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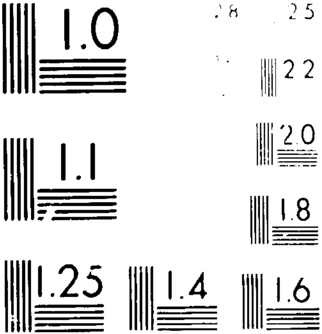
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DP/ID/SER.A/407
15 December 1982
English

12225

INDUSTRIAL PROJECT PREPARATION, EVALUATION AND IMPLEMENTATION

DP/TUR/79/024

TURKEY

Technical Report:

Karabük 1st, 2nd, 3rd Blast Furnaces Stove Modernization Project and Raw Material Preparation Facility of Turkish Iron and Steel Works General Directorate

Prepared for the Government of Turkey by the United Nations Industrial Development Organization, acting as executing agency for the United Nations Development Programme

Based on the work of Dr.J. Majumdar, Economist

United Nations Industrial Development Organization
Vienna

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CHAPTER 1

Executive Summary

1.1. PROJECT BACKGROUND, SECTOR STUDY AND HISTORY

The Turkish Iron and Steel Works (General Directorate) is the promoter of the present project of increasing the iron making capacity of the oldest steel plant in Turkey - Karabuk Steel Plant (located 200 miles North of the Capital, Ankara), from its present capacity of 600,000 tpy to 900,000 tpy by modernising the plant by two physically separable but operationally linked projects, viz.

1) installation of modern raw material preparation facility;

2) modernising the blast furnaces by replacement of refractories in the hot stoves so as to improve their energy efficiency resulting in reduction of production costs.

The first stage has been under implementation since 1976 and is expected to be completed by 1983. The Karabuk Steel Plant is expected to become a major supplier of pig iron to the foundries in Turkey. Out of the proposed incremental output of 300,000 tpy of hot metal through this project, 255,000 tpy will be meeting the demand of foundry sector in Turkey, and the remaining 45,000 tpy will be used by the Karabuk Steel Plant itself. The foundry sector which is mainly in the private sector in Turkey, is highly efficient and is able to meet the demands of the engineering industries to a large extent in Turkey, but they are greatly handicapped inter alia by shortage of pig iron resulting in costly import of this raw material. The Government of Turkey has a policy of gradual substitution of imports in the automobiles and other engineering industries which uses the output of the foundry sector.

1.2. MARKET STUDY AND JUSTIFICATION OF THE PROJECT

1.2.1. The Market

Demand for steel in Turkey is growing at a very rapid rate during the last two decades (12.3% per year between 1963-1976), Turkey being at the initial stage of heavy industrial development when steel consumption grows at a much faster rate than the rate of growth in GNP and rate of growth in industrial production. The domestic supply has always been lower than the demand resulting in heavy imports of steel (about 23 to 24% of total consumption).

The growth of foundry sector is even more than that of steel (17% per year between 1974-78). The linear regression analysis between per capita increase in GNP and per capita consumption of pig iron, however, shows a growth rate of 7 to 8% per year, which is more realistic in future. In the case of pig iron also there will be a big gap between demand and domestic supply (about 30 to 40% every year) even when the supply of 300,000 tons of pig iron will come into market from Karabuk's present project.

Hence there will be no dearth of market for the products of the Karabuk's incremental output as a result of investments in these projects in question.

1.2.2. Why Expand the Karabuk Plant?

Out of the several alternatives of meeting the future demand for pig iron including imports and the expansion of the capacity of plants at Erdemir and Isdemir, modernisation and expansion of Karabuk steel plant (which uses domestic raw material and produces foundry grade iron and which has a record of full utilisation under efficient management) is the most economical.

1.3. THE ESTABLISEMENT AND ITS FINANCIAL STRUCTURE

The Karabuk Iron and Steel Plant is owned and operated by KDC (Karabuk Demir Ve Celik Fabrikalari), a subsidiary of Turkish Iron and Steel Corporation. It has the following facilities at present:

Iror making (600,000 tpy)
Steel making (581,871 tpy)
Rolling mills (625,000 tpy)
Coke ovens (980,000 tpy)
Sinter plant (643,000 tpy)
Modern Foundry (40,000 tpy of pig iron casting and
30,000 tpy of ingot moulds)

But the main deficiencies are absence of raw material preparation equipment such as crushers, screening equipment and vibratory feeders to ensure uniformity of grain size in the mixture charged into the blast furnace. This results in increased heat losses and reduced productivity which is demonstrated by high consumption of coke per ton of hot metal produced. Thus, though the existing plant in Karabuk continues to achieve satisfactory output, there is urgent need for modernising the blast furnaces in Karabuk (envisaged in the project). The general management in Karabuk is efficient and the plant has been operating at output rates close to capacity. Financial performance for this near-capacity plant has been good as there had been net profit (after tax) in most of the years (601 x 10^6 TL) and 692 x 10^6 TL in 1979 and 1980 respectively). The other financial indicators are:

	1979	1980
Return on Sales	5.4%	3.2%
Return on Equity	29.7%	28.5%
Return on Fixed Assets	48.9%	44.1%
Current (ratio)	1:2	1:1

Financial position of the enterprise is, therefore, sound and the modern .tion programme of KDC is expected to keep the trend of increasing profit in the future.

1.4. THE PROJECT

1.4.1. Process

The choice of process in this project has been arrived at by experiments of samples of iron ores, limestones and coke used by the West German Institutes and as mentioned earlier, the modernisation process has two physically separate but operationally linked investment elements:

1) installation of modern raw material preparation facility to ensure improvement of physical characteristics (i.e. optimum grain size and that of ore blending facilities to ensure more uniform grade of iron ore.

2) Furnace stove modernisation project by replacing the existing refractory bricks by high alumina bricks of improved design and shape to increase the surface area by a total of 46% which would enable greater heat transfer and raise the blast temperature from the existing 750°C to 1150°C. Necessary changes will also be made

in the gas burners to raise the flame from 1150°C at present to 1410°C.

The above projects will reduce the present input per ton from 5.09 to 4.5 tonnes to produce one tonne of iron, and reduce the slag and dust content of the output from 0.55 tons and 0.05 tons to 0.49 tons and 0.03 tons per ton of output. The material balance (vide para 5.6) shows the 'Before' and 'After' modernisation situation.

1.4.2. The Work Force

The present labour force of 7233 (in 1980) in the steel plant will not be required in the modernised plant and the reduction is proposed by natural attrition only at the rate of 6% per year.

1.4.3. Infrastructure Requirements

1.4.3.1. Transport

Transportation of raw material viz. coke and ore for the increased output of 900,000 tpy (900,000 tons of coal and 1,500,000 tons of ore per year) will be by railways and the present capacity of railways have been found to be adequate for the additional volume of traffic.

1.4.3.2. Power

The power requirement will be 15MW and 135,000,000 KWh/year for the increased output in Karabuk, and it has been verified from Electricity Authority's programme that the additional capacity is available.

1.4.3.3. Environment

As far as the environment is concerned, the modernised Karabuk plant will cause less pollution of the atmosphere than at present, because of less production of blast furnace gas in the future.

1.4.4. Implementation Plan

The Implementation Plan has been worked out based on a Work Breakdown Structure of the project, and a Network and Bar Chart where all non-crucial activities are allowed to start at the mean times between Earliest Starting Time and Latest Starting Time, so as to have management cushion of half the

'FLOAT' on the one hand, and half of the economy (reduction in amount of interest during construction) on the other. The scheduled period of construction phase is found to be about 32 months.

1.4.5. Investment Schedule

Based on the above physical progress schedule of work, the investment outlay during the period 1982 to 1984 amounts to:

1982	-	1935.2×10^6 TL
1983	-	1672.5×10^6 TL
1984	-	207.24×10^6 TL
		3814.94×10^6 (Based on 1982 TL value)

Total investment outlay, however, amounts to 6040.96×10^6 TL after inclusion of expenditure before 1982, and 10% of contingencies over estimated amount and price escalation of 35% and 30% for 1983 and 1984 respectively for total currencies, and 7% for foreign currencies.

1.4.6. Source of Funds

The source of initial fund is as follows:

Equity	-	3752×10^6 TL
DYB Loan	-	748.74×10^6 TL
IBRD Loan	-	1540.00×10^6 TL

The Debt:Equity ratio thus works out to 38:62.

1.4.7. Interest during Construction

The interest on loan during construction period has been worked out on the basis of 21.5% per year. The amounts are:

1982	-	124.81×10^6 TL
1983	-	357.50×10^6 TL
1984	-	478.71×10^6 TL

1.4.8. Loan Repayment

The repayment of loan will be on the following basis:

DYB Loan	=	2 years of grace + 10 years of repayment (from 1987)
IBRD Loan	=	1 year of grace + 10 years of repayment (from 1987)

1.4.9. Production Cost

Unit production costs on 600,000 tpy, 750,000 tpy (with 50% of utilisation) and 900,000 tpy (with 10% utilisation) were worked out as follows:

600,000 tpy	-	15896.0 TL
750,000 tpy	-	14017.6 TL
900,000 tpy	-	13677.0 TL

Total manufacturing cost annually then has been worked out covering the operating costs, depreciation and interests.

1.4.10. Working Capital

The Working Capital worked out on the basis of Cash Balance based on stipulated Accounts receivable (one month's production costs), Inventory (raw material, two months, auxiliary material and finished product of one month's each) and cash in hand (of two months) is as follows:

1985	-	342.1×10^6 TL
1986	-	Increment of 466.7×10^6 TL
	Total	808.8×10^6 TL

The total investment cost schedule inclusive of Working Capital amounts to 6850.1×10^6 TL. The total assets also amount to the same figure (vide Annex 19).

1.4.11. The Revenue Schedule

The Revenue from Sale have been worked out on the unit price of pig iron as 18500 TL per tonne.

1.4.12. Cash Flow

The resulting Cash Inflow covering the sales revenue, and financial inflow and Cash Outflow covering total assets, operating costs and debt servicing and Corporate Tax (at 46.7%) of taxable profit (equal to sales minus production costs show cash surplus of 495.79×10^6 TL in 1985 rising to 1621.9×10^6 TL in 1997 (and thereafter).

1.4.13. Net Income Statement and Projected Balance Sheet

The Net Income Statement shows also that the profit after tax rises from 535.7 x 10^6 TL in 1985 to 1319.8 x 10^6 TL in 1997 and thereafter. The ratios on Net Income Statement works out to:

$\frac{\text{Gross Profit}}{\text{Sales}}$ = 36% in 1985 to 44.6% in 1997 and thereafter

$\frac{\text{Net Profit}}{\text{Sales}}$ = 19.3% in 1985 to 23.8% in 1997 ar thereafter

$\frac{\text{Net Profit}}{\text{Equity}}$ = 14.2% in 1985 to 35.1% in 1997 and thereafter

The projected balance sheet worked out on the basis of the above statements is found to be satisfactory (refer to Annex 23).

1.4.14. Commercial Profitability

Commercial profitability (IRR) of the project based on market cost of inputs and market value of outputs is only 11.0% approximately (refer to Annex 24(2)).

1.4.15. Sensitivity Analysis

Sensitivity Analysis made on commercial profitability shows that the Sales Revenue is the most sensitive element of the project cash flow (more than 4.4% reduction in the revenue will render negative NPV of the project). The operating costs comes next in sensitivity league table (more than only 9% increase in operating cost will leave the project with negative NPV). As regards the Capital Cost, an increase of more than 16.12% will make the NPV of the project cash flow negative.

Commercial profitability, however, improves (the IRR becomes 17.51%) if Corporate Tax of 46.7% on gross profit is excluded.

To achieve a commercial profitability with IRR of 21.5%, an annual subsidy of 1300.75 x 10^6 for the entire life of the project (20 years) will have to be provided by the Government.

1.4.16. National Economic Evaluation

To arrive at the National Profitability, shadow pricing based on Border Price numeraire of Little-Mirrlees method is applied following the World Bank Working Paper No. 392 on 'Shadow Prices for Project Appraisal in Turkey' (but with updated data of 1982 Turkish Economy). The National Parameters used were as follows:

Standard Conversion Factor (SCF)	=	0.685
Conversion Factor for Consumption Goods (CF_C)	=	0.88
Conversion Factor for Intermediate Goods (CF_I)	=	0.5598
Conversion Factor for Capital Goods (CF_K)	=	0.527
Shadow Wage Rate (SPI) Urban Formal Sector	=	0.66

The resulting conversion factors for the project's items work out as follows:

$CF_{(Operating\ Costs)}$	=	0.642 (for full capacity)
$CF_{(Working\ Capital)}$	=	0.71
$CF_{(Revenue)}$	=	1.00

The ERR of the cash flow with the shadow prices based on the above conversion factors works out to 26%.

1.5. PROJECT IMPLEMENTATION, MANAGEMENT AND CONTROL

The scope of work for the two phases of the Karabuk modernisation projects is very large with a total investment of 3818.56×10^6 TL (refer to Annex 10.6) spread over the remaining three year period (1982 to 1984). For successful implementation of the projects of this nature requires an independent Project Management Organisation under the control of a Project Manager, distinctly separate from the standard functional organisation. The Project Manager is not only required to have the complete responsibility for the tasks involved, but also for the resources needed for its accomplishment. He will be heading an implementation group consisting (refer to Annex 28) of Karabuk Steel Plants experienced able and knowledgeable personnel. The Project Management Organisation will also have an elaborate Project Management Information System (PMIS) for periodic monitoring of physical as well as financial progress, analysing cost and time over-run (if any) and updating the time and cost schedules by establishing control during the entire construction period.

The above measures are expected to help the implementation and management of the project a great deal.

1.6. CONDITIONS OF LOAN

As mentioned in para 4 above, the conditions of loan repayment are such that, while the grace period for DYB's own loan is two years, the same for IBRD loan is only one year. Moreover, repayments of IBRD loan will have to be twice in any year (May and November) whereas repayments for DYB's own loan need be made only once a year.

1.7. CONCLUSIONS

From the above it will be clear that the modernisation project is sound and viable from Technical, Financial and Management and Organisational points of view. Market Study shows that there will be no shortage of domestic demand of the output (iron) of the projects (refer to Chapters 3, 5 and 6).

The promoting enterprise is also sound financially, and managerially. All these point towards successful implementation of the project (refer to Chapters 4 and 6).

However, the commercial profitability is low and it appears it will be necessary to allow not only tax exemption, but also to allow annual subsidy for the projects in order to ensure a return of 21.5% per year (refer to Chapter 5).

The project, however, is viable from the point of view of the nation as the market cash flow when adjusted with appropriate shadow price factors gives an ERR of 26% (refer to Chapter 5). Hence, the project is viable from the point of view of the nation and as such its acceptance is recommended.

1.8. SALIENT POINTS

I. MAIN FEATURES

Type of Investment	:	Modernisation and Production Increase		
Production Capacity	:	Additional 300,000 tons/year pig iron		
Location	:	Karabuk		
Useful Life	:	20 years		
Beginning and Completion Dates	:	1982 and 1984		
				(in 10^6 TL)
		Local	Foreign	Total
Fixed Capital Investment	:	3792.00	2249.4	6041.3
Working Capital	:	808.8	-	808.8
Total Investment Amount	:	4600.8	2249.4	6850.1
Beginning Date of Financing by DYB	:	1982		
Total Amount of DYB loan	:	748.74 x 10^6 TL		
DYB loan of IBRD origin	:	1540.00 x 10^6 TL		

II. PROJECT'S PLACE IN THE ANNUAL PROGRAMME

Sector	:	Manufacturing Iron and Steel Industry
Project No.	:	79 C 170050
Page No.	:	167 official journal

III. CREDIT LIMIT OF THE ENTERPRISE

Credit limit of the Enterprise	:	9,764 x 10^6 TL
Amount used from the Limit	:	-
Loan applied for	:	2288.74 x 10^6 TL
Loan proposed	:	2288.74 x 10^5 TL

CHAPTER 2

Project Background, Sector Study, and History

2.1. INTRODUCTION

The objective of the proposed project is to increase the ironmaking capacity of the Karabük Iron and Steel Plant from 600,000 tpy to 900,000 tpy by modernisation of the blast furnaces, to improve their energy efficiency and reduce costs. Out of the incremental output of 300,000 tpy of hot metal (molten iron), 255,000 tpy will be marketed as pig iron to meet the demand of the foundry sector in Turkey, and the remaining 45,000 tpy will be used in the steel plant either to be processed into steel or used in the foundry of the steel plant itself. The modernisation will be achieved by implementation of two physically separable but operationally linked investment projects, which are (i) installation of modern raw material preparation facilities, and (ii) replacement of refractories in the hot stoves serving the blast furnaces.

2.2. PROJECT BACKGROUND

Karabük plant, which is the first integrated iron and steel factory in Turkey was established in 1939 and developed part by part by addition of units until it reached its present state in 1967. It was the only integrated factory in Turkey until 1965, and is continuously contributing to the economy with its above-mentioned production, despite all the problems it faces.

The Karabük plant has remained far behind the developments in today's iron and steel technology. The efficiency of blast furnace is low, and specific coke consumption is considerably high. As it is explained subsequently in the report, this situation is caused by the insufficiencies in the plants and equipment preparing ore and other input material for the blast furnaces, and the very low burning temperature of the blast furnace.

In 1972, the Enterprise decided that the 'Karabük Blast Furnace Production Increasing Project', the principal aim of which is the modernisation of input preparation units, be carried out with priority; and since 1973, investment expenditures related to the project are being made by the Enterprise. In order to increase the hot metal production of blast furnaces by 300,000 tons per year, the burning temperature must by all means be increased to 1100°C. To this end the 'Karabük 1st, 2nd and 3rd Blast Furnaces Stove

Modernisation Project' was prepared, and included in the 1979 Programme.

