the first five years period, when the set-up and know-how costs are not yet clearded.</u>

Net profit before Tax at 60 % production rate 2.8 million TL. (% 6)
Net profit before Tax at 80 % production rate 12.0 million TL (% 24)

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Net profit before Tax at 100 % production rate
21.0 million TL (% 42)

b. In the following years when the set-up and know-how cost are totally cleared:

Net profit before Tax at 60 % production rate 5.16 million TL (% 10).
Net profit before Tax at 80 % production rate 17.36 million TL (% 24)
Net profit before Tax at 100 % production rate 23.36 million TL (% 42)

The increase in rate of return on investment is very pronounced when operations shift from % 60 production rate to % 100 under the assumption that present custom laws will prevail. Aside from all considerations it is clear that the profitability ofthe unit is rather high. A break-even diagram for the Polyester Fiber unit is drawn in (Chart 1). This chart shows that the Break-even point under the present conditions is at % 54 capacity, which surely results in a high profitability index. The pay-back period for the polyester fiber unit is roughly three years. (This figure is calculated by dividing the total investment of nearly 100 million TL by the sum of Net profit after taxes, interest expenses and depreciation totals)

2. When custom walls are total ly removed:

Entering the European Common Market both S.A.S.A. and K.E.K. has to face the keen competition that will come from Western countries. To carry out a sound competitive analysis with the international market, the current C.I.F. price of polyester

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fibers in Europe 1.20 $/kg. = 10.9 TL/kg. is assumed as the the future sales price. This is quite a realistic and conservative assumption since it is an optimal one reached by the giants in this field. Those giants include such firms like Uhde of Germany and Montecattini of Italy. Under such premises, similar type of calculations are carried out in (Table A). Again with 50 million TL capital the following in and outflow figures are obtained:

Net loss at 60 % production rate 7.48 million TL
" " " 80 % production " 2.40 " TL
Profit before takes at 100 % production rate 2.48 million TL (% 5)

So the profitability of the polyester unit greatly decreases to loss figures at 60 and 80 % capacity rates. The Break-even point under those conditions are reached at 86 % capacity level. At 100 % capacity the unit makes profit at a rather low rate (% 5). So the entrance possibility to the European Common market damages the economic feasibility of the project. But the following points can be considered to the advantage of the project.

1. Two conditions; namely the forecasted increasing potential demand for the product together with the hattery characteristic of the operational activities (The capacity may be doubled by placing a new machinery near the existing one. The plant, lay out is planned considering this probable increase in capacity.) will result in capacity increases of the unit. This possibility will increase the profitability of the project. The unit can thus survive even in the

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existence of such keen competition if capacity levels are directed to more optimal ends. This is a fact that K.E.K. and S.A.S.A. executives must seriously consider since the optimal capacity for polyester fiber units is between 12.000-16.000 ton/annum , and this highly optimal figure of 10.6 TL/kg. is obtainable only under such an expansion.

2. Turkey"s entry into the European Common Market seems certain. But, the general idea derived from the late European Common Market Congerences held in Istanbul 1967, was that this entry would at least take another 10 years due to the 7 years grace period granted to Turkey. So under such circumstances the total investments in machinery and equipment will bedepreciated, this will result in a decrease in cost. Hence one may except a 20 % rate of return figure for the project in the future, even if we do enter the European Common Market and have to face their keen competition.

B. D.M.T. Unit

Calculations pertaining to the profitability of the D.M.T. unit are given in (Table 4). Considerations for this unit are the same as the polyester fiber unit.

1. According to the present custom regime:
Local sales price assumed for D.M.T. in (Table B) calculations is 6.000 TL/ton. (Present-customs included-import price of D.M.T. is 5.500 TL/ton) It is assumed that this figure will drop to 5.500 TL/ton after a short period of time. Exports are assumed to be carried out at a price of 3.500 TL/ton (World Market Prices). Capital is 35 million TL and the in and outflows for the unit are as follows.

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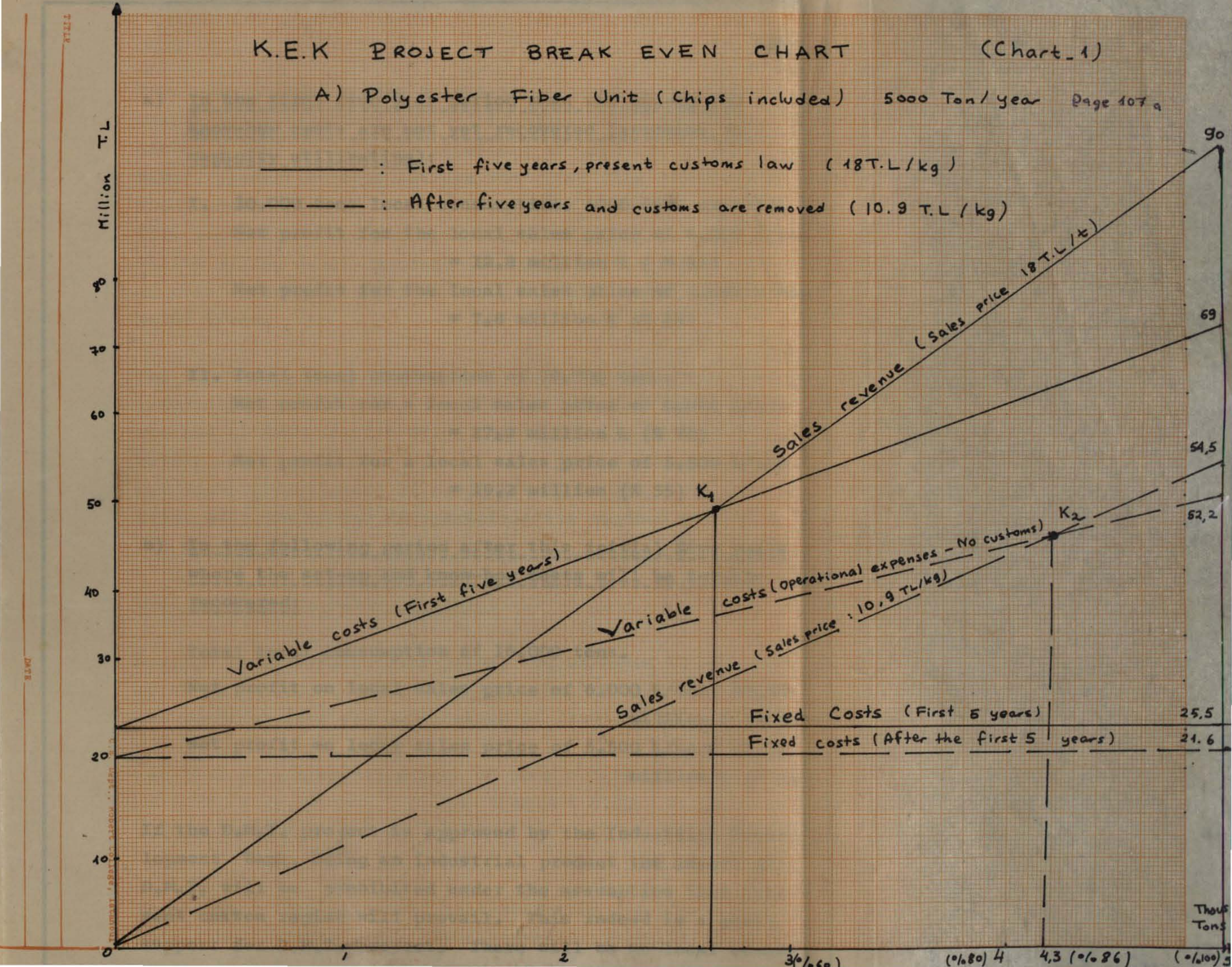