The '1st, 2nd and 3rd Blast Furnaces Stove Modernisation Project', which is the second stage in the modernisation of the Karabük plant, is a complement for the 'Blast Furnace Production Increasing Project'. This project will ensure a decrease of approximately 10 per cent in the specific coke consumption by increasing the temperature of the air entering blast furnaces from 700°C to 1100°C. Increasing the burning temperature of blast furnaces accelerates the reactions in the furnace and thus provides an approximate increase of 100,000 tons in hot metal production.

The first project has been under implementation since 1976, but progress has been slow due to resource constraints. World Bank assistance has been sought and obtained for financing the imported equipment needs of the two projects which are scheduled for completion by 1983.

2.3. THE TURKISH IRON AND STEEL SECTOR

2.3.1. The Turkish Steel Industry

The beginning of a modern steel industry in Turkey goes back to the 1930's with the establishment of the Karabük Steel Plant, followed by Eregli Steel Plant (Erdemir) which began operating in 1965. A third plant at Iskenderun (Isdemir) began production in 1976. Besides these large integrated steel plants which are all majority state owned and all use blast furnaces for producing iron from iron ore, Turkey has about twenty smaller steel plants in the private sector, with electric arc furnaces using scrap as raw material. The Karabük and Erdemir plants are located in Northern Turkey, and Isdemir is on the South-eastern coast, while most of the electric arc furnaces are located in Western Turkey. The present capacity of the integrated plants is 3.1 million tpy while that of the twenty smaller plants is about 900,000 tpy. Turkish steel plants produce a wide variety of steel products including special steels. Karabük also markets about 65,000 tpy of its iron output as foundry grade iron and the Iskenderun plant has been marketing about 200,000 tpy of pig iron as its steelworking facilities are not yet operating at full capacity. Erdemir does not supply pig iron, while the smaller electric arc furnace plants, being steel scrap based, cannot do so.

2.3.2. The Foundry Sector

The Karabük Steel Plant is to become a major supplier of pig iron which would be consumed by foundries: developments in the foundry sector, and the effect on pig iron demand are of particular relevance. The foundry industry in Turkey has made substantial progress in the past fifteen years as suppliers of intermediate inputs to engineering industries, serving principally the domestic market. The industry has a comparative advantage in terms of both labour and transport costs and the domestic market for castings generally has not been overly protected. Imported castings are speciality items (auto engine blocks, machine tool components, etc.) which exceed the technical capability of local firms. The Government, however, has a policy of encouraging gradual substitution of imports in automobile and other engineering industries which has led to local manufacture of more complex castings. The increasing technological sophistication, product mix and output of the engineering industries has resulted in substantial growth of the number and size of foundries. But equally important has been the increase in their technological competence, enabling them to produce castings of greater precision, complexity and quality for a variety of end uses, utilizing a variety of metals. Major materials which account for the bulk of castings produced in Turkey are ferrous-based grey iron, malleable iron, nodular iron (spheroidal) and steel. Non-ferrous metals, light or heavy, represent a smaller share of the total sector output. In 1976, of the total output of ferrous castings, grey iron accounted for 83%, malleable iron for 4% and steel for 13%.

The foundry industry is predominantly in private hands, and has shown dynamism, versatility, and receptiveness and adaptability to growing technological requirements. Many of the now larger private foundries started as small establishments fifteen to twenty years ago and went through successive stages of expansion. The foundry industry comprised 440 firms by the end of 1976, of which 400 were producing castings of grey iron, 4 of malleable iron, and 36 of steel. Of these firms, 88 (or 20% in number) were mostly medium (with a capacity of 500 - 5,000 tons/year), and some large (over 5,000 tons/year) in size, whereas the remaining 80% were small establishments (with capacity of 200 - 300 tons/year).

Large foundry firms account for about 23% of existing capacity, medium for 55%, and small for 22%. The average capacity of small foundries is about 260 tons/year. Small grey iron foundries, using simple equipment, produce a variety of standard final products such as weights, cooking vessels, sanitary pipes, agricultural implements, space heater parts, etc., which do not require dimensional accuracy or careful control of physical properties of the metal. Medium size foundries, all in the private sector, account for 75% of the grey iron casting capacity and almost all of steel capacity. The average size for large grey iron foundries is slightly over 5,000 tons/year which compares favourably with grey iron foundries in the UK (4,240 tons/year) and Germany (5,300 tons/year). Steel foundry capacity averages 1,500 tons/year. These figures suggest that the large foundries approximate internationally competitive size.

2.3.3. Performance

As a supplier of intermediate inputs to the engineering industry, growth of the foundry industry is conditioned by the growth of the output of the engineering sector itself, particularly those engineering products which use castings, and the rate of import substitution of imported castings, e.g. automobile engine blocks. Since the Government's policy has been to increase progressively the domestic value added of engineering industry products on a regular annual basis, the growth rate of foundry industries on average has been higher than that of the engineering sector. During 1975-78, total foundry capacity increased by about 128,000 tons or by 29% to 544,000 tons. Grey iron capacity increased by about 100,000 tons, or 8.5% per annum, while steel castings capacity by some 25,000 tons, or about 15% annually. Expansion in malleable iron has been negligible. This growth in capacity reflects the underlying pattern of the demand for castings.

By the end of 1980 total nominal capacity of the foundry industry reached 686,000 tons among 686 units. The total production of iron castings in Turkey has been estimated at 341,752 tons in 1978, and fell sharply to 285,000 tons in 1979. In 1980, output is not likely to have exceeded the 1979 level. Capacity utilisation, particularly of grey iron foundries was relatively low due to deterioration of the economic condition in the country and the consequent lower growth and capacity utilisation in the engineering industries. The situation was further worsened due to shortages of pig iron, coke and power and also due to severe labour unrest during 1979 and 1980. The overall capacity utilisation ratio for the foundry sector was about 40% in 1980.

CHAPTER 3

Market Study and Justification of the Project

3.1. DEMAND AND SUPPLY OF IRON AND STEEL IN TURKEY

The rate of increase in steel consumption during recent years has been more than that in various other economic indicators. For example, the annual increase in steel consumption during the period 1963-1976 was about 12.3% whereas within the same period, GNP increased by only 6.9%, industrial production increased by 9.9%, and construction increased by 7.9%. Despite this rapid increase in consumption, per capita consumption figures of Turkey are very low as compared to other countries. In 1976, per capita consumption level was about 100 kg/person. This figure is 500 - 700 kg in USA, Japan and West Germany, and 350 - 400 kg in England, France, and Netherlands.

A characteristic of iron and steel sector in Turkey is that the domestic production continuously remains below the demand and the shortfall is met through importation (see Annex 1 and 1a).

Beginning in 1974, production decreased because required inputs could not be provided due to the foreign payments deficit and foreign exchange bottleneck, therefore the necessity for imports increased. Because of the insufficiency of foreign exchange sources, import was made in 1977 by cash against goods and excess stocks were accumulated through importation.[1/] The apparent consumption amounts do not reflect the real (potential) demand because of the difficulties faced in imports made by normal foreign exchange allocations, insufficiency of domestic production, etc. This is an important point to be taken into account in demand analyses.

Iron and steel products consumption composition of Turkey (production and import) reflects the typical consumption pattern of the countries which are at the first stage of industrial development. The greatest portion of consumption belongs to non-flat products, and this indicates that most of the consumption is by infrastructure and construction sectors. Total consumption level of special steel products, sheet and other flat products indicates that an important diversification in industrialisation could not

1. Iron and Steel Industry in Turkey and its Problems. SPO, 1979.

yet be attained. No important and radical change in consumption pattern and domestic production composition is expected in the near future.

The most important factor in attaining the required level of molten steel production increase in Turkey is the volume of additional capacity from integrated plants and electrical arc furnaces, with the assumption that the plants operate with a certain utilisation. The development level of Turkish iron and steel industry and economic conditions require that the capacities necessary to increase domestic production be realised through the expansion of existing integrated plants. It is observed that in many countries, production increase is ensured with less cost by expanding existing integrated plants instead of setting-up new plants. It is envisaged that the capacity of Erdemir which is 1.5 million tons at present will reach 2.0 million tons in 1984, and 2.7 million tons in 1987; and the existing capacity of Isdemir which is 1.1 million tons at present will reach 2.2 million tons with technical and financial aids to be provided by USSR.

In the early sixties, most of the Turkish and foreign experts were of the opinion that a continuous and rapid increase will appear in Turkey's long term steel demand estimates. The apparent consumption increased rapidly until recent years. However, making estimations for future years is considerably difficult because of the growing deficit in the balance of foreign payments due to rapid increases in petroleum prices in 1974 and the unfavourable economic conditions caused by inflation. The period 1979-1988 is selected as an acceptable perspective (as forecasting for a longer term than this is difficult), and it is considered adequate to give molten steel production, consumption and capacity increase tendencies as of this period. The rate of increase will be low until 1985, and it is assumed that the consumption, together with economic growth, will rapidly increase during the following years.[1/] In this development, it is taken into account that the production increase will be realised by expansions of Erdemir and Isdemir. According to these studies, the apparent molten steel consumption level will be approximately 3.5 million tons in 1979/80, and 5.4 million tons in 1988. This consumption level, which is absolutely below the potential demand,

1. The research shows that there is a strong correlation between increase in GNP and demand for steel. A report prepared by IISI shows the steel demand elasticity for increase in GNP is over 1.0 in industrialised countries. During the past years, steel demand elasticity in Turkey was about 1.8.

is attained with an average annual 6% increase rate, compared with the previous years during which the increase rate was 12.3%. The data on hand show that molten steel production realised in integrated plants and electrical arc furnaces is about 2.5 million tons in 1979/80. With the assumption that capacity utilisation in the beginning of the period will continue throughout the period, the domestic molten steel production will reach 5.0 million tons in 1988. Comparison of quantities of supply and demand shows that molten steel production gap will be about 600,000 tons/year in 1983/84 (see Annex 2).

3.2. DEMAND AND SUPPLY OF PIG IRON

The demand for all types of foundry products grew at 17% per annum during 1974-78 and reached 342,000 tons. However, the growth of demand was arrested due to the extreme economic conditions in 1979 and 1980 and declined to 285,000 tons. The demand for grey iron castings is now projected to grow at only 7% per annum during 1980-88 to reach 496,000 tons (see Annex 3 and 3a). The projected growth in demand for castings would improve the capacity utilisation ratio of foundries from the present low of 41% to 60% by 1988, including 80,000 tons of forthcoming additional foundry capacity during 1980-88.

The requirement for foundry pig is also estimated by using the linear regression equation obtained by examining the relationship between per capita pig consumption and per capita increase in GNP. Data used were for the period 1965-1978 period. For projections for future years, it is assumed that per capita GNP will increase by 1% during 1980-84 and by 3% during 1985-1995. As an alternative to this estimation, another estimation was also tried by using the pig demand elasticity as 1.3 (see Annex 4 and 4a.)

Demand projections indicate that beginning from 1984, a sufficient domestic demand will exist for the total additional pig iron increase of 300,000 tons/year achieved in the blast furnace production of the Karabük plant, whether consumption is taken as a function of capacity increase, or whether it is estimated by examining its relation with the increase in GNP. In addition, the research shows that in the case of ensuring material inputs and required technological advance with regard to the production of complex and high-quality foundry products for Turkish foundry industry, an important export potential will exist.

At present Karabük is the only integrated plant which has been marketing pig iron regularly, at an annual level of about 65,000 - 95,000 tons per year. Isdemir, which began to operate in 1976, has marketed about 200,000 tons of pig iron per year, but plans to stop supply from 1983, when its steelmaking facilities are fully operational. Erdemir has not been marketing any pig iron.

3.3. JUSTIFICATION OF THE PRESENT PROJECT

Conceivably, four alternatives can be considered for meeting the future demand for pig iron:

(i) to maintain supply at present levels, i.e. 95,000 tpy from Karabük and 200,000 tpy from Isdemir (until 1983);

(ii) to maintain present output levels at Karabük and to expand output at Erdemir and Isdemir, by raising furnace output to 115% of capacity under conditions of most efficient operations most likely to be obtainable after some additions to existing facilities;

(iii) expand output at Karabük by modernising the furnaces as proposed, with Erdemir and Isdemir plants at present levels producing iron adequate only to meet their own requirements for steelmaking;

(iv) increase output at Karabük by modernisation and simultaneously at Erdemir and Iskendurun by operation under most efficient conditions, i.e. 115%.

From Annex 3a, it is evident that even under alternative (iv), which is the most optimistic supply estimate, imports would be necessary after 1980. Ruling out alternative (i) as very large and sustained imports would be reached, alternative (ii) carries considerable risks as

(a) neither Erdemir nor Isdemir plants have operated at even close to capacity, and it would be unrealistic to expect sustained production at 115% of rated blast furnace capacity, in order to enable them to supply pig iron to foundries after meeting their own needs for steelmaking;

(b) as both plants are of balanced design, diversion of pig iron to foundries on a continuous and sustained basis would require either overrunning the blast furnaces or result in under-utilisation of steelmaking facilities;

(c) both the plants are dependent partially on imported raw materials, which would be a major bottleneck. The major advantage that could be for this alternative is the lower variable cost of production, as both plants are larger and more modern. However this advantage is likely to be largely offset by their high fixed costs due to large capital investment and attendant higher financial charges.

Alternative (iii) which provides the justification for the proposed project has the advantages that Karabük utilizes only domestic raw materials, is already well advanced in implementing its modernisation projects, produces foundry grade iron (as opposed to blast furnace iron produced by Erdemir and Isdemir) and has a long record of full capacity utilisation and profitable operation. Moreover, the additional investment at Karabük would easily pay for itself, in terms of foreign exchange saved from domestic production at internationally competitive costs, and benefits of overall reduction in steelmaking costs due to modernisation.

CHAPTER 4

The Establishment (Company)

4.1. OWNERSHIP AND CONTROL

The Karabük Iron and Steel Plant was established in 1939 and is owned and operated by Karabük Demir Ve Celik Fabrikalari (KDC). KDC is a subsidiary of the Turkiye Demir Ve Celik Isletmeleri (Turkish Iron and Steel Corporation), which is the holding SEE for KDC, Isdemir and the Divrigi Iron Ore Mining Company. In 1976, the Turkish Iron and Steel Works General Directorate decided that KDC (in accordance with the principles of Law No. 440), would be attached no longer to the General Directorate, but would continue its activities with self-administration. Although Karabük Establishment is a state enterprise like Iskenderun Iron and Steel and Divrigi Mine Plant Establishments, it possesses the authority to determine and apply selling prices for its products since January 24th 1980, within the framework of economic measures taken by the Government.

KDC's authorised capital was raised from TL 1.5 billion to TL 3.0 billion in 1979. The present paid in capital of TL 2.1 billion is held by Turkiye Demir Ve Celik. The management of KDC is in the hands of a Board of Directors consisting of five members including the Chairman, who is the General Director of the plant. The other members are the three Assistant General Directors in charge of production, sales and finance, and the remaining member is a workers' representative.

4.2. GENERAL MANAGEMENT

A problem that KDC has experienced, in common with all SEEs in Turkey, has been frequent changes in top management. KDC has had 21 General Directors in 40 years. However, the plant has operated near capacity due to a well trained and stable work force and shop level supervisors, and the fact that most of KDC's General Directors have been appointed by promotion internally. The Government now appears resolved to insure SEE managements from political interference and frequent changes, which can be expected to have a beneficial effect. The present management and project team is capable of implementing the modernisation projects reasonably well, and KDC's overall management situation is acceptable.

4.3. MAJOR EXISTING FACILITIES

The Company's Iron and Steel Plant is located at Karabük, about 200 km north of Ankara. The iron and steel plant supports a few local industries such as small rolling mills, foundries and fabrication shops located in the town of Karabük. The Company's township and the town have a total population of about 35,000 and are dependent on the steel plant.

a) Ironmaking. KDC has three blast furnaces with a total ironmaking capacity of 600,000 tpy. Furnace No. 1, which has a useful volume of 357cu.m and an ironmaking capacity of 386 tons per day was commissioned in 1939, at the inception of the steel plant. Furnace No. 2 is identical in volume and capacity and was commissioned in 1950 during the postwar expansion of the plant. Furnace No. 3 has a volume of 803 cu.m. and a capacity of 950 tons per day. This furnace was erected in 1962, during large scale expansion of the entire plant at which time the original steelmaking shop and the rolling mills were replaced and the sinter plant was expanded. All the three blast furnaces have been in operation continuously since their commissioning, except for normal relining operations between successive five-year 'campaigns'.

b) Steelmaking. KDC's steelmaking facilities consist of one steelmaking shop containing six Siemens-Martin open hearth furnaces. The furnaces which have a capacity of 150 tons per charge were erected during 1959-1963 replacing the original four open hearth furnaces with a capacity of 65 tons each operating since 1944. The six furnaces together have a crude steel output capacity of 620,000 tpy. To achieve output of crude steel at this level scrap is added to hot metal (molten iron) from the blast furnaces for steel production. The scrap/iron ratio varies depending on iron availability as part of the blast furnace iron is also required to be marketed to meet demand of foundries. During 1979, 458,625 tons of hot metal (molten iron) from the blast furnaces was used, together with 151,704 tons of steel scrap to produce 581,871 tons of crude steel. The rest of the hot metal output from the blast furnaces is either consumed in the foundry shops of KDC and/or sold as foundry grade iron.

c) Rolling Mills. The crude steel output of the plant is cast into ingots and rolled into a range of rolled products in KDC's five rolling mills, all erected during 1959-1965. The total rolled products capacity is 625,000 tons, although the attainable output level is dependent on the product mix. Eight mm. diameter steel bars for concrete reinforcement account normally for over 60% of the output of rolled products. Other important products are steel billets for smaller rolling mills in the private sector, heavy sections and rails.

d) Coke Ovens. The coke charge for the blast furnaces is prepared from metallurgical grade coal in seven coke oven batteries with a total capacity of 980,000 tpy. Sulphuric Acid and Ammonium Phosphate are produced in an adjoining coke oven by-products plant.

e) Sinter Plant. The sinter plant, which produces sintered ore to be blended with raw ore for blast furnace charge consists of two strands. The first strand was commissioned in 1953, while the second larger strand was built in 1961. The sinter plant has a total capacity of 643,000 tpy.

f) Other Facilities. KDC operates a fairly modern foundry with a capacity of 40,000 tpy of pig iron castings and 30,000 tpy of ingot moulds for KDC's use as well as to meet needs of Isdemir and Erdemir steel plants. A major additional facility is a modern heavy fabrication shop operated as a separate Department (Engineering Projects and Construction Department) which carries out engineering, fabrication and erection of major industrial structures in Turkey and has also carried out fabrication and erection work in other countries.