K.E.K PROJECT BREAK EVEN CHART (Chart_1)
A) Polyester Fiber Unit (Chips included) 5000 Ton / year
Page 107 a
Million T.L
: First five years, present customs law (18 T.L / kg)
: After five years and customs are removed (10.9 T.L / kg)
Sales revenue (Sales price 18 T.L / t)
Variable costs (First five years)
Variable costs (operational expenses - No customs)
Sales revenue (Sales price : 10,9 TL/kg)
Fixed Costs (First 5 years)
Fixed costs (After the first 5 years)
K1
K2
90
69
54,5
52,2
25,5
21.6
80
70
60
50
40
30
20
10
0
1
2
3(%60)
(%80) 4
4,3 (%86)
(%100) 5
Thous Tons

a) In the first five year period when the set-up and know-how costs are not yet recovered (assuming full capacity utilization):

I. 10.000 tons local consumption. 6000 tons exports:

Net profit for the local sales price of 6.000 TL/ton
= 12.8 million TL (% 37)

Net profit for the local sales price of 5.000 TL/ton
= 7.8 million TL (% 28)

II. Total local consumption of 16.000 tons.

Net profit for a local sales price of 6.000 TL/ton
= 27.2 million TL (% 78)

Net profit for a local sales price of 5.500 TL/ton
= 19.2 million (% 55)

b) In the following period after this initial five years where the set-up and know-how costs will be totally recovered:

Total local consumption of 16.000 tons.

Net profit on local sales price of 6.000 TL/ton= 29.36
million TL (% 84)

Net profit on local sales price of 5.500 TL/ton= 21.36
million TL (% 61)

If the D.M.T. project is approved by the Industrial Development Bank, being an industrial product the import of D.M.T. will be prohibited under the assumption that present custom regime will prevail. This indeed is a great support for D.M.T. project. There will be no local competition. The only competitive source, the Petro-Chemical

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five year planned period as was pointed out by Feridun Onar - production manager of Petro-Chemical industries-. Although they possess the necessary aromatic units for D.M.T. production they believe that this line of activity shoul d be carried by the end-user firms, namely the textile industries like all over the world. So the profitability of the D.M.T. project is highly commandable, even if this sales price is reduced to the CIF import figure of 5.500 TL/ton.

The Break-even diagram drawn according to the above summary information is given in (chart-2). Break-even point is reached at 45% capacity which pronounces the high profitability of the project. The pay-back period for the unit is 2.6 years (for a price of 6.000 TL/ton) or 3.1 years (for a price of 5.500 TL/ton) if operations are carried out at 100 % capacity.

2. <u>When customs are removed totally</u>

For the local D.M.T. sales price, the existing C.i.f. price of 400 $ = 3.500 TL/ton is assumed. Following conclusions can be drawn from the calculation of (Table - B)

Net loss at a production rate of 60 % = 5.39 million TL
" " " " " " " 80 % = 0.10 " "
Net profit before Tax at a production rate of 100 % = 3.70 million TL. (%10)

So the same considerations that hold true for the polyester unit also prevails here. The Break-even point being at a rather high 81% capacity figure, satisfactorl profits can be achieved only at 100 % capacity. Further decreases in