4.4. EXISTING SHORTAGE OF FACILITIES

At present, KDC does not have raw material preparation equipment such as crushers, screening equipment and vibratory feeders to ensure uniformity of grain size in the mixture of coke, iron ore, sintered ore and limestone being charged into the blast furnaces. Absence of accurate feed composition control results in fluctuating operating conditions as variation in grain sizes and excessive presence of fines reduces permeability of gas through the feed in the blast furnaces, increases heat losses and reduced productivity. Poor energy efficiency is already evident from the high top gas temperatures observed in all the three blast furnaces at Karabük and is demonstrated by the high coke rate (consumption of coke per ton of hot metal produced). All these adverse effects are accentuated by low blast temperature. During 1979, the temperature of the blast for the furnaces ranged between 630°C - 740°C, which is much lower than temperatures achieved at modern plants internationally (about 1200°C - 1400°C). Under existing conditions, the consumption of coke, which is scarce and valuable energy source, is excessive. The coke rates for the three furnaces during 1979 were 900 kg/ton of hot metal, 904 kg/ton of hot metal and 865 kg/ton of hot metal respectively compared to international standards of approximately 600 kg/ton. These bottlenecks have the effect of increasing cost of production and excessive production of black furnace gas which is being burned off, resulting in energy waste and avoidable air pollution. Thus, though the existing plants continue to achieve satisfactory output, there is an urgent need to modernise the blast furnaces by two physically separable but operationally linked stages:

i) Installation of modern raw material preparation equipment, and

ii) increase in blast temperature.

4.5. PAST OPERATIONS OF THE KDC

Historically, KDC's major production units have always operated at output rates close to capacity - a situation unusual among SEEs in Turkey. It is noteworthy that these high rates of capacity utilisation were maintained despite the fact that some of the major units of KDC, i.e. the coke ovens, blast furnaces and sinter plant are relatively old, adequate maintenance, operational and technical skills developed over 40 years have enabled the plants to operate close to capacity. Output of major products during the last three years and capacity utilisation rates are shown in Table 1 below.

Table 1: KDC - Output of Major Products 1978-80

Product	1978 (000'T)	(C.U.R.)	1979 (000'T)	(C.U.R.)	1980* (000'T)	(C.U.R.)
Hot Metal	530	88%	508	85%	620	107%
Ingot Steel	597	95%	582	93%	625	100%
Rolled Products	525	84%	514	82%	550	88%
Coke & Dust	707	88%	655	81%	646	81%
Sinter	600	93%	583	90%	600	93%

* Provisional

4.6. FINANCIAL PERFORMANCE

KDC has always maintained profitable operations, except for the years 1977 and 1978 when it incurred operating losses despite operating its plant at near-capacity. These losses, which arose as a result of the then Government's price controls in the face of increasing production costs, amounted to TL 651 million as of December 31st, 1978. During 1979, profitability was restored and the company ended the year with a before tax profit of TL 601 million. Preliminary figures for 1980 indicate a profit of TL 405 million for the year. Selected data regarding KDC's operating results and financial position is provided in Table 2 below:

Table 2: KDC - Selected Financial Data (TL million)

	1977	1978	1979	1980*
Sales Revenue	4,213	6,434	11,071	21,930
Net Profit/(Loss) before Tax	(123)	(528)	601	692
Net Profit/(Loss) after Tax	(123)	(528)	352	405
Net Fixed Assets	830	1,025	1,228	1,569
Total Equity	1,571	1,006	2,020	2,425
Return on Sales (%)	-	-	5.4	3.2
Return on Equity (%)	-	-	29.7	28.5
Return on Fixed Assets (%)	-	-	48.9	44.1
Current Ratio (times)	1.4	1.0	1.2	1.1

* Provisional

Source: 1977, 1978 and 1979 Annual Reports of Turkish Iron and Steel Works General Directorate

It is expected that the modernisation programme of KDC will help in keeping the trend of increasing profit in the future.

CHAPTER 5

The Project

5.1. INTRODUCTION

The choice of process in this project has been based on extensive experiments of samples of iron ores, limestones and coke used in Karabük, and the design of the project was based on quantity and quality of blast furnace gas available in Karabük by the two West German Institutes (see paras 5.2 and 5.3 below).

The choice of process is therefore based on the availability of current assets with Turkish Iron and Steel Organisation in Karabük and is, in fact, modernisation of a valuable available asset. The only other alternative to increase the production of pig iron from the present level of 600,000 tons to 900,000 tons per year would be to demolish the small and old No. 1 and No. 2 plants in Karabük (as there is no extra space available in Karabük), and replace them by a completely new modern 300,000 ton plant to work in parallel with the large existing plant No. 3. A quick calculation of the comparative costs shows that the second alternative would be more expensive on two accounts, namely:

1) the initial investment cost of dismantling two plants and replacing them with a new plant;

2) to continue the old process with the remaining blast furnace would be costlier than what is envisaged in the project of modernising all the existing three plants.

5.2. SCOPE AND PURPOSE

The first stage of the project involves installation

a) of a modern raw material preparation facility to ensure improvement of physical characteristics, i.e.optimum grain size with variations within acceptable limits, and

b) of ore blending facilities to ensure more uniform grade of iron ore.

The capacity of the raw material preparation facilities will also be increased to support the higher level of output projects. This stage has been under implementation since 1976, but progress has been slow due to shortage of funds, particularly foreign exchange. The second stage envisages replacement of refractories in the hot stoves or the blast furnaces with high alumina bricks of improved design, along with replacement of burners and blast pipes and installation of instrumentation. These changes would enable blast temperatures to be raised from the existing 630°C - 750°C to 1,150°C. The proposed modernisation projects will improve the operating efficiency of the blast furnaces; reduce the present high levels of coke consumption, thereby effecting saving of a valuable energy source; and increase output of pig iron from the furnaces. The two stages can be implemented independent of each other, but their beneficial effect is additive and the projected economies can be maximised by co-ordinated implementation of both investment projects.

5.3. RAW MATERIAL PREPARATION MODERNISATION PROJECT

The major new facilities include:

a) construction of primary storage yard and erection of two wagon tippers and reclaimers;

b) erection of iron ore crushing and screening plant including intermediate storage bins, primary, secondary and fines crushers; and coarse, intermediate and fines screens and conveyors;

c) coal and limestone grinding plant including additional bunkers, impact crusher, screens and conveyors to provide uniform charge to the sinter plant;

d) ore blending yard including ore mixing beds, storage bins and conveyors;

e) blast furnace burden preparation plant, including vibratory feeders, weighing scales and conveyors.

The above facilities have been designed to achieve a handling capacity necessary to support an output of 900,000 tpy of molten metal. The project was designed by Theinstahl Huttenwerke after extensive experiments on samples of iron ores, limestone and coke used at Karabük. Optimum grain sizes and permissible limits of size variation were determined after trials at laboratory and plant scales. The overall design, layout and specifications of major equipments have been verified by Rheinstahl as well as the consultants of the World Bank and found to be technically appropriate to attain the targeted output.

5.4. FURNACE STOVE MODERNISATION PROJECT

The existing refractory bricks in all the nine stoves were installed in 1959-64, and are almost at the end of their useful life of about 20 years. The temperature of the blast that can be achieved is dependent on the calorific value of the gas burned to heat the stoves, the flame temperature, volume of blast and the physical and chemical properties of the refractories i.e. surface area, shape and alumina and iron content in the refractory material. While the quantity and calorific value of the blast furnace gas available as fuel are adequate, the physical and chemical properties of the bricks prevent the blast temperatures from exceeding 750°C. This temperature is well below the current international norm of 1,150°C - 1,300°C. The project proposes the replacement of the existing refractory bricks by high alumina bricks of improved design and shape to increase the surface area by a total of 46% which would enable greater heat transfer and raise the blast temperature to 1,150°C. Necessary changes will also be made in the gas burners to raise the flame temperature from 1,150°C at present to 1,410°C. The components of the project are:

a) installation of 806 tons of refractories in each of the six stoves serving blast furnaces Nos. 1 and 2 - total 4,836 tons;

b) installation of 1,987 tons of refractories in each of the three stoves serving blast furnace No. 3 - total 5,961 tons;

c) replacement of ring pipes;

d) replacement of burners;

e) additional instrumentation to monitor stack gas temperatures.

The design of the project was formulated at the Institute of Metallurgy of Berlin University. It has been established that the calorific value of the gas and quantity available are adequate. The refractory bricks proposed were designed according to a mathematical model developed in the institute twelve years ago, tested extensively in European steel plants and accepted by major refractory manufacturers in Europe and used successfully since 1974.

The relationship between blast temperature, coke consumption and furnace output has been established over the years based on operational data of blast furnaces in the world. In the case of KDC's furnaces, conservative assumptions have been used. Partial verification of the expected results was carried out in 1967 by modifying the stoves of furnace No. 3 to raise the temperature by only 100°C. The observed reduction in coke consumption was 29 2 kg/ton of output compared with the theoretically expected reduction of 30 kg. Annex 5 shows the flow diagram of the process in Karabük. Annexes 6, 7 and 8 show the following:

i) relationship between air access temperature and specific coke consumption:

ii) relationship between specific coke consumption and production (in general);

iii) relationship between specific coke consumption and production (in Karabük)

5.5. PRODUCTION PLANS AND RAW MATERIALS

Build up of pig iron output over the next five years is expected to be quite fast given that KDC has achieved stable full capacity operation during the past twenty years. The completion of the raw materials preparation facilities at the end of 1982 will bring about the first major increase in output. Delays are not likely to be substantial in the completion of the project as a substantial part of the civil works have already been completed. By value, 44% of the imported equipment required has also been purchased and is already on site. With regard to the blast furnace stove modernisation project, the delivery period of the refractory bricks for the stoves is not expected to exceed six months from placement of orders and it is estimated that all the nine stoves can be refitted by early 1984. The modernisation of stoves will begin in the stoves of the No. 3 blast furnace, and the required renewal in No. 3 blast furnace will be completed in 1983. Under these conditions, 50% expansion capacity will be attained in 1983, and 100% will be attained in 1984.

5.6. MATERIAL BALANCE AND SUPPLY OF MATERIAL

Input and output materials before and after modernisation of Karabük plants are shown below:

	Inputs		Outputs		
	For 1 ton (tons)	For 600,000 tons (tons)		For 1 ton (tons)	For 600,000 tons (tons)
Before Modernisation					
Iron ore	0.740	444,000	Pig	1,000	600,000
Sinter	1.0	600,000	Slag	0.55	330,000
Coke	0.880	528,000	Dust	0.05	30,000
Limestone	0.28	168,000			
Others	0.060	36,000			
Air	2.130	1278,000	Blast Furnace gas	3,490	2094,000
Total	5,090	3054,000		5,090	3054,000
After Modernisation		For 900,000 tons (tons)			For 900,000 tons (tons)
Iron ore	0.766	689,400	Pig	1,000	900,000
Sinter	0.974	876,600	Slag	0,490	441,000
Coke	0.720	648,000	Dust	0.030	27,000
Limestone	0.100	90,000			
Others	0.060	54,000			
Air	1.880	1692,000	Blast Furnace gas	2,980	2682,000
Total	4,500	4050,000		4,500	4050,000

The required quantities of iron ore and limestone are expected to be available domestically without major problems. KDC at present obtains 866,700 tons of metallurgical coal per year from the Zonguldak coal mines which is converted into coke for the blast furnaces and coke breeze for the sinter plant. After the modernisation of the blast furnaces, the consumption of coke per ton of output will decline by 27% and the increase in total iron output will increase the coal requirements only by 52,900 tpy - an increase of less than 10%. No major problems are therefore expected in obtaining the additional quantity required.

5.7. LABOUR REQUIREMENTS BEFORE AND AFTER MODERNISATION

KDC employed a total of 9,936 workers at the end of 1980, of which 2,703 were employed in the Engineering Projects and Construction Division and 7,233 in the steel plant. This number is excessive by standards of more modern plants in the world and also by comparison with Erdemir, which employs

6,860 workers for a steelmaking capacity of 1.5 million tons. Allowance, however, has to be made for the fact that KDC operates an older and less automated plant. Moreover, the Government has enforced a hiring freeze since September 1980 and KDC expects to lose approximately 6% of its work force every year through attrition. At this rate, during the period of project implementation, the present degree of overmanning will be substantially reduced. Agreement will be sought during negotiations that KDC will, as a condition of the loans, formulate and adopt personnel policies which would reduce its personnel levels and prevent overmanning in future.

5.8. LOCATION

The Karabük Steel Plant is located in the northern part of Turkey as shown in the map at Annex 9. Since this project is related to the modernisation of stoves in Karabük only, the question of locational choice or additional land does not arise.

5.9. INFRASTRUCTURE FACILITIES

5.9.1. Transportation

The map in Annex 9 shows the rail transport communication (the main transport source of the project), as well as the locations of Iron Ore deposits and Coal deposits. Two bulky materials (coal and ore) have to be transported. At the end of modernisation, materials to be consumed are given below:

For 900,000 tons molten material

Coke:	648.000 tons/year. With 1.35 coal to coke conversion	= 890,000 tons coal
Ore:	689,000 tons/year. With 1.35 coal to coke conversion	= 689,000 "
Ore (Sintered):	877,000 tons/year (90% sinter is made of ore)	= 788,000 "

By the completion of blast furnaces modernisation projects, Karabük has to handle nearly 900,000 tons of coal and 1500,000 tons of ore annually. Materials carried during the period 1977 to 1980 for Karabük are shown below. As can be seen, anticipated increased volumes of coal and ore will be easily handled by the existing facilities even if you discard the positive effects of wagon tipping stations, 500,000 tons of new blending, and stocking areas.

Year:	1977	1978	1979	1980
Coal	1,105,000 tons	1,183,000 tons	900,000 tons	1,115,000 tons
Ore	920,000 tons	1,114,000 tons	1,000,000 tons	1,755,000 tons
Source	Annual Report 1977, p.53	Annual Report 1978, p.37	Budget 1980* p.48	Budget 1981* p.46

* Budget Reports give the previous year's actual figure for comparison.

5.9.2. Power Supply

At the end of the project, specific electricity consumption will increase by 15 Kwh/ton (from 130 Kwh/ton to 145 Kwh/ton).

Annual energy requirement increase = 15 Kwh/ton x 900,000 tons
= 135,000,000 Kwh/year

Capacity requirement = 135,000,000 ÷ (24 hrs x 365 days)
= 15 MW

In the Investment Programme of 1981 (page 167) of the Electricity Authority in Turkey, provision was made for an increase of about 25 MW by the end of 1983. Hence, no shortage of power supply is expected.

5.10. ENVIRONMENT

The steel plant is located in a valley which tends to trap smoke and other gases and creates an unacceptable degree of air pollution. A major cause of air pollution is the excessive generation of blast furnace gas due to incomplete coke combustion in the furnaces. At present approximately 15,000 cu.m of blast furnace gas is flared, which will be eliminated after the modernisation project is completed. Thus, the modernisation project will have a beneficial effect on the surroundings. Liquid effluents from the plant are treated and discharged into a small river flowing through the plant site. Assurances will be obtained during negotiations that KDC will operate its facilities in accordance with Government regulations in force.

5.11. IMPLEMENTATION PLAN

To arrive at a realistic and most economic implementation schedule, it is necessary to undertake the following steps:

a) work breakdown structure of the whole project into identifiable Activities;

b) make the logical sequence of Activities;

c) make a Network Diagram on on arrow scheme so as to show the Critical Activities and Critical Path and 'floats' of non-critical Activities;

d) Activity-wise break-up of the cost estimate of the initial Fixed Investment of the Karabük Project;

e) draw a Bar Chart and Financial Resource Histogram by starting all non-critical Activities such that only half the 'floats' are preserved as this will ensure considerable economy for the interest during construction. This arrangement ensures the balance between 'managerial cushion' on the one hand, as half the 'floats' will be still there, and 'economy' on the other as 'interest during construction' will be considerably reduced by starting the works not on their earliest starting timings;

f) arrive at the Financial Profile of the finalised work schedule based on item (d) above.

Annex 10 shows all the above items as follows

Annex 10.1 - the work breakdown structure;

Annex 10.2 - the logical sequence of Activities;

Annex 10.3 - the Network Diagram;

Annex 10.4 - the activity-wise break-up of the cost estimate of the Initial Investment Cost:

Annex 10.5 - the Bar Chart and Financial Resource Histogram of the finalised schedule; and

Annex 10.6 - the Financial Profile of the initial investment cost.

5.12 INVESTMENT OUTLAY

The project's implementation commenced from 1973 with Equity funds. Prior to 1982 the investment outlay amounted to 2226.4 x 10^6TL (in current TL). The proposed investment for the period 1982 to 1984 (approximately for 35 months - vide paragraph 5.11), are as follows:

1982	-	1935.2 x 10^6TL
1983	-	1672.5 x 10^6TL
1984	-	207.24 x 10^6TL
Total		3814.94 x 10^6TL (in 1982 TL)

A physical contingency of 10% (over the estimated amount) has been incorporated in the above figures. Annex 11 gives the estimated figures and their distribution over the period 1982 to 1984 together with the actual expenditure prior to 1982, with the break-up into local and foreign (equivalent) currencies. Annex 11 also shows the following items:

a) Escalation of the cost over 1982TL assuming escalation of 35% on local currency for 1983 and 30% on local currency for 1984 and only 7% on foreign currency requirement.

b) Interest during construction (from Annex 13).

c) Total investment amount in current TL incorporating all the above items.

5.13 SOURCE OF INITIAL FUND

The sources of initial finance of 6041 x 10^6TL for the total investment amount (see Annex 11) are as follows:

1)	Equity	-	3752.22 x 10^6TL
2)	DYB Loan	-	748.74 x 10^6TL
3)	IBRD Loan	-	1540.00 x 10^6TL

Annex 12 shows the sources of initial funding and their yearwise and currencywise (local and foreign) distribution.

The 'debt:equity ratios' works out to approximately 38:62.

5.14 INTEREST DURING CONSTRUCTION

The fixed interest rate for bot' ~he DYB and IBRD loans is 21.5% per year. Based on the amounts of 1 rom these two sources and to a total of 6041.34 x 10^6TL (= 2249.4 $_{}$0^{6}TL + 3814.94 x 10^6TL) yearwise loan disbursements, the interest payable during construction period are shown in Annex 13.

5.15 INTEREST AND REPAYMENT OF LOANS

The grace periods for both the DYB and IBRD loans are as follows:

DYB loan - 2 years

IBRD loan - 1 year

Thus, the repayments will start from 1987 (for the DYB loan) and 1986 (for the IBRD loan).

Annex 14 shows the interest payable based on rate of interest of 21.5% per year and the repayment schedule for both the loans.

5.16 PRODUCTION COSTS

The unit costs of production of pig iron have been worked out first for:

i) 600,000 tonnes output per year before modernisation;
ii) 750,000 tonnes output per year with 50% utilisation after modernisation;
iii) 900,000 tonnes output per year with 100% utilisation after modernisation

Based on the Unit Costs, Incremental Operating Costs for both 50% and 100% utilisation of installations are then worked out. They are shown in Annex 15(a) and 15(b) respectively. The total production cost of pig iron and their yearwise distribution covering the entire life of the project is shown in Annex 16. The total production cost covers the operating cost and depreciation (vide Annex 15(b)), and Interest payments (vide Annex 14).

5.17 CASH BALANCE AND WORKING CAPITAL REQUIREMENT

The required annual cash balance for the project is worked out based on the formula 'total Production Cost less Raw Material, Utility and

Depreciation'. This is shown in Annex 17. The Working Capital Requirements have then been calculated, based on the following minimum requirements, and shown in the same Annex 17.

Accounts Receivable:		one months of production costs <u>minus</u> depreciation and interest
Inventory:	:	Raw material - 2 months Auxiliary Material - 1 month Finished Product - 1 month
Cash in Hand	:	2 months
Accounts Payable	:	nil

5.18 TOTAL INVESTMENT COST SCHEDULE

The total Investment Cost incorporating the Fixed Investment Cost (vide Annex 11) and Working Capital Requirement (vide Annex 17) are shown in Annex 18.

5.19 TOTAL ASSETS SCHEDULE

The total assets covering the Fixed Investment Cost (vide Annex 11) and Current Assets (from Annex 17 for Working Capital Requirement) are shown in Annex 19.

5.20 REVENUE SCHEDULE

The annual sales revenue of pig iron for both 50% and 100% utilisation throughout the entire life of the project are shown in Annex 20.

5.21 CASH FLOW TABLE FOR FINANCIAL PLANNING

The yearwise cumulative cash balance estimation based on the difference between Cash Inflow (consisting of Financial Resources shown in Annex 12 and Sales Revenue shown in Annex 20), and the Cash Outflow (consisting of Total Assets (vide Annex 19), Operating Costs (vide Annex 15(b)), Debt Servicing (vide Annex 14), and Corporate Tax (vide Annex 22), are shown in Annex 21.

5.22 NET INCOME STATEMENT AND FINANCIAL RATIOS

This table incorporates the Sales Revenue and Production Costs so as to show the taxable profit based on which the Corporate Tax (46.7% in Turkey) can be worked out. This enables the following Financial Ratios to be calculated:

Gross Profit : Sales

Net Profit : Sales

Net Profit : Equity

Annex 22 shows the calculation.

5.23 PROJECTED BALANCE SHEET

The projected Balance Sheet has been worked out from different Assets and Liabilities and is shown in Annex 23.

5.24 FINANCIAL EVALUATION (COMMERCIAL PROFITABILITY)

For this purpose, the following information is already available from the various Annexes:

Cash Inflow:

Sales Revenue - vide Annex 20

Cash Outflow:

Total Investment Outlay (from 1982 onwards)	-	vide Annex 18
Operating Cost	-	vide Annex 16
Tax	-	vide Annex 22

However, as mentioned on page 33 para 5.12, investment in this project started in 1973. The actual expenditure between 1973 and 1980 had been all in domestic currency, whereas the expenditure in 1981 consisted of both domestic and foreign currency. The profitability of the project has been based on 1981/82 Turkish Lira. Therefore, all the expenditure prior to this must be converted to 1981/82 Turkish Lira. They are shown in Annex 24 (p.1). The resulting Cash Flow on market price is shown in Annex 24 (page 2). The IRR of the project based on the market price cash flow amounts to 11% approximately.

5.25 SENSITIVITY ANALYSIS (ON COMMERCIAL PROFITABILITY)

The changes in NPV of the projects for 10% changes in the different elements viz. Investment Costs, Operating Costs and Sales Revenue, have been worked out taking the initial year (the year '0') of the project as 1973, and using 10% discount rate. The calculations are shown in Annex 25. The results of the Sensitivity Analysis are as follows:

Items of Cash Flow	Changes in NPV due to 10% change in the items	Alternatively changes in the item to make NPV = 0
1. Investment Costs	62%	16.12%
2. Operating Costs	111%	9%
3. Sales Revenue	226%	4.4%

From the above, it appears that the most sensitive item of the cash flow is Sales Revenue, as only 4.4% fall in sales (due to several reasons such as fall in demand or under-utilisation) will render the project non-viable. Even though the Sales Revenue is the most critical, the other items of cash flow are not very good either. The next most crucial item is Operating Cost, where a 9% increase will render the project a negative NPV. The Investment Cost is the least sensitive item of Cash Flow, but more than 16% to 17% increases in Capital Cost are not rare for Industrial Projects, and it happens that the project is again not viable. Hence the project requires a very good management and organisation team to ensure that cost over-run and fall in Sales Revenue do not occur in the initial construction and operation stage of the project.

5.26 COMMERCIAL PROFITABILITY - WITHOUT CORPORATE TAX AND SUBSIDY

The commercial profitability on market price (i.e. market price IRR) of the project is only 11% whereas the acceptable rate of return in Turkey is 21.5%.

The NPV of the project with discount rate above 11% (the IRR of the project) is negative.

Hence the project is not viable commercially specially when Corporate Taxes etc. are included.

If exemption of Corporate Tax is given by the government, the IRR works out to be 17.51% and NPV at 21.5% discount rate works out to (-695.03×10^6TL). The calculations are shown in Annex 26.

Calculation has also been made to see how much subsidy will be required annually to achieve an IRR of 21.5% for the project. It shows that approximately 1300.75×10^6TL annual subsidy for the 20 years life of the project will be needed (over and above the Corporate Tax exemption) to make 21.5% return nased on the market price cash flow of the project. The calculation for subsidy requirement is also shown in Annex 26.

5.27 NATIONAL ECONOMIC EVALUATION

The shadow pricing of the inputs and outputs of the project has been based on the World Bank Staff Working Paper No. 392 on 'Shadow Prices for Project Appraisal in Turkey'. This World Bank Study followed the Little-Mirrlees method (extended subsequently by the Bank staff members - Squire and Van der Tak) which uses conversion factors on all costs and benefits of a project into border price (or in other words, world price) with numeraire 'uncommitted foreign exchange (expressed in terms of units of local currency (Turkish Lira) converted at the official exchange rate) in the hands of government'.

The National Parameters worked out in the above Working Paper No. 392 of the World Bank were based on data between 1974 and 1978. It is felt that they are required to be revised in 1982 as the economic data (such as Imports, Exports, Taxes, Duties, etc.) have considerably changed from what they were in 1978. A separate 'Note' on shadow price factors based on 1982 data of Turkish Economy has been prepared where the Conversion Factors have been worked out and they have been used here in this Feasibility Report. The relevant Conversion Factors are given below:

Standard Conversion Factor (SCF)	-	0.685
Conversion Factor for Consumption Goods (CF_C)	-	0.88
Conversion Factor for Intermediate Goods (CF_I)	-	0.5598
Conversion Factor for Capital Goods (CF_K)	-	0.527
Shadow Wage Rates (SPI)		
Rural Sector	-	0.65
Urban Informal Sector	-	0.64
Urban Formal Sector	-	0.66

Based on the above National Parameters for Turkey, the following items are worked out:

1) Revenue for Pig Iron - (Traded items) based on cif and fob prices. (In Turkey the fob price = cif price), shadow price factor is, therefore, one.

2) Cash flow during Construction period (based on break up of traded and non-traded components) using shadow price factors for capital and intermediate goods and SCF

3) Iron Ore - (non-traded for Turkey) (based on marginal social cost of extraction, transportation and profit margin) $CF_{ORE} = 0.48$

4) Sinter (based on sector conversion factor with 1982 data): $CF_{SINTER} = 0.54$

5) Limestone and Manganese (non-traded for Turkey). They are similar to ore. $CF_{LSandMN} = 0.48$

6) Coke (traded imported item) based on cif price, $CF_{COKE} = 0.72$

7) Electricity and Water (non-traded): SCF = 0.685 are used.

8) Direct Labour (equivalent to Urban formal sector): $SPI_{UFS} = 0.66$

Based on these shadow price factors, the conversion factors of Operating Cost and Working Capital amounts to:

$CF_{Operating\ Costs}$:

Output 6 x 10^5 tonnes per year	=	0.65
Output 7.5 x 10^5 tonnes per year	=	0.643
Output 9 x 10^5 tonnes per year	=	0.642

$CF_{Working\ Capital}$ = 0.71

The ERR based on the above amounts to 26% approximately. The calculations for Conversion Factors and ERR are shown in Annex 27.

CHAPTER 6

Project Implementation Management and Control

6.1. PROJECT MANAGEMENT ORGANISATION

The investment works are to be carried out under the co-ordination and responsibility of the Planning Department of the Turkish Iron and Steel Works General Directorate. However, in view of the size of the expansion, it will be necessary to assign the complete responsibility for the task as well as all the resources needed for its accomplishment, to one project manager. The organisation he will head will resemble a regular line division (of standard functional alignments) relatively independent of any other division or staff group.

The project management organisation, together with the responsibility of various activities (of the implementation plans given in Annex 10.1, 10.2 and 10.3), is shown in Annex 28.

Karabuk Steel Works completed the setting up of blast furnace No. 2, belonging to Erdemir Plants within the scheduled programmed time, and the Technical and Management personnel in Karabuk Plant are fully qualified and experienced. With operating experience of about 43 years, the Implementation Group in Karabuk belongs to a well developed organisation with personnel competent enough to implement, manage and control the project's construction stage successfully. (Annex 29 shows the qualifications and experience of the Project Management Group.)

6.2. PROJECT MANAGEMENT INFORMATION SYSTEM (PMIS)

To ensure implementation, management and control of the project at the construction stage and thereafter, a PMIS is to be introduced under the overall supervision of the Planning Manager and direct control of the Chief (PMIS). The information will be inter alia under the following categories:

a) Project action planning and control information

- Master plan and schedule with milestones (for PMIS) at Executive and Project level.
- Task work statements for each activity of work break-down structure.

- Task schedule
- Progress reporting through Bar Charts and Network
  (Annex 30 shows the Bar Chart of the project with milestones for PMIS.)

b) Resource planning and budgeting information, including manpower resources and cost estimates and cost budgets.

c) Contracting, work authorisation and resource control information
- Work orders and Contracts
- Expenditure records
- Work and resource (fund and manpower) control information through Bar Charts and Network

d) Project Financing Information
- Financial plan
- Financial progress reporting including debt repayments and interest payments

6.3. CONTRACT PLAN

The Project Implementation and Management Group as well as the Enterprise have sufficient experience and knowledge for supervising and managing the work involved in this project and hence separate contracts for civil engineering, plants and fabrication, and erection etc., and procurement of both domestic and imported equipment and materials, will be resorted to (instead of single turn-key type of contract). This is expected to ensure maximum economy in the contractual aspects of the project. The project management organisation will also be responsible for 'Technology Licence Agreements' in connection with imported plants and equipment.

CHAPTER 7

Conditions of Loan

7.1. PROGRAMME AND CREDIT LIMIT OF THE ENTERPRISE

The project is included in the approved 'programme' of the Government (i.e. State Planning Organisations Annual Programme), and the DYB's loan of TL.2288.74 x 10^6 (DYB's own loan of TL.748.74 x 10^6 plus IBRD's loan through DYB of TL.1540 x 10^6) is within the Credit Limit of the enterprise as stipulated by the Government.

In the footnote relating to this project in the 1982 Investment Programme, it is mentioned that the investment disbursement can be increased by revising the project during the year, with respect to its improvement. The 1982 investment amount of the project will reach TL.1935.21 x 10^6 (see Appendix 12.) The requirement of financing from external sources will be TL.1161.13 x 10^6 (DYB loan: TL. 39.13 x 10^6 + DYB loan of IBRD origin: TL.1122.00 x 10^6, leaving the equity to be TL.774.08 x 10^6. Thus the financing of the project will be adequately met.

7.2. TERMS AND CONDITIONS OF LOAN

The terms and conditions of the total mount of loan of TL.228.74 x 10^5 are as follows:

<u>Amount:</u> DYB loan: TL.748.74 x 10^6

DYB loan of IBRD origin : TL.1540 x 10^6

<u>Interest Rate:</u> 21.5 per cent

<u>Term:</u> For DYB loan: 2 + 10 years

Grace period: 1985, 1986

Repayment: 1987 to 1996

For DYB loan of IBRD origin: 1 + 10 years

Grace period: 1985

Repayment: 1986 to 1995

7.3. REPAYMENT SCHEDULE

	DYB Loan	DYB Loan of IBRD Origin	
1982) 1983) 1984)	Construction	Period	
1985	-	-	
1986	-	77	May
		77	November
		154	
1987	74.87	77	May
		77	November
		154	
1988	74.87	77	May
		77	November
		154	
1989	74.87	77	May
		77	November
		154	
1990	74.87	77	May
		77	November
		154	
1991	74.87	77	May
		77	November
		154	
1992	74.87	77	May
		77	November
		154	
1993	74.87	77	May
		77	November
		154	
1994	74.87	77	May
		77	November
		154	
1995	74.87	77	May
		77	November
		154	
1996	74.87	-	
Total	748.74	1540	

They also refer to paras 5.13 to 5.15 of Chapter 5 , and Annexes 12 to 14.

ANNEX 1

ANNUAL PRODUCTION, IMPORT AND CONSUMPTION OF STEEL BETWEEN 1956-1976

(in tons)

PRODUCT GROUPS	1956	1957	1958	1959	1960	1961	1962
Rod Production	142,561	167,014	180,255	203,454	223,816	193,202	276,748
Import	54,980	25,642	20,195	88,959	104,807	89,152	14,747
Flat Production	51,759	65,183	62,039	73,735	69,440	56,463	65,296
Import	77,023	52,240	44,134	71,039	84,264	83,917	130,142
Total Production	194,320	332,197	242,294	277,189	293,256	249,665	342,044
Total Import	132.000	77,882	64,329	159,998	189,071	173,069	144,888
Total Consumption (Apparent)	418,052	392,020	340,441	512,376	530,913	513,043	608,891

Product Groups	1963	1964	1965	1966	1967	1968	1969
Rod Production	342,103	389,045	435,500	552,700	699,328	738,864	794,885
Import	51,632	28,439	-	52,800	30,754	23,078	52,390
Flat Production	81,306	108,083	199,800	281,600	349,120	468,022	483,605
Import	167,515	127,649	44,900	110,100	53,025	26,515	27,438
Total Production	423,409	497,128	635,300	834,300	1,048,448	1,206,886	1,278,490
Total Import	291,167	155,088	44,900	162,900	83,775	49,593	79,828
Total Consumption (Apparent)	764,845	776,302	936,100	1.128.500	1,267,142	1,446,546	1.550,947

PRODUCT GROUPS	1970	1971	1972	1973	1974	1975	1976
Rod Production	786,900	865,000	969,000	1,158,400	1,107,700	1,085,000	1,105,000
Import	156,133	234,000	81,000	121,200	465.500	328.000	330.000
Flat Production	580,200	520,000	715,000	517,900	839,900	955,000	950,000
Import	30,688	38,000	100,000	201,800	486.000	366.000	478.000
Total Production	1,367,100	1,385,000	1,684,000	1,676,300	1,947,600	2,040,000	2,055,000
Total Import	186,821	272,000	181,000	323,000	951,500	694,000	808,000
Total Consumption (Apparent)	1,718,200	1,886,000	2,183,000	2,210,500	2,631,000	2,998,000	3,494,500

Source: Erdemir's Expansion Project December 1977.