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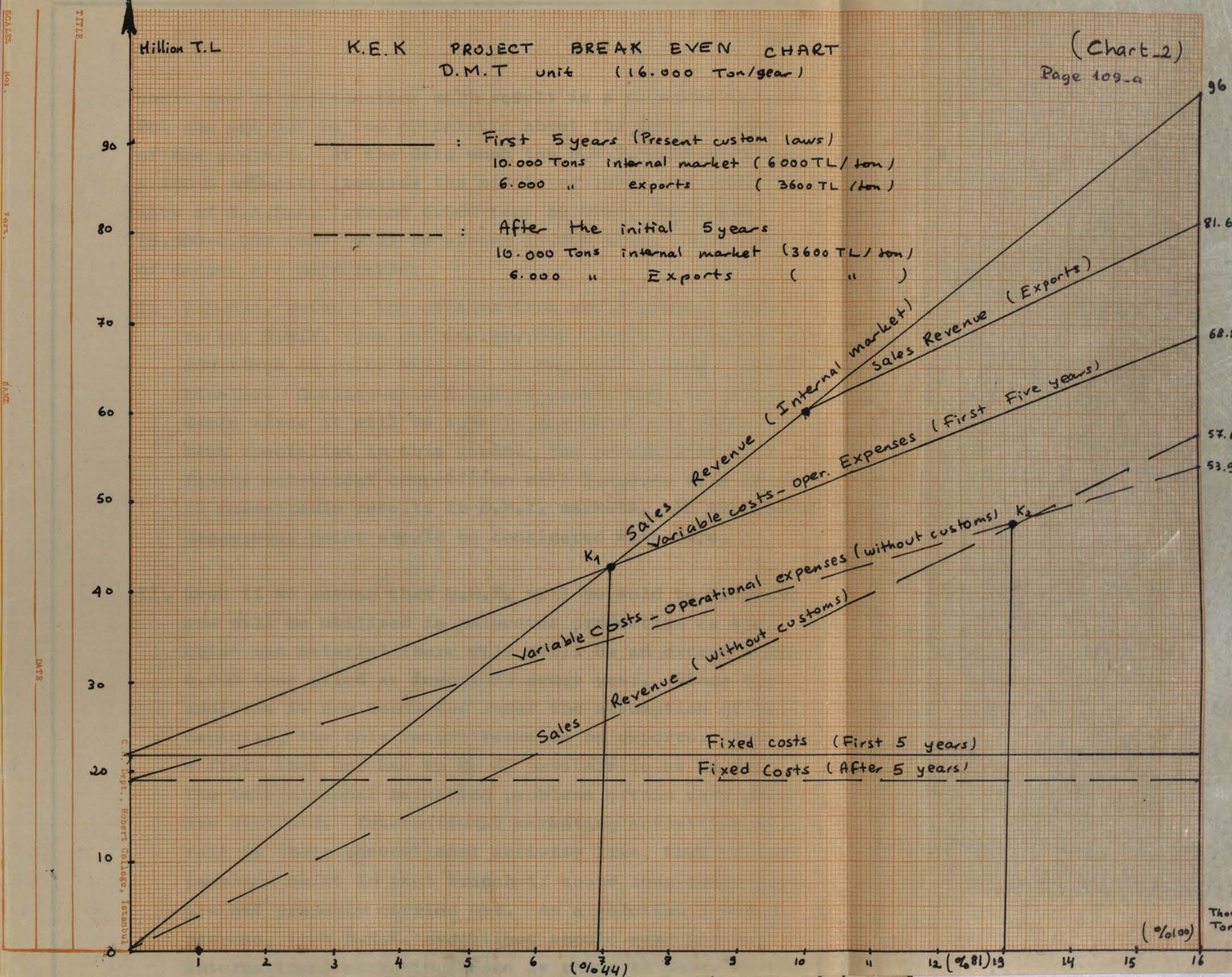

Million T.L
K.E.K PROJECT BREAK EVEN CHART
D.M.T unit (16.000 Ton/year)
(Chart_2)
Page 109_a
: First 5 years (Present custom laws)
10.000 Tons internal market (6000 TL/ton)
6.000 " exports (3600 TL/ton)
: After the initial 5 years
10.000 Tons internal market (3600 TL/ton)
6.000 " Exports (")
Sales Revenue (Internal market)
Sales Revenue (Exports)
Variable costs - oper. Expenses (First Five years)
Variable Costs - Operational expenses (without customs)
Sales Revenue (without customs)
Fixed costs (First 5 years)
Fixed Costs (After 5 years)
K1
K2
96
81.6
57.
53.
(%44)
(%81)
(%100)
0
10
20
30
40
50
60
70
80
90
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16

costs due to depreciation will result in a decrease in cost. But one can not be too optimistic about the initial phase of the project. At the date when the D.M.T. unit will reach a 100 % capacity (towards the middle of 1972) the total capacity of S.A.S.A. (around 6.000 tons by then) and K.E.K. (5.500-6.000 tons) will be around 11.000 tons. Two signs of danger are detectable:

I. S.A.S.A. being a competitive firm would perhaps prefer to buy D.M.T. from outside sources, since a comparative advantage in price will not be secured if bought domestically. Quality-wise K.E.K.'s D.M.T. will be commandable since it will be totally guarenteed by Uhde, the best specialist in this field. The possibility of a future cut-throat competition with S.A.S.A. will lead to undesirable results in D.M.T. markets. So the second dangereous point should be considered with care.

II. Even if we assume that D.M.T. will be sold to S.A.S.A. and will be utilized in polyester production as the chief raw material there will still be an excess 5.000-6.000 tons piled as inventory every year. Since the analysis is now conducted under the assumption of full capacity, the only resort seems to be exports. This is a field that one has to be as pessimistic as he can. The international marketing problems ofthis very product are manifold. International marketing activities do not fall in their conventional activity line, thus serious problems exist in that branch if sound long-range plans are not properly carried out. As a solution I would propose, that K.E.K. executives should seek paralel international marketing lines as those of Uhde, as soon as possible.

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TABLE - A

Profitability Calculations for the Polyester fiber unit

(Chips included) 5.000 Tons capacity.

Annual Production Rates (000's Tons)

	3000 Tons % 60 Capacity Thousand TL.	4000 Tons % 80 Capacity Thousand TL.	5000 Tons % 100 capacity Thousand TL	Explanatory notes
Annual Sales Revenues				
a) Under present customs regime	3.000x18=54.000	4.000x18=72.000	5.000x18=90.000	Sales price 18TL/kg
b) When customs walls are removed	3.000x10.9=32.700	4000x10.9=43.600	5000x10.9=54.500	Sales price 10.9 TL/kg.
Annual Operational Outflows				
a) First five years	51.200	60.000	69.000	Before set-up and know-how costs are cleared. Figures are taken from Table - I.

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TABLE - A

Annual Production Rates (000's Tons)

	3000 Tons % 60 Capacity Thousand TL.	4000 Tons % 80 Capacity Thousand TL.	5000 Tons %100 Capacity Thousand TL.	Explanatory notes
Annual Operational Outflows				
a) After the first five years	54.000-48.840 = 5.160 (% 10)	72.000-57.690 =17.360 /% 55)	90.000-66.640 = 23.360 (%47)	Sales price 18 TL/kg.