ANNEX 1.a

MOLTEN STEEL PRODUCTION AND CONSUMPTION

(In Million Ton)

Years	Production	Consumption
1975	1,8	3,1
1976	1,9	4,0
1977	1,9	4,4
1978	2,2	3,6
1979	2,5	3,5

Source : Erdemir Annual Report 1979
International Iron and Steel Institute, 1980

ANNEX 2

TRENDS IN SUPPLY
(INCLUDING INTEGRATED PLANTS AND ARC FURNACES)
AND DEMAND OF STEEL IN FUTURE

(In thousand tons)

	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
Integrated Plants										
ERDEMİR	1,100	1,500	1,500	1,500	1,500	2,000	2,000	2,000	2,740	2,740
ISDEMİR	1,000	1,000	1,100	1,100	1,100	1,100	2,200	2,200	2,200	2,200
KARABÜK	600	600	600	600	750	900	900	900	900	900
	2,700	3,100	3,200	3,200	3,350	4,000	5,100	5,100	5,840	5,840
Are Furnaces	800	800	800	900	900	1,000	1,000	1,100	1,100	1,200
Total Capacity	3,500	3,900	4,000	4,100	4,250	5,000	6,100	6,200	6,940	7,040
Expected Production	2,500	2,788	2,860	2,931	3,038	3,575	4,000	4,433	4,920	5,033
Expected Demand	3,500	3,500	3,605	3,713	3,825	4,016	4,256	4,555	4,920	5,362
Difference		(712)	(745)	(782)	(787)	(441)	(256)	(122)	–	(328)

ANNEX 3

TRENDS IN PIG IRON CONSUMPTION (Apparent) AND DEMAND

(In thousand tons)

Years	Pig Iron Consumption(x)
1975	136
1976	166
1977	212
1978	313
1979	285
1980	285 (T)
	Projected
1981	310
1982	340
1983	363
1984	385
1985	420
1986	444
1987	488
1988	496

(x) Source: M.K.E.K. Market Research for Foundry, ITU, Mech.Eng. 1980

(T) Estimated

ANNEX 3.a

PIG IRON SUPPLY AND DEMAND COMPARISON

(In thousand tons)

		1981	1982	1983	1984	1985	1986	1987	1988
Supply	KARABÜK	95,0	125,0	150,0	300,0	300,0	300,0	300,0	300,0
	İSDEMİR	200,0	200,0	198,0	–	–	–	–	–
	Import	15,0	15,0	15,0	–	–	–	–	–
	TOTAL	310,0	340,0	363,0	300,0	300,0	300,0	300,0	300,0
Demand		310,0	340.0	363,0	385,0	420,0	444,0	488,0	496,0
Difference		0	0	0	(85,0)	(120,0)	(144,0)	(188,0)	(196,0)

ANNEX 4

DEMAND FOR PIG IRON

(In Thousand Tons)

Years	Per capita consumption	Total demand
1980	8,086	361.1
1981	8,189	367.2
1982	8,292	389.7
1983	8,396	403.6
1984	8,501	418.0
1985	8,821	443.7
1986	9,150	470.8
1987	9,488	499.5
1988	9,838	429.8
1989	10,199	561.9
1990	10,569	595.6
1991	10,951	631.4
1992	11,344	669.1
1993	11,746	708.7
1994	12,166	750.9
1995	12,593	795.2

$Y = -2{,}150{,}883 + 0.0020659\ x$

$R^2 = 0{,}88$

Y = p.c. Pig Iron Consumption

x = p.c. GNP

ANNEX 4.a.

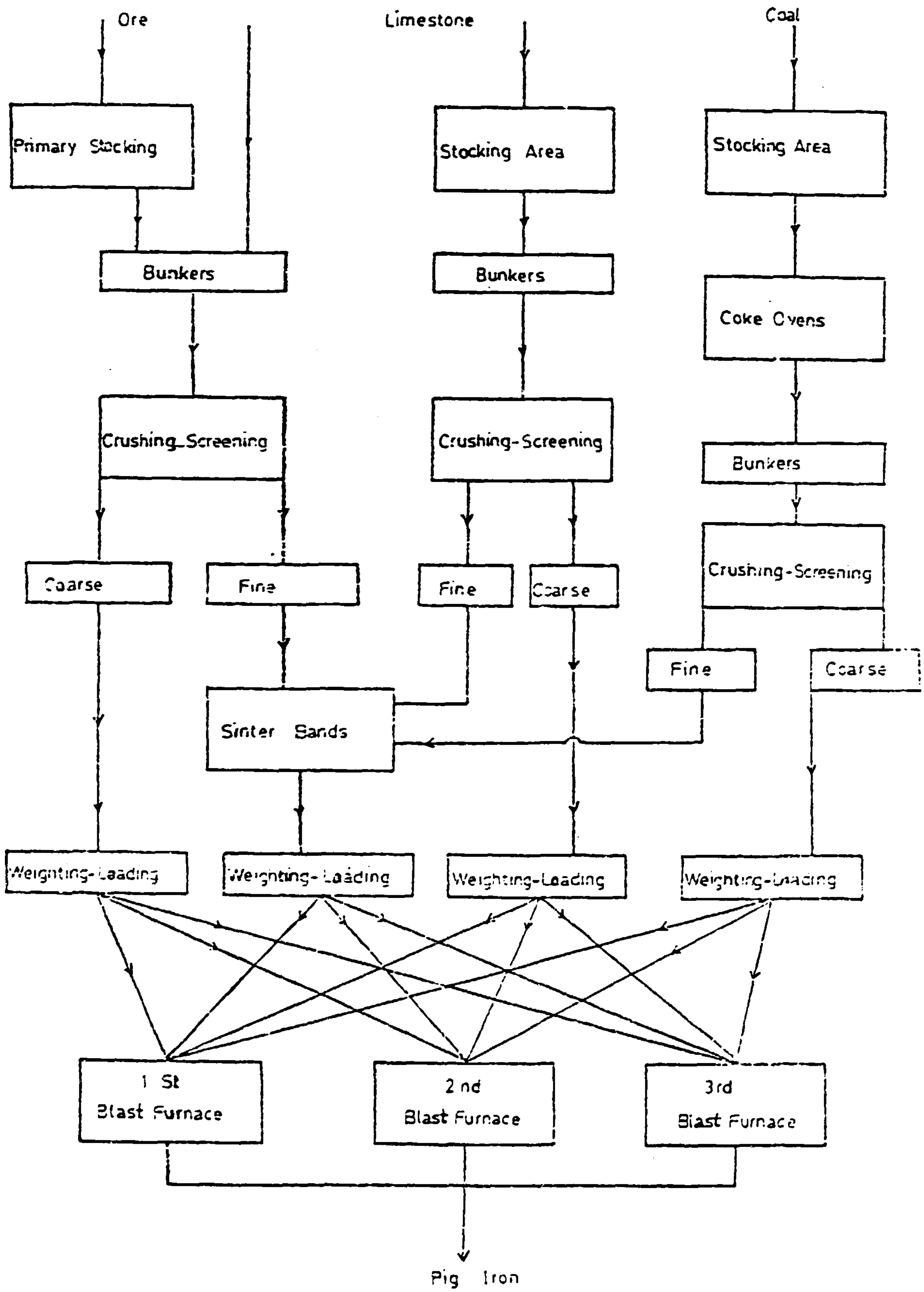
PIG IRON DEMAND PROJECTIONS

(In Thousand Tons)

Years	Per Capita Consumption	Total Demand
1980	8,552	384,0
1981	8,663	398,0
1982	8,776	412,4
1983	8,890	427,3
1984	9,005	442,8
1985	9,356	470,6
1986	9,721	500,2
1987	10,100	531,7
1988	10,494	565,1
1989	10,904	600,7
1990	11,329	638,5
1991	11,771	678,7
1992	12,230	720,2
1983	12,707	766,7
1984	13,202	814,9
1995	13,717	866,6

ANNEX 5

FLOW DIAGRAM OF KARABÜK



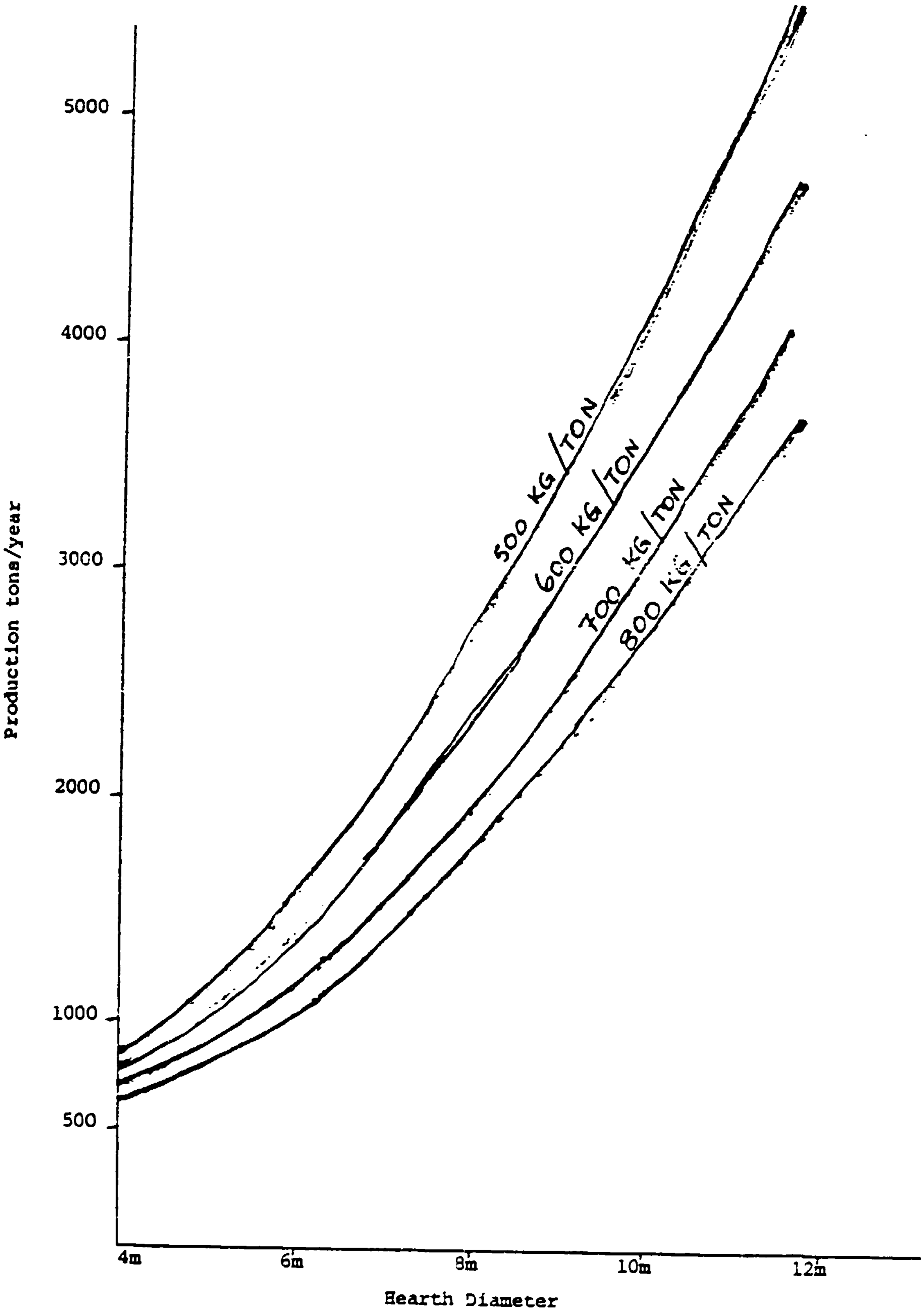
ANNEX - 6

RELATION BETWEEN AIR ACCESS TEMPERATURE AND SPECIFIC COKE CONSUMPTION

	Blast Furnace No. 1	Blast Furnace No. 2	Blast Furnace No. 3
1. Specific coke consumption after modernisation of blast furnace	820 kg/ton	824 kg/ton	785 kg/ton
2. Average air access temperature	650^{o}C	650^{o}C	738^{o}C
3. Coke saving (650^o-700^{o}C)	% 2	% 2	-
4. Coke gain	16,4 kg	16,5 kg	-
5. Specific coke consumption	804 kg/ton	807 kg/ton	785 kg/ton
6. Coke saving (700^o-800^{o}C)	% 4	% 2	% 2,5
7. Coke gain	32 kg	32 kg	14 kg
8. Specific coke consumption	772 kg/ton	775 kg/ton	766 kg/ton
9. Coke saving (800^o-900^{o}C)	% 3,5	% 3,5	% 3,5
10. Coke gain	27 kg	27 kg	26 kg
11. Specific coke consumption	745 kg/ton	748 kg/ton	740 kg/ton
12. Coke saving (900^d-1000^{o}C)	% 3	% 3	% 3
13. Coke saving	22 kg	22 kg	22 kg
14. Specific coke consumption	723 kg/ton	726 kg/ton	718 kg/ton
15. Coke saving (1000^o-1100^{o}C)	% 2,5	% 2,5	% 2,5
16. Coke gain	18 kg	18 kg	18 kg
17. Specific coke consumption	705 kg/ton	708 kg/ton	700 kg/ton
18. Total coke gain (650^o-1100^{o}C)	115 kg/ton	115 kg/ton	85 kg/ton
19. Average weighted coke gain	-	99 kg/ton	

ANNEX 7

Relationship between Specific Coke Consumption and Production (in Karabük)



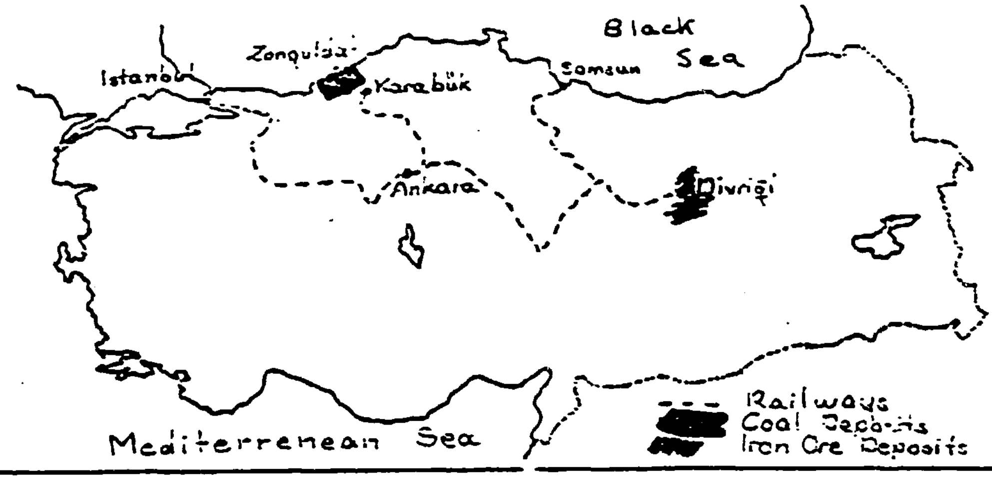
Source: Lüth-König, The Planning of Iron and Steelworks, p.53, Springer - Verlag - Berlin

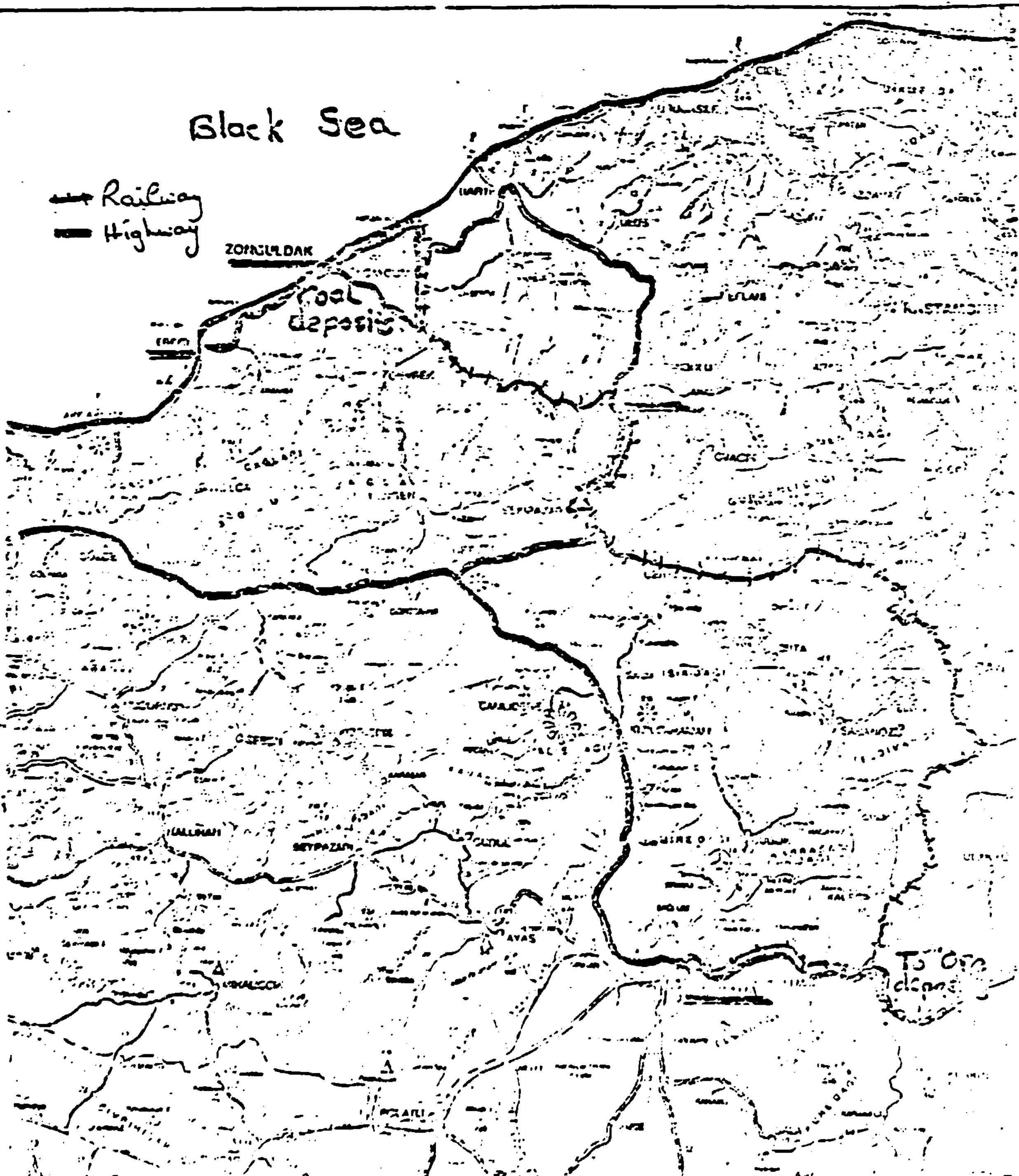
ANNEX - 8

RELATION BETWEEN SPECIFIC COKE CONSUMPTION AND PRODUCTION FOR KARABÜK'S BLAST FURNACES

Production coinciding to Specific Coke Consumption (Ton-Year)

	1975's PRODUCTION	0,800 Kg-ton	0,750 Kg-ton	0,700 Kg-ton	0,650 Kg-ton	0,600 Kg-ton	0,550 Kg-ton	0,500 Kg-ton
3. Blast Furnace	340,000	572,000	610,000	654,000	704,000	763,000	832,000	915,000
2. Blast Furnace	147,000	196,000	209,000	224,000	241,000	261,000	285,000	313,000
1. Blast Furnace	148,000	196,000	209,000	224,000	241,000	261,000	285,000	313,000
T O T A L	635,000	964,000	1,028,000	1,102,000	1,186,000	1,285,000	1,402,000	1,541,000


Black Sea
Istanbul
Karabük
Samsun
Ankara
Divriği
Mediterrenean Sea
Railways
Coal Deposits
Iron Ore Deposits


Black Sea
Railway
Highway
ZONGULDAK
Coal Deposits

ANNEX 10.1

WORK BREAK-DOWN STRUCTURE OF THE KARABÜK PIG IRON PROJECT

The project can be broken down into the following major Activities:

a) Wagon Tipping and Dumping (Construction)

b) Wagon Tipping and Dumping (Erection)

c) Wagon Tipping and Dumping (Commissioning)

d) Ore Blending (Procurement)

e) Ore Blending (Erection)

f) Ore Blending (Commissioning)

g) Ore Preparation (Procurement)

h) Ore Preparation (Erection)

i) Ore Preparation (Commissioning)

j) Blast Furnace Charge (Procurement)

k) Blast Furnace Charge (Erection)

l) Blast Furnace Charge (Commissioning)

m) Sampling (Procurement)

n) Sampling (Erection)

o) Sampling (Commissioning)

p) Limestone Crushing and Screening (Erection)

q) Limestone Crushing and Screening (Commissioning)

r) Coke Crushing and Screening (Commissioning)

s) Sinter Feed (Erection)

t) Sinter Feed (Commissioning)

u) Stove Modification No. 1

v) Stove Modification No. 2 and No. 3

w) Production of first batch of Pig Iron.

The Logical Sequence of the above Activities is shown in Annex 10.2.

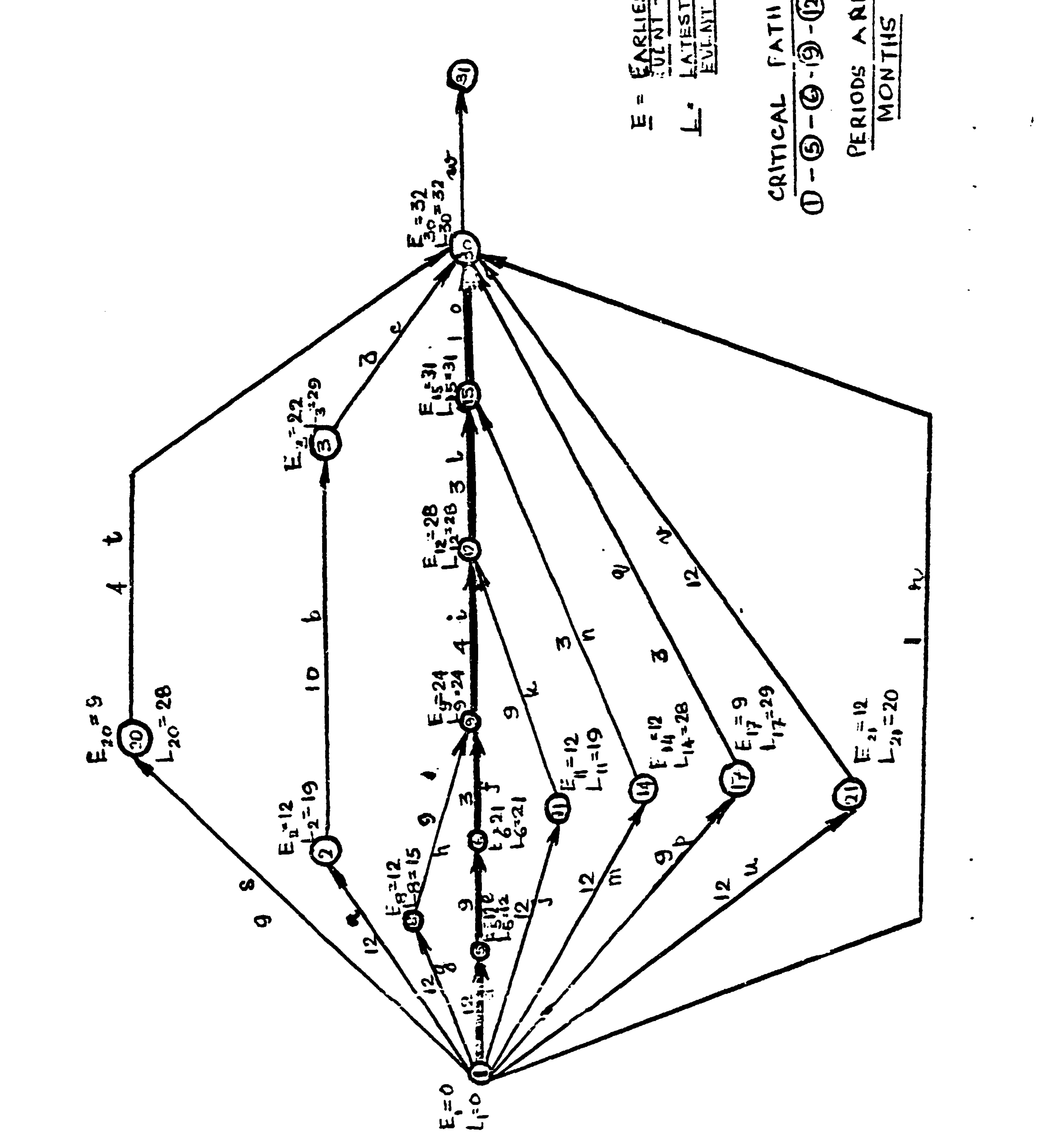
ANNEX 10.2.

LOGICAL SEQUENCE OF ACTIVITIES OF THE KARABÜK PIG IRON PROJECT

Event Nos.	Activity	Time Duration (months)	Preceding Activities
1 - 2	a	12	-
2 - 3	b	10	a
3 - 30	c	3	b
1 - 5	d	12	-
5 - 6	e	9	d
6 - 9	f	3	e
1 - 8	g	12	-
8 - 9	h	9	g
9 - 12	i	4	h, f
1 - 11	j	12	-
11 - 12	k	9	j
12 - 15	l	3	k, i
1 - 14	m	12	-
14 - 15	n	3	m
15 - 30	o	1	n, l
1 - 17	p	9	-
17 - 30	q	3	p
1 - 30	r	1	-
1 - 20	s	9	-
20 - 30	t	4	s
1 - 21	u	12	-
21 - 30	v	12	u
	w	-	c, o, q, r, t, v

ANNEX 10.3

NETWORK DIAGRAM



ANNEX 10.4.

ACTIVITY-WISE BREAK-UP OF THE COST ESTIMATE

The total cost of 3821.4 x 10^6TL for the Karabük pig iron and modernisation project has been broken up activity-wise and they are shown below:

Activity (1)	Cost x 10^6TL (2)	Duration (mths) (3)	Cost/Month (4) = (2) ÷ (3)
1 - 2	242.0	12	20.17
1 - 5	616.0	12	51.33
1 - 8	445.5	12	37.12
1 - 11	363.0	12	30.25
1 - 14	36.3	12	3.03
1 - 17	231.0	9	25.67
1 - 20	192.5	9	21.39
1 - 21	550.0	12	45.83
1 - 30	2.2	1	2.20
2 - 3	82.5	10	8.25
3 - 30	4.4	3	1.47
5 - 6	286.0	9	31.78
6 - 9	12.1	3	4.03
8 - 9	110.0	9	12.22
9 - 12	5.5	4	1.37
11 - 12	60.5	9	6.72
12 - 15	4.4	3	1.46
14 - 15	22.0	3	7.33
15 - 30	1.1	1	1.10
17 - 30	2.2	3	0.73
20 - 30	550.0	12	45.83
	3821.4		

ANNEX 10.5

BAR CHART AND FINANCIAL RESOURCE PLANNING SCHEDULE

In order to arrive at the most suitable scheduling of the Activities, it is necessary to draw Bar Charts and make Financial Resource Analyses. For this purpose three different Bar Charts were made viz:

Case A - with all Activities commenced at their earliest starting times;

Case B - with all Activities commenced at their latest starting times;

Case C - with Activities scheduled in such a way that only half the 'floats' available for non-critical Activities are used.

Using the three different scheduling of Activities, the Opportunity Cost of Capital Investment for the three different Cases worked out as follows: (rate of interest was assumed to be 21.5% per year):

Case A - 1524.49×10^6TL

Case B - 1074.85×10^6TL

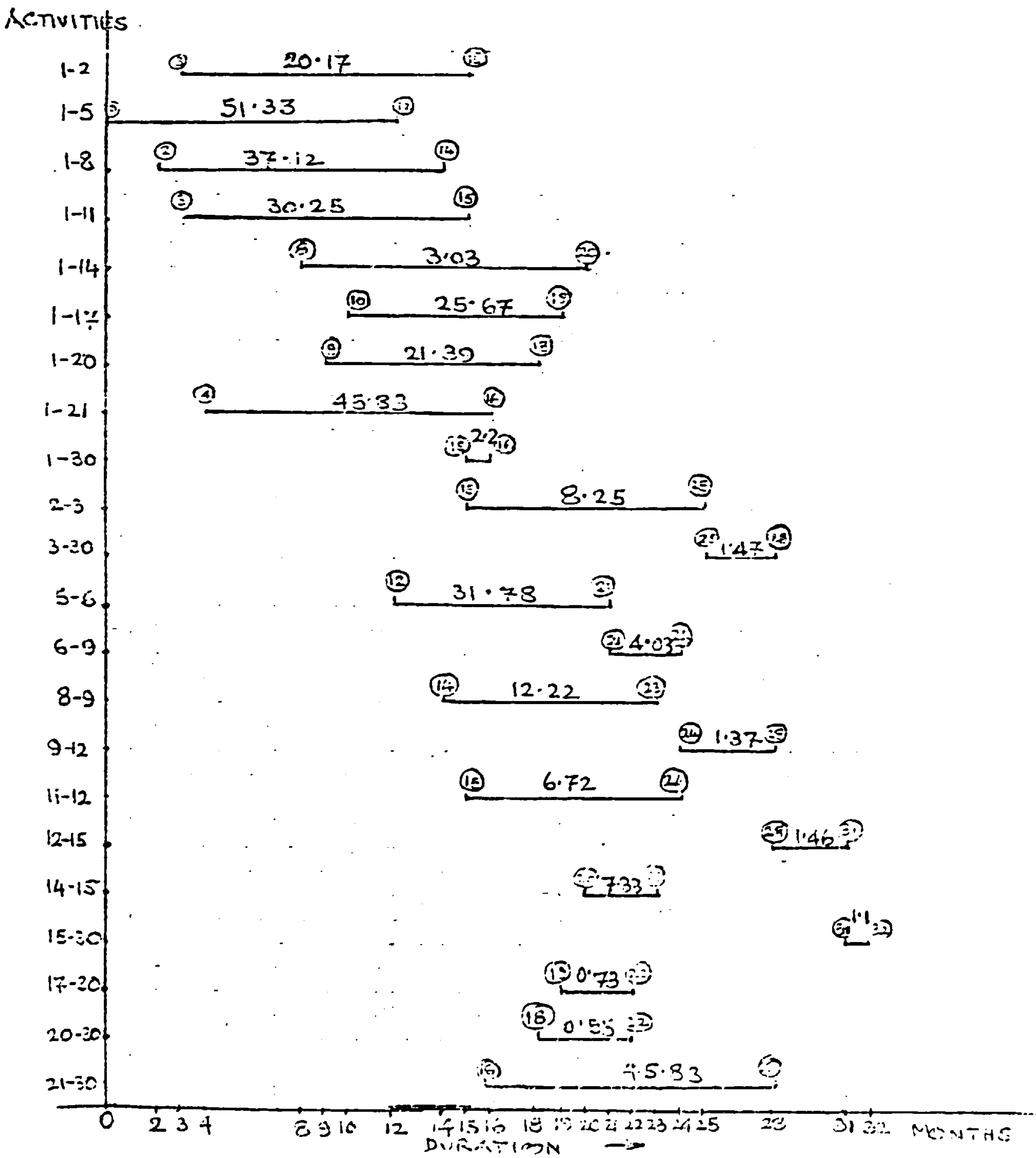
Case C - 1202.13×10^6TL

While Case A schedule is the best from the point of view of managerial control (as all the floats remain available in the non-critical Activities), it is the most expensive. Case B is the most economical with regard to the opportunity cost of capital, but very undesirable for final adoption from the point of view of managerial control as all the floats are eliminated. Therefore, it is considered desirable to adopt Case C schedule as the final in this instance, so that the managerial cushion can be maintained, while some economy (as regards opportunity cost of capital) can be achieved.

ANNEX 10.5/cont...

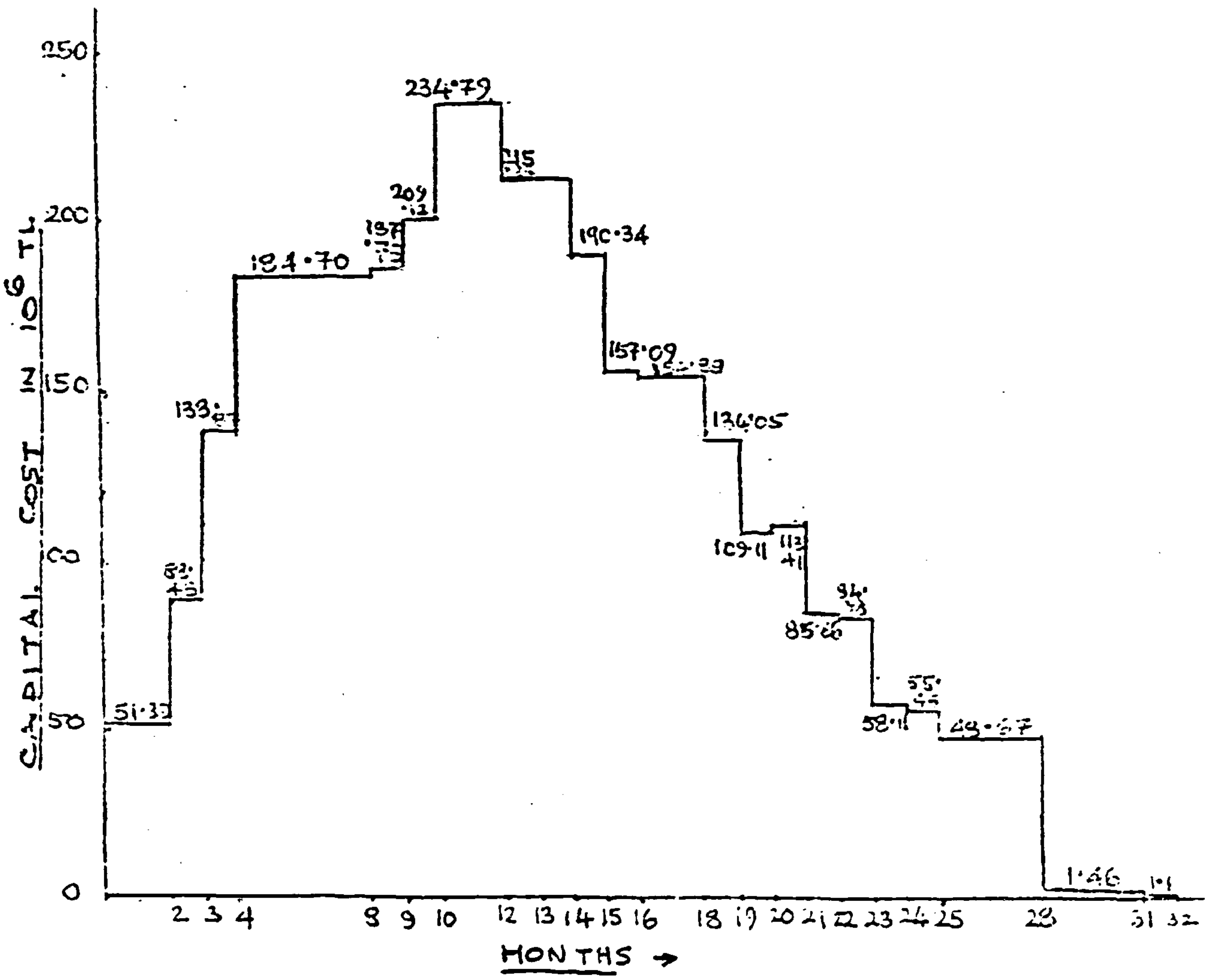
BAR CHART showing Activities scheduled so as to have only half amount of floats for non-critical Activities (i.e. all Activities started mid-way between EST and LSTs)

Resources shown are cost/time (i.e. 10^6TL per month) for each Activity.