Profitability Calculations (capital 50 million TL)

	3000 Tons	4000 Tons	5000 Tons	Explanatory notes
a) First five years	54.000-51.200 =2800(% 6)	72.000-60.000 =12.000 (%24)	90.000-69.000 =21.000 (% 42)	Sales price 18 TL/kg
b) After the first five years	54.000-48.840 = 5.160 (%10)	72.000-57.640 =17.360 (% 55)	90.000-66.640 =17.360 (%47)	Sales price 18 TL/kg.
c. When custom walls are removed	22.700-40.180 = -7.480	43.600-46.100 = - 2.400	54.500-52.220 = 2.280 (%5)	Sales price 10.9 TL/kg.

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Table - B

Profitability Calculations for the D.M.T. unit at 16.000 Tons Capacity

Annual Production Rates (1000 Tons)

	9600 ton % 60 (1000 TL.)	13.000 tons % 80 (1000 TL.)	16.000 ton % 100 (10.000 TL.)	Explanatory notes
Annual Sales Revenues				
a) The excess of 10.000 tons will be expected.	9.600x6=57.600	(10000x6)+(3000x3.6) = 70.800	(10000x6)+(6000x3.6) = 81.600	Local sales price 6000TL/T. export price 3.600 TL/ton.
b) Total Local consumption	9.600x5.5=52.800	13.000x5.5=71.500	16.000x5.5=88.000	Sales price 5.500 TL/ton
c) When custom walls are removed	9.600x3.6=34.560	13.000x3.6=46.800	16.000x3.6=57.600	Sales price local and export both is assumed 3.600 TL/ton.
Annual Operational Outflows				
a) First five years	49.750	59.350	68.800	Round off figure from (Table 2)

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TABLE - B

Annual Production Rates (1000 Tons)

Annual Operational Outflows	9600 tons % 60 (1000 TL.)	13.000 Tons % 80 (1000 TL.)	16.000 Tons % 100 (10.000 TL.)	Explanatory notes
b) After the first five years	47.590	57.190	66.640	When know-how (1.960,000 TL) and set-up (400.000 TL) costs are cleared.
c) When custom walls are removed	39.950	46.700	53.900	Customs are removed.
Profitability calculations (Capital 35 million TL)				
a. First five years				
i) The excess of 10.000 tons will be exported.	57.600-49.750 =7.850 (% 22)	70.800-59.350 = 10.450 (%50)	81.600-68.800 =12.800 (%37)	Local sales Price=6.000TL/T.
ii) Total local consumption	52.800-40.750 =3.210 (% 9)	71.500-59.350 =12.150 (%35)	88.000-68.800 = 19,200 (%55)	Sales price = 5.500TL/ton
b) After the first 5 years				
i) The excess of 10.000 tons will be expected.	57.600-47.590 =10.010 (% 29)	70.800-59.350 = 13.610 (%39)	81.600-68.800 =14.960 (% 43)	Local S.P.=6000TL/T. Export " =3600TL/T.

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Profitability Calculations (Capital 35 millions TL)

b) After the first 5 years	9600 ton % 60 (1000 TL.)	13.000 tons % 80 (1000 TL.)	16.000 Ton % 100 (10.000 TL.)	Explanatory notes
ii) Total local consumption	87.600-47.590 =5.210 (% 15)	70.800-57.190 14.310 (% 41)	81.600-66.640 =21.360 (% 61)	Sales price 5500 TL/ton
iii) When custom walls are removed	34.560-39.950 = -5.390 (-)	46.800-46.700 = 100 (-)	57.600-53.900 =3.700 (%10)	Sales price local and export together = 3600 TL/ton

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Cash Flow analysis of the Project

A complete cash flow analysis of the K.E.K. project is carried out for six years period, the beginning date being 1968. The first three years of the project ($2\frac{1}{2}$ years to be exact) will be devoted to the choice of plant site and location followed by construction of the buildings, installation of machinery and equipment, recruiting and training of the necessary work-force. Surely there will be no revenue generated from production operations in this period. Production will start in 1970 and the second phase of the analysis evaluates the flow of cash in the next four production years.

The detailed analysis for both projects are given in detail im (Table-3) and (Table-4). Here under the heading of sources various kinds of cash flows are accumulated. Cash outflows includes the figures that are broadly discussed in the previous parts of this thesis. Both in polyester unit and D.M.T. calculations it is assumed that % 10 dividents will be distributed to stockholders starting from the second operational year. While preparing this Tables it was also assumed that the long-term liabilities will be paid in % 20 installations.

These assumptions pertaining to the rates ofdividend distribution and payment of long-term liabilities are made by the K.E.K.'s management team. There figgures were quite realistic, so I have applied figures derived from their project proposal, directly to my cash flow analysis.

This cash flow analysis simply deals with the available resources and outflows that the company will possess during the coming 6 years period, considering the company as a seperate entity.

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A) Polyester Fiber Unit

The financing needs for the project are 5 million TL for the first year, 60 million TL for the second year and 20 million TL for the third year. These sum up to a total of 80 million TL. This sum will be financed with 50 million TL capital in three years and with 35 million TL investment credit during the last two years. (Credit period 5 years, payments will begin 1 year after the operations.) In the operations period additional financing needs will be provided by 15 million TL. commercial credit. In the first year (for only 8 months) and second year the unit will operate at 80 % capacity, while starting with the third year it will operate at full capacity. Commercial credits will be paid starting with the first year. Assuming that profits will be realized starting with the second year, dividends at a 10 % rate on net profits will be distributed. Consequently, at the end of the fourth operational year it will be possible to pay the credit interests, 60 % of the investment credit debt and % 10 dividends.

B) D.M.T. unit

The financing needs for the project are; 26 million TL for the first year, 41 Million TL. for the second year, 8 million TL. for the third year. These sum up, to a total 75 million TL. This sum will be financed with 35 million TL. capital in the first two years, and with 40 million TL. investment credit at the last two years. (Credit period is 5 years, payments will begin 1 year after the operations.) In the operations period additional financement needs will be provided 10 million TL. commercial credit. In the first year (for 9 months) the firm will operate at 80 % capacity from the second year on with 100 % capacity. ./..