ANNEX 10.5/cont...

FINANCIAL RESOURCE HISTOGRAM



ANNEX 10.5 /cont...

OPPORTUNITY COST OF CAPITAL INVESTMENT

$$51.33 \left[\frac{(32-1) + (32-2)}{12}\right] \times 0.215 = 56.10$$

$$88.45 \left[\frac{32-3}{12}\right] \times 0.215 = 45.95$$

$$138.87 \left[\frac{32-4}{12}\right] \times 0.215 = 69.66$$

$$184.7 \left[\frac{(32-5) + (32-6) + (32-7) + (32-8)}{12}\right] \times 0.215 = 337.54$$

$$187.73 \left[\frac{32-9}{12}\right] \times 0.215 = 77.36$$

$$209.12 \left[\frac{32-10}{12}\right] \times 0.215 = 82.43$$

$$234.79 \left[\frac{(32-11) + (32-12)}{12}\right] \times 0.215 = 172.47$$

$$215.24 \left[\frac{(32-13) + (32-14)}{12}\right] \times 0.215 = 142.68$$

$$190.34 \left[\frac{32-15}{12}\right] \times 0.215 = 57.97$$

$$157.09 \left[\frac{32-16}{12}\right] \times 0.215 = 45.03$$

$$154.89 \left[\frac{(32-17) + (32-18)}{12}\right] \times 0.215 = 80.47$$

$$134.05 \left[\frac{32-19}{12}\right] \times 0.215 = 31.22$$

$$109.11 \left[\frac{32-20}{12}\right] \times 0.215 = 23.45$$

$$113.41 \left[\frac{32-21}{12}\right] \times 0.215 = 22.35$$

$$85.66 \left[\frac{32-22}{12}\right] \times 0.215 = 15.34$$

$$84.38 \left[\frac{32-23}{12}\right] \times 0.215 = 13.60$$

$$58.11 \left[\frac{32-24}{12}\right] \times 0.215 = 8.33$$

$$55.45 \left[\frac{32-25}{12}\right] \times 0.215 = 6.95$$

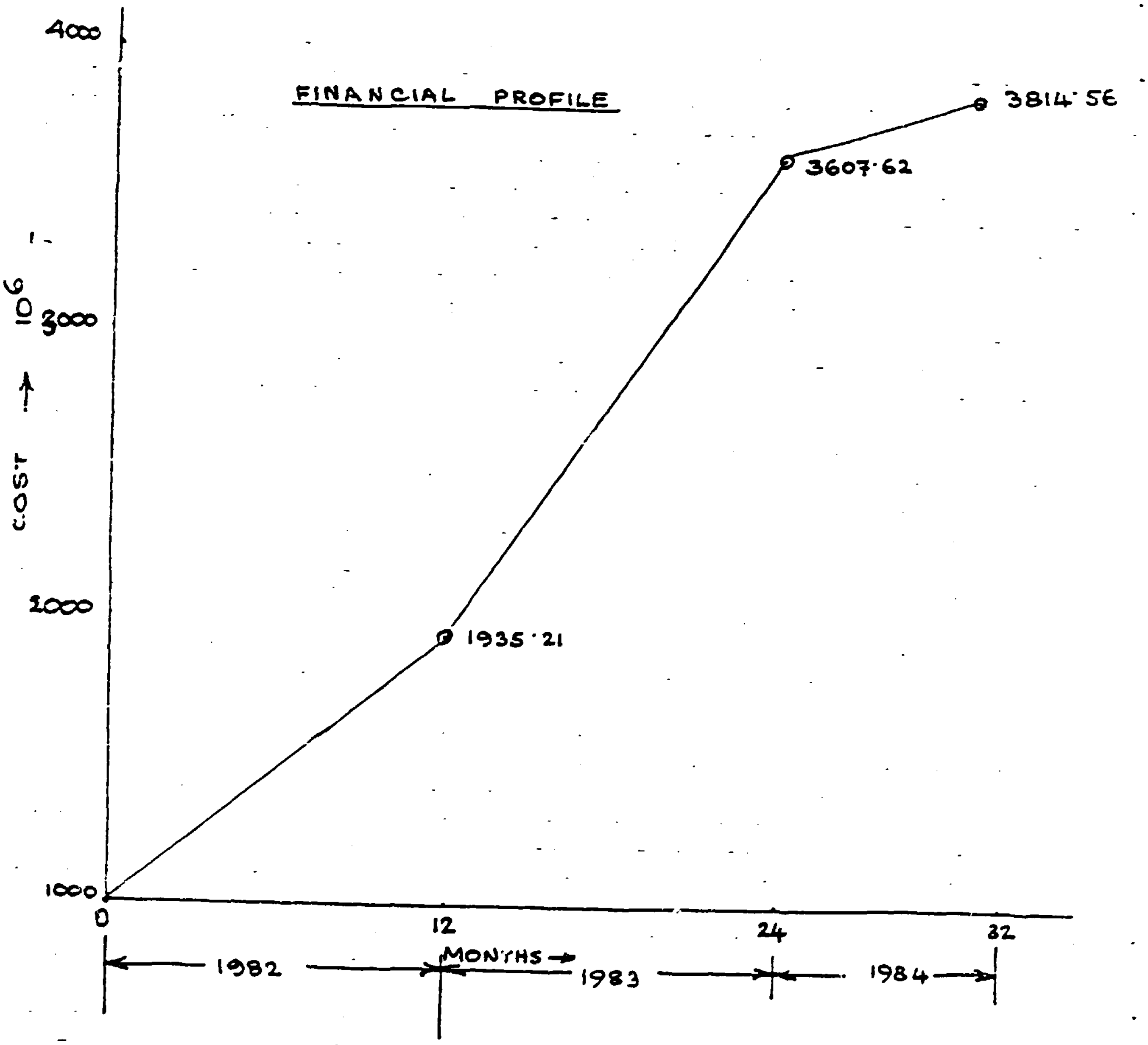
$$48.67 \left[\frac{(32-26) + (32-27) + (32-28)}{12}\right] \times 0.215 = 13.08$$

$$1.46 \left[\frac{(32-29) + (32-30) + (32-31)}{12}\right] \times 0.215 = 0.15$$

TOTAL 1202.13

ANNEX 10.6.

FINAL PROFILE OF THE INITIAL INVESTMENT COST AS PER THE FINALISED SCHEDULE PLAN



ANNEX 11

TOTAL FIXED INVESTMENT COSTS

(IN 10^6 TL)

	CURRENCY			BEFORE 1982			1982			1983			1984		
	LOCAL	FOREIGN	TOTAL	LOCAL	FOREIGN	TOTAL	LOCAL	FOREIGN	TOTAL	LOCAL	FOREIGN	TOTAL	LOCAL	FOREIGN	TOTAL
1. Research and Project Preparation	58	36	94	58	36	94									
2. Land	-	-	-												
3. Construction	1215	-	1215	610	-	610	137.1		137.1	385.5		385.5	82.4	-	82.4
4. Machinery and Equipment	152	1413.4	2935.4	773	673.4	1457.4	374	690	1064	370	50	420.0			
5. Refractory Material	180	660.0	840				40	330	370	110	330	440	30	-	30
6. Import Expenditure	142.0	-	142.0	15		15	98.57		98.57	28.57		28.57			
7. Transportation and Insurance	57.0	-	57.0	6.0		6.0	39.43		39.43	11.43		11.43			
8. Erection of Equipments and Plants	371.2	-	371.2	50		50	50.2		50.2	235		235	36	-	36
9. Commissioning of Plants	40	-	40										40	-	40
SUB TOTAL:	3505.7	2109.4	5694.6	1577	709.4	2226.4	789.3	1020	1759.3	1140.5	380	1520.5	188.4		188.4
10. Physical Contingency 10%	206.82	140.0	346.74	(68%)	(32%)	(100%)	73.9	102	175.9	114.0	38	152.0	18.84		18.84
TOTAL: (IN 1982 TL VALUE)	3792.02	2249.4	6041.34				813.2	1122	1935.2	1254.55	418	11672.5	207.24		207.24
11. ESCALATION ON 1982 T. LIRA	(@ 35% on local for 1983 AND 7% on foreign for 1983 AND 30% on local for 1984						(42%)	(58%)	(100%) 1935.0 (1982 T.LIRA	(75%) 1702.55	(25%) 447.26	(100%) 2149.81	(100%) 363.71		(100%) 363.71
12. INTEREST DURING CONSTRUCTION	(FROM ANNEX 13)								124.01			357.50			478.71
TOTAL	INVESTMENT AMOUNT IN CURRENT TL:								2060.01			2507.31			842.42

ANNEX 12

SOURCES OF INITIAL FUND (FOR CONSTRUCTION PERIOD) (in 10^6 TL)

	Before 1982			1982			1983			1984			TOTAL		
	LC	FC	TC	LC	FC	TC	LC	FC	TC	LC	FC	TC	LC	FC	TC
EQUITY	1517	709.4	2226.4	774.08	-	774.08	668.96	-	668.96	82.78	-	82.78	3042.82	709.4	3752.22
DYB LOAN	-	-	-	39.13	-	39.13	585.45	-	585.45	124.16	-	124.16	748.74	-	748.74
IBRD LOAN	-	-	-	-	1122.0	1122.00	-	418	418.00	-	-	-	-	1540.0	1540.00
TOTAL	1517	709.4	2226.4	813.21	1122.0	1935.21	1254.41	418	1672.41	206.94	-	206.94	3791.56	2249.4	6040.96

Notes:

1. Before 1982 all expenditure (LC and FC) are from Equity
2. From 1982 to 1984, DEBT:EQUITY ratio is 38:62
3. From 1982, all Foreign Currencies are from IBRD Loan

ANNEX 13

INTEREST DURING CONSTRUCTION

(in 10^6TL)

Item	Year	Investment	1982	1983	1984
DYB Loan	1982 1983 1984	39.13 585.45 124.16	4.2 - -	8.4 62.93 -	8.4 125.87 13.34
TOTAL		748.74	4.2	71.33	147.61
IBRD Loan	1982 1983	1122.0 418.0	120.61 -	241.23 44.94	241.23 89.87
TOTAL		1540.0	120.61	286.17	331.10
GRAND TOTAL			124.81	357.50	478.71

Notes: 1. Investment is from Annex 12 (Sources of Initial Fund)

2. Simple Fixed Interest Rate for both the loans (DYB and IBRD) is 21.5% per year

3. For the first year of loan, the period of interest is 6 months only

ANNEX 14

INTEREST AND REPAYMENT OF LOAN

(10^6 TL)

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
INTEREST												
DYB Loan	160.98	160.98	160.98	144.85	128.73	112.60	96.48	80.35	64.23	48.10	31.98	15.85
IBRD Loan	331.10	331.10	297.99	264.88	231.77	198.66	165.55	132.44	99.33	66.22	33.11	
TOTAL	492.08	492.08	458.97	409.73	360.5	311.26	262.03	212.79	164.56	114.32	65.09	15.85
REPAYMENT												
DYB Loan			75	75	75	75	75	75	75	75	75	73.74
IBRD Loan		154	154	154	154	154	154	154	154	154	154	
TOTAL		154	229	229	229	229	229	229	229	229	229	73.74

Notes:

1. Grace period for DYB Loan - 2 years (i.e. repayment starts from 1987)
2. Grace period for IBRD Loan - 1 year (i.e. repayment starts from 1986)
3. IBRD Repayments are twice a year (i.e. every 6 months) but assumption in the table has been - repayments only once in a year
4. Repayments of the loans for both IBRD and DYB are to be made in 10 years after grace period by equal instalments
5. Interest rate for both DYB and IBRD loans is 21.5% per year

ANNEX 15(a)

UNIT COST OF PRODUCTION OF PIG IRON

(in TL)

Items	Unit Costs TL	Before Modernisation			After Modernisation					
					50% Utilisation			100% Utilisation		
		600,000 Tonnes per Year			750,000 Tonnes per Year			900,000 Tonnes per Year		
RAW MATERIAL: 1. Ore	1859/tonne	0.74	1375		0.766	1424		0.766	1424	
AUXILIARY MATERIAL:										
2. Sinter	3050/tonne	1.00	3050	11059	0.974	2971	9560	0.974	2971	9560
3. Limestone	420/tonne	0.28	117		0.100	42		0.100	42	
4. Manganese	1521/tonne	0.03	46		0.03	46		0.03	46	
5. Coke	9030/tonne	0.88	7846		0.72	6501		0.72	6501	
UTILITY: 6. Electricity	2.9/KwH	130	337	407	145	420	490	145	420	490
7. Water	3.5/m³	20	70		20	70		20	70	
8. Direct Labour	L.S.	-	1080		-	864		-	720	
9. Misc.	L.S.	-	500		-	500		-	500	
			14421			12838			12694	
10. Factory Overhead (80% of total overhead which is again ⅙ of the cost of Karabük indirect labour)	L.S.		1100			943.68			786.4	
FACTORY COST:			15601			13781.68			13480.4	
11. Administrative Overhead (20% of total overhead which is again ⅙ of the cost of Karabük entire indirect labour)			295			235.92			196.6	
OPERATING COST:			15896.0			14017.6			13677.0	

ANNEX 15 (b)

INCREMENTAL PRODUCTION COST (BASED ON EXISTING PRODUCTION COST)

	For 50% Utilisation	For 100% Utilisation
Raw Material	(1424x750,000)-(1375x600,000) = 243 x 10^6	(1424x9000,000)-(1375x600,000) = 456.6 x 10^6
Auxiliary Material	(9560x750,000)-(11059x600,000) = 534.6 x 10^6	(9560x900,000)-(11059x600,000) = 1968.6 x 10^6
Utility	(490x750,000)-(407x600,000) = 123.3 x 10^6	(490x900,000)-(407x600,000) = 196.8 x 10^6
Administrative Overhead	(235.92x750,000)-(295x600,000) = 0	(196.6x900,000)-(295x600,000) = 0
Factory Costs	(13781.68x750,000)-(15601x600,000) = 975.66 x 10^6	(13480.4x900,000)-(15601x600,000) = 2771.76 x 10^6
Operating Costs	(14017.6x750,000)-(15896x600,000) = 975.6 x 10^6	(13677x900,000)-(15896x600,000) = 2771.7 x 10^6
Depreciation	(432.196x750,000)-(29.44x600,000) = 306.48 x 10^6	(365.07x900,000)-(29.44x600,000) = 310.89 x 10^6

ANNEX 16

ANNUAL PRODUCTION COST ESTIMATE

(10^6 ·TL)

Items	Before 1984	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
	Construction Period	←	50% Utilization	100% Utilization					OPERATING PERIOD													→
OPERATING COST (from Annex 15b)		-	975.6	2771.7	2771.7	2771.7	2771.7	2771.7	2771.7	2771.7	2771.7	2771.7	2771.7	2771.7	2771.7	2771.7	2771.7	2771.7	2771.7	2771.7	2771.7	2771.7
FINANCIAL COSTS: Interest (from Annex 14)			492.1	492.1	459.0	400.7	360.5	311.3	262.0	212.8	163.6	114.3	65.1	15.9								
DEPRECIATION (from Annex 15b)			302.1	302.1	302.1	302.1	302.1	302.1	302.1	302.1	302.1	302.1	302.1	302.1	302.1	302.1	302.1	302.1	302.1	302.1	302.1	302.1
Total Production or Manufacturing Costs			1769.8	3565.9	3533.6	3483.5	3434.3	3385.1	3335.1	3286.6	3237.4	3188.1	3138.9	3089.7	3073.8	3073.8	3073.8	3073.8	3073.8	3073.8	3073.8	3073.8

<u>Note:</u> Depreciation is only for new investment distributed over the life of 20 years (on the basis of weighted average depreciation of 5% per year)

ANNEX 17(a)

CASH BALANCE

(10^6 TL)