Credit interests will be paid from the first year on, and investment credit from second year on, also 10% dividends consequently at the end of the fourth operational year it will be possible to pay credit interests and 60 % of investment credit debt and 10 % dividents.

K.E.K Project Cash Flow Analysis, A) Polyester Fiber Unit (Chips production included) 15. ton per day and 5.000 ton/year fiber

(1000 T.L)

	Construction Period			First four years of production				
	1. year (1968)	2. year (1969)	3. year (1970)	1. year (1970)	2. year (1971)	3. year (1972)	4. year (1973)	TOTALS
A) Sources of cash proceeds								
1. Net profit	—	—	—	5.750 +	13.430 ++	19.190 +++	19.190	57.560
2. Paid-in capital & increase	5.000	35.000	10.000	—	—	—	—	50.000
3. Long term debts	—	25.000	10.000	—	—	—	—	35.000
4. Short term debts	—	—	—	15.000	—	—	—	15.000
5. Depreciations	—	—	—	10.440	10.440	10.440	10.440	41.760
Total cash proceeds	5.000	60.000	20.000	31.190	23.870	29.630	29.630	199.320
B) Cash outlays								
1. Fixed Assets								
a) Project	2.800	1.920	740	—	—	—	—	5.460
b) Land	1.000	—	—	—	—	—	—	1.000
c) Buildings	800	12.000	5.427	—	—	—	—	18.227
d) Machine & equipment	—	31.781	7.680	—	—	—	—	39.461
e) Transportation utilities	—	500	500	—	—	—	—	1.000
f) Assembly	—	2.500	1.250	—	—	—	—	3.750
g) Know-how	—	4.922	—	—	1.641	1.641	1.641	9.845
h) Set-up expenses	175	—	1.825	—	—	—	—	2.000
l) Contingencies	—	2.500	1.757	—	—	—	—	4.257
2. Net Work-in Capital	4.775	~~19.179~~ 58.623	19.179	15.000	1.641	1.641	1.641	85.000 / 15.000
3. Interest payments:								
a) For the long-term debt	—	2.500	—	3.500	3.500	2.800	2.100	14.400
b) For the short-term debt	—	—	—	2,250	2.250	2.250	2.250	9.000
4. Debt payments	—	—	—	—	7.000	7.000	7.000	21.000
5. Distribution of profits (%10 net)	—	—	—	—	5.000	5.000	5.000	15.000
Total cash outlays	4.775	~~19.179~~ 58.623	19.179	20.750	19.391	18.691	17.991	159.400
C) (Cash proceeds – cash outlays)	225	1.377 ~~821~~	821	10.440	4.479	10.939	11.639	39.920
Cumulutative	225	1.602 ~~2.423~~	2.423	12.863	17.342	28.281	39.920	

Notes:

\+ There will not be any profits incurred in the first production year. If 4000 ton capacity operates for 8 months it produces 2667 tons of fiber. This figure is 53.3% of 5000 tons. Since the Break even point is at 54% with the revenue obtained in this period that years total fixed and variable expenses will be compansated and there will be no profits.

++ At 4000 tons capacity:

Profit:
12.000.000 T.L /year
– 4.320.000 T.L (interest %36)
= 7.680.000 T.L
\+ 5.750.000 T.L (Interest)
= 13.430.000 T.L

(Profit figure for after Tax, before interest payment)

+++ At 5000 tons capacity

Profit:
21.000.000 TL/year
– 7.560.000 T.L (%36 Tax)
= 13.440.000 T.L
5.750.000 (Interest)
= 19.190.000 T.L

(Profit figure – after Tax before interest payments)

(Table- 4)

K.E.K PROJECT CASH FLOW ANALYSIS FOR THE D.M.T UNIT (16.000 Ton per year) 1000 TL

	Construction period			First four years of production				Totals
	1. year (1970)	2. year (1971)	3. year (1972)	1. year (1972)	2. year (1973)	3. year (1974)	4. year (1975)	
A) Sources of cash proceeds								
Net profit (Before interest, after tax)	—	—	—	10.300 +	13.700 ++	13.700	13.700	51.400
2) Increases in paid-in capital	26.000	9.000	—	—	—	—	—	35.000
3) Debt (Long term)	—	32.000	8.000	—	—	—	—	40.000
4) Debt (Short term)	—	—	—	10.000 ++	—	—	—	10.000
5) Depreciations	—	—	—	10.080	10.080	10.080	10.080	40.320
	26.000	41.000	8.000	30.380	23.780	23.780	23.786	176.720
B) Cash Outlays								
1.) Fixed assets								
a) Project	8.700	960	—	—	—	—	—	9.660
b) Land	—	—	—	—	—	—	—	7.700
c) Building	2.700	5.000	—	—	—	—	—	38.177
d) Machine & Equipment	8.705	27.172	2.300	—	—	—	—	500
e) Others & Transport	300	200	—	—	—	—	—	3 000
f) Assembly	—	2.400	600	—	—	—	—	9845
g) Know how	4.923	—	1.640	—	3.282	—	—	1000
h) set-up expenses	100	360	540	—	—	—	—	
i) Contingencies	—	1.818	1.300	—	—	—		3118
	25.428	37.910	6.380	—	3282	—	—	73.000
2) Working capital	—	—	—	10.000	—	—	—	10.000
3) Interest payments: a) Long term	—	3.200	—	4.000	4.000	3200	2400	16.800
b) Short term	—	—	—	1.500	1.500	1500	1500	6.000
4) Debt Payments	—	—	—	—	8.000	8000	8000	24.000
5) Profit Distribution (%10)	—	—	—	—	3.500	3500	3500	10.500
	25.428	41.110	6.380	15.500	20.282	16.200	15.400	140.300
(Cash proceeds — Cash outlays)	572	(1.110)	1.620	14.880	3.498	7.580	8.380	36.420
Cumulutative	572	462	2.082	16.962	20.460	28.040	36.420	

\+ In the first production year the profit is calculated as follows: At 13.000 ton capacity / year 9.750 tons can be produced in 9 months. This is 61 % of 16.000 tons capacity. According to the B. Even graph previously obtained (graph -B) the profit is 7.500.000 T.L so;

7.500.000 T.L	(9 months)	
– 2.700.000 T.L	(Tax %36)	
4.800.000 T.L		
5.500.000 T.L	(Interest)	
10.300.000 T.L		

++ The present demand for D.M.T (1968) is around 10.000 tons. The local sales of this amount and the export of the rest is assumed. At 16.000 tons capacity:

Profit:

12.800.000 T.L /year	
– 4.600.000 T.L (%36 interest)	
8.200.000 T.L	
5.500.000 T.L (Interest)	
13.700.000	

+++ working capital will be used for the starting operations.

CHAPTER VI. LONG RUN EFFECTS OF THE PROJECT AND CONCLUSION

A) A Brief summary to the propogation of the project.

B) The effect of the K.E.K. project to Balance of Payments

C) The effect of the project to National Economy.

D) Competitive Analysis

E) C6nclusions

In this final chapter of this thesis the long-run effects of the K.E.K. project are analyzed. Although being a short one, I have spent most of my efforts on this part in drawing conclusions. Especially in the case of Competitive analysis I had the utmost difficulty of collecting information due to the very competitive nature of the Textile Industry.

Starting with a brief summary of the advancement process of the project, the long-run effects of the project upon Balance of Payments and National Economy have been analyzed in broad terms. Exact data, information and forecasts were not available to carry out a more extensive and detailed analysis, of those future effects, such a study necessitated, multifold assumptions which could not readily be justified.

I think the broad nature of this analysis is quite adequate to give a general idea to the reader, as to the value of project.

One point was especially pleasing. The conclusions derived in this chapter were almost the same as the ones reached by an extensive analysis done by the State planning organization. Their conclusions and recommendations included in their very recent - 2 / 5 / 1968 report follow almost paralel lines with mine.

A) A Brief Summary to the propogation of the project

1) The lead time for the project is slightly over four years (From the beginning, of 1968 to April 1972). During this period the investment expenses amount to nearly 158.000.000 TL

2) During this period the polyester fiber unit will begin its operations. The unit will operate at 80 % capacity

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for 20 months. With the revenue generated by the operations of this period a bulky portion of debt payments will be made, plus the % 10 devidend distribution to stockholders.

3. Starting from the begining of 1972, till the end of 1973 both units will operate at 100 % capacity. With the revenue generated by the operations of this second period the total of debt and dividend payments will be made, plus a net profit of 39.9 + 20.5 = 60.4 million TL. as was calculated in the previous chapter.

4. A last point that is of interest is that the depreciation method used in variable-operational cost calculation is straigh-line . The results derived above show that utilization of an accelarated method of depreciation would be more appropriate. Utilization of such a technique will remove part of the heavy burden that the company will face under the European Common Market Conditions.

B) <u>The effect of the K.E.K. Project to Balance of Payments</u>

Annual foreign currency savings that may be realized with the activities of both units are shown in the following Table in detail.

The effect of K.E.K. project to Balance of Payments

(Annual savings of foreign currency)

A) Polyester Fiber (Chips included). Production capacity 5000 T.

	1000 $ (% 60)	1000 $ (% 80)	1000 $ (%100)	Explanatory notes
a) Foreign currency needed for the import of polyester fibers	$ 3.600	$ 4.800	$ 6.000	Cif price 1.20 $/kg.
b) Foreign currency needed for the production of polyester chips domestieally	$ 1.560	$ 2.080	$ 2.5090	D.M.T. 1.08 kg/kg and 0.40 $/kg, glycol 0.416 kg/kg and 0.18 $/kg. Additional supplementory needs 55.000 $.
c) Annual net foreign currency savings	$ 2.040	$ 2.720	$ 3.410	

B) D.M.T. unit (16.000 ton production capacity)

Annual production rates

1) If all the D.M.T. is consumed domestically

	% 60	% 80	% 100	Explanatory notes
a) Foreign currency needed for the import of D.M.T.	$ 3.850	$ 5.200	$ 6.400	Cif price 400 $/ton
b) Foreign currency ne needed for the domestic production of D.M.T.	1.700	2.260	2.830	P-xylol 0.710 kg/kg and 200 $/ton, Methanol 0.489kg/kg and 72.5 $/ton and additional needs 60.000 $/year
	$ 2.150	$ 2.940	$ 3.570	

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2.) <u>If the excess of 10.000 ton D.M.T. is exported</u>

	%60	% 80	%100	
a) Foreign currency needs for the import of D.M.T.	$ 3.850	$4.000	$ 4.000	Cif price 400 $/ton
b) Foreign currency needs for the domestic production of D.M.T.	$ 1.700	$1.770	$ 1.770	P-xylol of 710 kg/kg and 200$/ton, Methanol o.480 Kg/kg and 72.5 $/ton. Additional needs 40.000 $/year
c) Annual net foreign currency savings	$ 2.150	$ 2.230	$2.230	
d) Foreign currency obtained from the export excess of 10.000 ton D.M.T.	-	$ 1.150	$2.300	Fob price 385 $/ton
e) Foreign currency needed for the domestic production of the export D.M.T.	-	$ 640	$1.070	P-xylol 0.710 kg/kg and 200 $/ton, Methanol o.480 kg/kg and 72.5 $/ton, 15.000 $/year additional needs
	-	$ 510	$1.230	
f) Total net foreign currency savings	$ 2.150	$ 2.740	$3.460	

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As was pointed out in the previous chapters the potential demand in Turkey is expected to follow an accelerated trend. The domestic production of this product will provide vast benefits to the country as shown in (Table-A). Aside from these figures, polyester fibers are expected to be substituted for Merinos wool, whose foreign currency needs are nearly 15 million $. There is a third beneficial point of interest, which is purposefully neglected in the previous calculations following a rather conservative approach. When the units begin to operate linearly methanol will be produced as a by-product of the D.M.T. condensation unit. After purification this methanol may be recyled to initial process. So methanol recovery will provide an additional 16.000 $ (2.190 ton x 72.5 $/ton) foreign currency saving.

C) The effect of the project to National Economy

The value added by the K.E.K. project is an attractive figure to the benefit of National Economy. Calculations in (Table-B) outline the process in detail. While carrying out the calculations the following assumptions are made:

a) Both units will work at full capacity
b) 10.000 tons of D.M.T. will be sold in Turkey, while the excess 6.000 tons will be exported.

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TABLE - B

Value added by the project

	Polyester unit (1000 TL.)	D.M.T. unit (1000 TL.)	Total (1000 TL.)
Wages	520	325	845
Work force	3.950	2.400	6.350
Depreciation	10.440	10.080	20.520
Profit	21.000	12.800	33.800
Value added	35.910	25.605	61.515
Total investm.	100.000	85.000	185.000
Value added coef. (Total investm.) / Value added	2.78	3.32	3.01

So in nearly three years a sum equivalent to total project investments will be added to national income.

D) Competitive Analysis

The potential competitors of K.E.K.'s products can be grouped in two categories. S.A.S.A., the main competitive firm, that has been referred to many times previously constitutes the major portion of competition. In the second category one can place three new synthetic fiber units placed in the Marmara area. A brief analysis of the competitive firms was found essential to make the right decision.

I. S.A.S.A.: S.A.S.A. is established with the joint investment of Bossa and Güney Textile Indusrties of the Adana region,

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with the payment of a $ 1 million royalty fee and a patent aggeement with I.C.I firm ofEngland. S.A.S.A had been importing D.M.T. and the polyester chips until the beginning of 1968 in order to produce polyester fibers. At the begining of 1968 the polyester chips production unit started its operations. So what S.A.S.A. does is to import the main raw material (D.M.T.) and the semi-finished product, (polyester chips), treat it in its fiber production unit to produce the end-product. S.A.S.A.'s production capacity is around 4000 tons and this capacity can shift to 4500 ton polyester cotton fiber or 3500 ton polyester woolen fiber in the desired fashion.

S.A.S.A's end products are continious polyester filaments and staple polyester fiber as in the case of K.E.K., and their main production lines are curtain cloth and various textile mixtures. The cost-curve data for S.A.S.A are given below for various capacity levels;

Capacities (Tons)	2488	2960	3556	3977
Total manufacturing Cost (TL)	55.500.000	62.000.000	69.000.000	74.671.600
Deduct custom tax examption	1.860.000	1.860.000	1.860.000	1.860.000
Deduct the decrease in chips cost due to the new unit which started its operations in 1968	1.116.000	1.116.000	1.116.000	1.116.000
Total (TL)	52.524.000	59.024.000	66.024.000	71.695.600
All(Tow+Dye)Finishing Cost	497.	592.000	771.200	810.000
New Manufacturing (TL) Cost	53.021.600	59.616.000	66.735.200	72.505.000

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With these very high manufacturing costs in hand S.A.S.A. sells polyester fibers for 27 TL./kg. The figures obtained above are much more higher than those estimated for K.E.K's product in Chapter V of this thesis.

Now S.A.S.A's main claim is that the establishment of K.E.K. is completely unnecessary, for the country. To support this argument they submitted a new project proposal to Industrial Development Bank and State Planning Organization. Their main claim is that they are able to achieve an additional 5.000 polyester production capacity.
(The sum equivalent to K.E.K.'s initial capacity) with an additional investment of only 25 million TL. With such an expansion in capacity the sales price of polyester fiber will fall to 18 TL./kg. This proposal was found to be too far away from realism by both organizations. A total revision of the project was adviced. The figure roughly calculated by these organizations for the additional unit was around 50 million TL, not including the know-how and engineering fees which will amount to a substantial figure. Apart from these considerations S.A.S.A's offered optimal price of 19 TL/kg of polyester fiber is not a competitive figure to K.E.K's 14.5-15 TL./kg in the long run.

II. Others

Firms grouped under this category are either just starting their operations in the preparation stage.

a) Polylen Polyester fiber unit: This firm is established with the joint investments of various private sector textile industries of Bursa. The unit will start its operations on the 15'th of May with an annual capacity of 1000 tons.

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b) <u>Sancak Tül polyester unit</u>: This firm plans to start its operations with imported polyester chips, process it to produce the continious polyester filaments. THe planned capacity is 4.000 ton/year.

c) <u>Sifaş</u>: This firm, located in Bursa, has been producing nylon and orlon fibers of the polyamide group. Having a letter of credit designed for nylon production, Sifaş was able to get the necessary permission for the production of polyester in place of polyamides towards the end of 1968. Annual capacity is 2000 tons.

So one can easily see that although there seems to be only one apparent competitor to K.E.K., namely S.A.S.A the cut-throat competition existing in other textile areas are also spreading into the polyester field, realizing the fact that this is the one with the largest growth potential. In spite of its continious efforts to establish an over-all monopoly of polyester fibers in the country, S.A.S.A seems far away from success due to its high manufacturing cost. Having such a high cost proves that S.A.S.A.'s operations have not been optimized. So a keen future competition in this field shall be beneficial with respect to both firms since it will force them to optimize their operations. The benefits derived from this competition is also persistent to national economy. S.A.S.A claim is that one polyester fiber unit with 15.000 tons capacity which will satisfy the domestic demand is more economical, is worth considering. But presently neither K.E.K. nor S.A.S.A possess the adequate sources to indulge in such an expansion.

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There is one pertinent fact. The potential demand for the polyester fibers, especially in the mixed form with cotton is vastly increasing. The problem is the survival of Turkish Textile economy when faced with the keen competition of the European Common Market. Market will be sufficient for the firms which deserve business success.

CONCLUSIONS

1) From the Market survey and research that is presented in Chapter III. of this theis it was found that demand for polyester fibers is around 5.000 tons presently. Most probably this demand is expected to climb to 7.200 tons in 1970. 10.300 tons in 1972 and roughly 16.000 tons in 1975. A self-criticism ofmy marketing process may show the following flaws:

i) While the percentage of synthetic fibers was assumed to be 12.95 % in Turkey in 1975. The reader may note a shift from % 12.95 % to 14.85 % in this ratio, without giving much justification to this jump.

ii) It may be argued that long range demand forecasts are dangereous. Especially in the case of new products a sudden jump in demand is foreseenable as it was the case for refrigirators, radios in Turkey. But with time the increasing trends of demand may get less pronounced.

In contrast to this minor flaw there is one very important point that was not previously discussed due to the lack of adequate quantitative information. As soon as the production processes of polyester fibers are optimized with a sales price of around 12.5 TL/kg. a great extent of replacement demand will be generated, especially in connection with cotton. Although cotton has a sales price of 7.5 TL/kg in the market, due to their superior mixability, durability, strenght and

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appearance polyester fibers are expected to replace it to a large extent. With its superior product characteristics the substituability was achieved all-over the world. Especially the (%67 Polyester %33 cotton) mixture is creating miracles in the textile world with its vast use areas. The extent of this future replacement demand is, I think, quite enough to remove all reservations from pessimistic minds. So, to sum up, there is and will be enough market for the product in the future in spite of the competing firms.

2) The second part of the project is the D.M.T. unit. The general attitude of the State planning organization towards this unit is also favorable as is the case for polyester unit, but with one qualification. The capacity of D.M.T. unit should be 25.000 tons in place of 16.000 tons. The following justifications may be given to support this argument:

i) The domestic demand for polyester staple fiber will be nearly 10.500 tons at the time the D.M.T. unit starts its operation in 1972. To this sum one can add the demand for continious polyester filaments (2.000 tons). In the fibering process the D.M.T./fiber ratio is 1.08. So the potential demand for D.M.T. will be (10.500+2.000)x1.08 = 13.500 tons. A 16.000 tons capacity will not be able to satisfy the total demand after 1975 So a larger unit is commendable to tackle the D.M.T. problem in the country, so as to enable us to make long-range plans.

ii) 25.000 tons/year capacity is considered much more economical according to world standards. The unit should work with % 60 capacity in the first 2-3 years, then will utilize full capacity. ./..

iii) While the total investment for a 16.000 ton/year D.M.T. unit is 44 million D.M.. The sum of 25.000 ton/year capacity adds up to only 54.6 million D.M.[1] So with approximately 25 million TL. difference this additional and much more economical capacity can be achieved.

iv) Besides the usage as a raw material of synthetic textiles a very recent usage of D.M.T. is in the film industry in the production of films as a finisher. The competitive product in this field is P.V.A. with a slightly lower price. But the product specifications of D.M.T. especially in the case of colourdd films makes it a superior product. The trend is towards colored films in Turkey. Two coloured films were shot in 1966, followed by 13 in 1967, 17 in 1968 up to May. The potential use of D.M.T. in Turkish film industry which occupies the second place in the world, in terms of the number of films produced is a point of interest.

3) The total of the project requires a complete knowledge in Advanced Chemical Technology. K.E.K's attitude towards signing Know-how and Engineering agreements with Hoechst and Uhde - the most experienced and modern ones in the field - is a highly commendable one. Hoescht accepted the payment of its Know-how fees with finished - products of K.E.K for the first three years. Such an agreement will constitute a strong guarentee for K.E.K's products.

1 A report prepared by Uhde Chemical Textile Factories of Germany on April 1968 to be submitted to the Management team of K.E.K.

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4) The most appropriate plant site for the unit is around İzmit bay. The plant should be located as close as possible to Petro-Chemical industries, since Petro-Chemical industries will start the production of p-xylol- the main raw material in D.M.T. production-in 1975.

5) While calculating the investments, I was as conservative as possible constantly including rather high contingency figures. The necessary investment totals amount to 85 million TL for the polyester and 73 million TL for the D.M.T. unit. The possible barganings with the foreign advisory firms in terms of know-how, engineering fees equipment and assembly costs, a more critical analysis of domestic expenses pertaining to local constructions and payments may reduce these investments.

6) The polyester fiber unit will start its operations towards the middle of 1970 with % 80 capacity till 1972, then with full capacity. The D.M.T. unit will start to work with % 100 capacity in 1973.

7) The total investment need for the polyester fiber project is 100 million TL. with, 50 million TL in capital funds, 35 million TL investment credit and 15 million TL commercial credit. This need for the D.M.T. unit is 85 million TL with 35 million TL capital, 40 million TL investment credit, 10 million commercial credit. All these calculations are carried out in a rather conservative approach. Besides this point if we consider the net cash proceeds obtained from the polyester unit in the begining years to be totally invested in the D.M.T. unit whose construction will only begin in 1970 the financial burden will be greatly reduced.

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8) The private-sector partness of the K.E.K. project are mostly textile firms. K.E.K. will be a corporation in the western manner, totally open to public since %50 of the capital expected to be secured from the public. Thus K.E.K. will determine its own business policy in the future. One point is of interest at this stage. Although the bulk of the potential investors are cooperative in the investment stage of the project they will be competitive in their end-products since polyester fibers will be utilized in their own production lines. Those production lines are various forms of textiles and chiefly competitive. Akfil, Mensucat Santral T.A.Ş. , Bozkurt T.A.Ş. will utilize polyester fibers in their cotton fabric, while Altınyıldız T.A.Ş. will utilize them in woolen fabrics. But those firms were already competing in the textile market for years, another new competing area will not drastically hurt them. If they didn't cooperate they could not be able to prevent a S.A.S.A monopoly of the south.

9) Finally as was seen in the preceeding calculations of this Chapter the project has many beneficial affects on the Balance of Payments problems of our country. The foreign currency savings adds up to 3.4 million $ in the polyester fiber unit case and to 3.6 million $ in the D.M.T. unit summing up to a saving amount of 7 million $.

"The project is economically feasible for Turkey".

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