Item	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Total Production Costs (from Annex 16)	1769.8	3565.9	3533.6	3483.5	3434.3	3385.1	3335.1	3286.6	3237.4	3188.1	3138.9	3089.7	3073.8	3073.8	3073.8	3073.8	3073.8	3073.8	3073.8	3073.8
Less:																				
Raw Material (from Annex 15(b))	243	456.6	456.6	456.6	456.6	456.6	456.6	456.6	456.6	456.6	456.6	456.6	456.6	456.6	456.6	456.6	456.6	456.6	456.6	456.6
Auxiliary Material (from Annex 15(b))	534.6	1968.6	1968.6	1968.6	1968.6	1968.6	1968.6	1968.6	1968.6	1968.6	1968.6	1968.6	1968.6	1968.6	1968.6	1968.6	1968.6	1968.6	1968.6	1968.6
Utility (from Annex 15(b))	123.3	196.8	196.8	196.8	196.8	196.8	196.8	196.8	196.8	196.8	196.8	196.8	196.8	196.8	196.8	196.8	196.8	196.8	196.8	196.8
Depreciation (from Annex 15(b))	302.1	302.1	302.1	302.1	302.1	302.1	302.1	302.1	302.1	302.1	302.1	302.1	302.1	302.1	302.1	302.1	302.1	302.1	302.1	302.1
	1203.0	2924.1	2924.1	2924.1	2924.1	2924.1	2924.1	2924.1	2924.1	2924.1	2924.1	2924.1	2924.1	2924.1	2924.1	2924.1	2924.1	2924.1	2924.1	2924.1
REQUIRED CASH BALANCE	566.8	641.0	609.5	559.4	510.2	461.0	411.0	362.5	313.3	264.0	214.8	165.6	149.7	149.7	149.7	149.7	149.7	149.7	149.7	149.7

ANNEX 17(b)

WORKING CAPITAL REQUIREMENT

Minimum Requirements of Current Assets and Liabilities

(10[6] TL)

	Minimum days of coverage (mths)	Coefficient of turnover*	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
I. CURRENT ASSETS																						
A. Accounts Receivable	1	12	81.3	230.9	230.9	230.9	230.9	230.9	230.9	230.9	230.9	230.9	230.9	230.9	230.9	230.9	230.9	230.9	230.9	230.9	230.9	230.9
B. Inventory																						
a) raw material	2	6	40.5	76.1	76.1	76.1	76.1	76.1	76.1	76.1	76.1	76.1	76.1	76.1	76.1	76.1	76.1	76.1	76.1	76.1	76.1	76.1
b) auxiliary material	1	12	46.5	164.0	164.0	164.0	164.0	164.0	164.0	164.0	164.0	164.0	164.0	164.0	164.0	164.0	164.0	164.0	164.0	164.0	164.0	164.0
c) finished product	1	12	81.3	230.9	230.9	230.9	230.9	230.9	230.9	230.9	230.9	230.9	230.9	230.9	230.9	230.9	230.9	230.9	230.9	230.9	230.9	230.9
C. Cash in Hand	2	6	94.5	106.9	101.6	93.2	85.0	76.8	68.5	60.4	52.2	44.0	35.8	27.6	24.95	24.95	24.95	24.95	24.95	24.95	24.95	24.95
D. Current Assets			342.1	808.8	803.5	795.1	786.9	778.7	770.4	762.3	754.1	745.9	737.7	729.5	726.85	726.85	726.85	726.85	726.85	726.85	726.85	726.85
II. CURRENT LIABILITIES ACCOUNTS PAYABLE	1	12	-75.0	-218.5	-218.5	-218.5	-218.5	-218.5	-218.5	-218.5	-218.5	-218.5	-218.5	-218.5	-218.5	-218.5	-218.5	-218.5	-218.5	-218.5	-218.5	-218.5
III. WORKING CAPITAL																						
A. Net Working Capital			267.1	590.3	585.0	576.6	568.4	560.2	551.9	543.8	535.6	527.4	519.2	511.0	508.35	508.35	508.35	508.35	508.35	508.35	508.35	508.35
B. Increase in Working Capital			-	323.2	-5.3	-8.4	-8.2	-8.2	-8.3	-8.1	-8.2	-8.2	-8.2	-8.2	-2.65	-2.65	-2.65	-2.65	-2.65	-2.65	-2.65	-2.65

* Coefficient of Turnover = $\frac{\text{12 months}}{\text{"n" months of minimum coverage}}$

Notes:

a) Accounts Receivable: one month at production costs *minus* depreciation and interest

b) Inventory: (i) raw material - two months
(ii) auxiliary material - one month
(iii) finished product - one month at factory cost plus administrative overheads
(iv) work in progress - Nil (as the process of manufacturing pig iron is confined to one day (at factory cost) after feeding raw and auxiliary material and other inputs)

c) Cash in Hand: two months

d) Accounts Payable: one month for raw and auxiliary material and utilities.

NB. Accounts Payable may be considered as NIL if payments for raw and auxiliary materials and utilities are required to be made *without* the time-lag (here one month). In that case the 'Net Working Capital' will be as follows:

	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
A. Net Working Capital	342.1	808.8	803.5	795.1	786.9	778.7	770.4	762.3	754.1	745.9	737.7	729.5	726.85
B. Increase in Working Capital	-	466.7	-5.3	-8.4	-8.2	-8.2	-8.3	-8.1	-8.2	-8.2	-8.2	-8.2	-2.65

ANNEX 18

TOTAL INVESTMENT COST SCHEDULE

(10^6 TL)

Item	Before 1982			1982			1983			1984			1985			1986			TOTAL		
	Local	Fgn	Total	Local	Fgn	Total	Local	Fgn	Total	Local	Fgn	Total	Local	Fgn	Total	Local	Fgn	Total	Local	Fgn	Total
1. Fixed Investment Cost (from Annex 11)	1517	709.4	2226.4	813.2	1122	1935.2	1254.5	418	1672.5	207.24	-	207.24							3792.0	2249.4	6041.3
2. Working Capital (from Annex 17)													342.1	-	342.1	466.7	-	466.7	808.0	-	808.0
Total Investment Costs	1517	709.4	2226.4	813.2	1122	1935.2	1254.5	418	1672.5	207.24	-	207.24	342.1	-	342.1	466.7	-	466.7	4600.0	-	6050.1

ANNEX 19

TOTAL ASSETS

(10^6 TL)

Item	Before 1982			1982			1983			1984			1985			1986			TOTAL		
	Local	Fgn	Total	Local	Fgn	Total	Local	Fgn	Total	Local	Fgn	Total	Local	Fgn	Total	Local	Fgn	Total	Local	Fgn	Total
1. Fixed Investment Cost (from Annex 11)	1517	709.4	2226.4	813.2	1122	1935.2	1254.5	418	1672.5	207.24	-	207.24							3792.0	2249.4	6041.3
2. Current Assets (from Annex 17)													342.1	-	342.1	466.7	-	466.7	808.8	-	808.8
Total Assets	1517	709.4	2226.4	813.2	1122	1935.2	1254.5	418	1672.5	207.24	-	207.24	342.1	-	342.1	466.7	-	466.7	4600.8	2249.4	6849.0

Note: Current Assets should be increments only

ANNEX 20

REVENUE SCHEDULE

(10^6 TL)

Item	Unit Price TL per tonne	Quantity 50% Utilisation tonnes	Quantity 100% Utilisation tonnes	Amount 10^6 TL	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Pig Iron	10500	150000	-	2775																				
	10500	-	300000	5000																				
Sales Revenue					2775	5550	5550	5550	5550	5550	5550	5550	5550	5550	5550	5550	5550	5550	5550	5550	5550	5550	5550	5550

ANNEX 21

CASH FLOW TABLE FOR FINANCIAL PLANNING

(10^6 TL)

Items	Before 1982	1982	1983	1984	1985	1986	1987	1988	1989	1990
	←—— CONSTRUCTION			——→						
					50%	100%				
A. CASH INFLOW	2226.4	1935.2	1672.4	207.0	2775	5550	5550	5550	5550	5550
1. Financial Resources Total (from Annex 12)	2226.4	1935.2	1672.4	207.0						
2. Sales Revenue (from Annex 20)					2775	5550	5550	5550	5550	5550
B. CASH OUTFLOW	-2226.4	-1935.3	-1672.4	-207	-2279.2	-4811.[illegible]	-4401.1	-4375.4	-4349.[illegible]	-4316.5
1. Total Assets (from Annex 19)	-2226.4	-1935.2	1672.4	-207	342.1	-466.7				
2. Operating Costs (from Annex 15(b))					-975.6	2771.7	-2771.7	-2771.7	2771.7	2771.7
3. Debt Servicing										
(a) Interest (from Annex 14)					-492.00	492.00	-450.87	409.73	-360.5	-311.26
(b) Repayments (from Annex 14)						-154	-229	-229	[illegible]	-229
4. Corporate Tax (from Annex 22)					-469.4	-926.57	941.60	956.06	[illegible]	1002.6
C. SURPLUS	0	0	0	0	495.79	738.15	1148.[illegible]	1174.5	1200.7	1225.4
D. CUMULATIVE CASH BALANCE	0	0	0	0	495.79	1233.9	2382.[illegible]	3557.1	4757.0	5993.3

Items	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
	OPERATION													→
A. CASH INFLOW	5550	5550	5550	5550	5550	5550	5550	5550	5550	5550	5550	5550	5550	5550
1. Financial Resources Total (from Annex 12)														
2. Sales Revenue (from Annex 20)	5550	5550	5550	5550	5550	5550	5550	5550	5550	5550	5550	5550	5550	5550
B. CASH OUTFLOW	4297.0	-4270.4	-4244.2	-4218.0	-4191.7	-4010.3	3928.0	-3928.0	-3928.0	-3928.0	3928.0	-3928.0	3928.0	-3928.0
1. Total Assets (from Annex 19)														
2. Operating Costs (from Annex 15(b))	-2771.7	2771.7	2771.7	-2771.7	-2771.7	-2771.7	2771.7	-2771.7	-2771.7	-2771.7	2771.7	-2771.7	2771.7	-2771.7
3. Debt Servicing														
(a) Interest (from Annex 14)	262.03	212.79	-163.56	114.32	65.09	15.85								
(b) Repayments (from Annex 14)	-229	-229	-229	-229	-229	-73.74								
4. Corporate Tax (from Annex 22)	1034.[illegible]	-1057	-1080	1103	-1125.9	-1148.9	1156.3	-1156.3	-1156.3	-1156.3	1156.3	-1156.3	1156.3	-1156.3
C. SURPLUS	1252.9	1279.5	1305.7	1331.9	1358.2	1539.7	1621.9	1621.9	1621.9	1621.9	1621.9	1621.9	1621.9	1621.9
D. CUMULATIVE CASH BALANCE	7246.[illegible]	[illegible]525.7	9831.4	11163.4	12521	14061	15683	17305.2	18927.1	20549.0	22170.9	23792.[illegible]	25414.[illegible]	27036.7

ANNEX 22

NET INCOME STATEMENT

(10^6 TL)

	1982/1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
	Con-struc-tion	50%	100%	←						OPERATING	
1. SALES (from Annex 20)		2775	5550	5550	5550	5550	5.	5550	5550	5550	5550
2. PRODUCTION COSTS (from Annex 16)		-1769.8	-3565.9	-3533.6	-3483.5	-3434.1	-3385.1	-3335.1	-3286.0	-3237.4	-3188.1
3. GROSS OR TAXABLE PROFIT (= (1) - (2) above)		1005.2	1084.1	2016.4	2066.5	2115.7	2164.9	2214.9	2263.4	2312.6	2361.9
4. TAX (@ 46.7%)		-469.4	-926.5	-941.6	-965.0	-998.4	-1002.6	-1034.3	-1057	-1080	-1103
5. PROFIT AFTER TAX (= (3) - (4) above)		535.7	1057.9	1074.7	1101.4	1127.0	1153.0	1180.5	1206.4	1232.0	1258.9
6. ACCUMULATED PROFIT AFTER TAX		535.7	1593.3	2660.0	3769.4	4897.1	6051.0	7231.9	8437.9	9670.9	10929.4
RATIOS:											
GROSS PROFIT: SALES (%)		36	35	36	37	38	39	40	40.70	41.6	42.5
NET PROFIT: SALES (%)		19.3	19	19.3	19.8	20.3	20.7	21.2	21.7	22.2	22.6
NET PROFIT: EQUITY (%) (Equity from Annex 12)		14.2	28.1	28.6	29.3	30	30.7	31.4	32.1	32.8	33.5

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
	PERIOD									→
1. SALES (from Annex 20)	5550	5550	5550	5550	5550	5550	5550	5550	5550	5550
2. PRODUCTION COSTS (from Annex 16)	-3138.9	-3089.4	-3073.8	-3073.8	-3073.8	-3073.8	-3073.8	-3073.8	-3073.8	-3073.8
3. GROSS OR TAXABLE PROFIT (= (1) - (2) above)	2411.1	2460.3	2476.2	2476.2	2476.2	2476.2	2476.2	2476.2	2476.2	2476.2
4. TAX (@ 46.7%)	-1125.9	-1140.9	-1156.3	-1156.3	-1156.3	-1156.3	-1156.3	-1156.3	-1156.3	-1156.3
5. PROFIT AFTER TAX (= (3) - (4) above)	1285.1	1311.3	1319.8	1319.8	1319.8	1319.8	1319.8	1319.8	1319.8	1319.8
6. ACCUMULATED PROFIT AFTER TAX	12214.5	13525.9	14845.7	16165.5	17485.3	18805.1	20124.9	21444.7	22764.5	24064.3
RATIOS:										
GROSS PROFIT: SALES (%)	43.4	44.3	44.6	44.6	44.6	44.6	44.6	44.6	44.6	44.5
NET PROFIT: SALES (%)	23.1	23.6	23.8	23.8	23.8	23.8	23.8	23.8	23.8	23.3
NET PROFIT: EQUITY (%) (Equity from Annex 12)	34.2	34.9	35.1	35.1	35.1	35.1	35.1	35.1	35.1	35.1

ANNEX 23

PROJECTED BALANCE SHEET

(10^6 TL)

Item	Before 1982	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
A. ASSETS (Total)	2226.4	4161.6	5834.1	6041.3	6577.1	7479.8	8321.1	9105.1	10075.6	11000.7	11943.2	12912.5
1. Current Assets Cumulative (Total)					837.8	2042.7	3186.1	4352.2	5544.7	6772.0	8016.6	9288.0
a) Cash Balance (from Annex 21)					495.7	1233.9	2382.6	3557.1	4757.8	5993.3	7246.2	8525.7
b) Current Assets (from Annex 17)					342.1	808.8	803.5	795.1	786.9	778.7	770.4	762.3
2. Fixed Assets (from Annex 11) Initial Income less Depreciation (Annex 15(b))	2226.4	4161.6	5834.1	6041.3	5739.2	5437.1	5135.0	4832.9	4530.8	4228.7	3926.6	3624.5
3. Losses (if any)	-	-	-	-	-	-	-	-	-	-	-	-
B. LIABILITIES	2226.4	4161.6	5834.1	6041.3	6576.7	7480.2	8326.0	9198.4	10097.1	11021.9	11973.5	12950.9
1. Current Liability*	-	-	-	-	-	-	-	-	-	-	-	-
2. Loan (from Annexes 12 and 14)	-	1161.1	2164.5	2288.7	2288.7	2134.7	1905.7	1676.7	1447.7	1218.7	989.7	760.7
3. Equity (from Annex 12)	2226.4	3000.4	3669.4	3752.2	3752.2	3752.2	3752.2	3752.2	3752.2	3752.2	3752.2	3752.2
4. Reserve (from Annex 22)						1593.3	2668.0	3769.4	4897.1	6051.0	7231.5	8437.9

Item	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
A. ASSETS (Total)	13908.0	14929.7	15977.6	17207.0	18524.2	19844.0	21163.8	22483.6	23803.4	25123.2	26443.0	27763.5
1. Current Assets Cumulative (Total)	10585.5	11909.3	13259.4	14790.9	16410.1	18032.1	19654.0	21275.9	22897.8	24519.7	26141.6	27763.5
a) Cash Balance (from Annex 21)	9831.4	11163.4	12521.7	14061.4	15683.3	17305.2	18927.1	20549.0	22170.9	23792.8	25414.8	27036.7
b) Current Assets (from Annex 17)	754.1	745.9	737.7	729.5	726.8	726.8	726.8	726.8	726.8	726.8	726.8	726.8
2. Fixed Assets (from Annex 11) Initial Income less Depreciation (Annex 15(b))	3322.4	3020.3	2718.2	2416.1	2114.0	1811.9	1509.8	1207.7	905.6	603.5	301.4	-
3. Losses (if any)	-	-	-	-	-	-	-	-	-	-	-	-
B. LIABILITIES	13954.5	14984.4	16040.5	17278.1	18597.9	19917.7	21237.5	22557.3	23877.1	25196.9	26516.7	27836.5
1. Current Liability*	-	-	-	-	-	-	-	-	-	-	-	-
2. Loan (from Annexes 12 and 14)	531.7	302.7	73.7	-								
3. Equity (from Annex 12)	3752.2	3752.2	3752.2	3752.2	3752.2	3752.2	3752.2	3752.2	3752.2	3752.2	3752.2	3752.2
4. Reserve (from Annex 22)	9670.5	10929.4	12214.5	13525.9	14845.7	16165.5	17485.3	18805.1	20124.9	21444.7	22764.5	24084.3

* Current Liability has been assumed NIL (refer to note in Annex 17 for Working Capital)

Note: Small differences between assets and liabilities figures are due to
a) rounding of figures
b) current assets figures coming down from 808.8 to 726.8 - whereas 808.8 has been taken as Working Capital ignoring the negative values in 'increasing Working Capital'

ANNEX 24(a)

EXPENDITURE FROM 1973 - 1981

10^6TL

	1973	1974	1975	1976	1977	1978	1979	1980	1981 LC*	1981 FC*
Value of Expenditures in 1980 TL	4.5	102.35	89.91	182.32	151.75	357.3	275.8	616.34	481.18 105.00 586.18	829.72 585.15 1414.87
Value of Expenditures in 1981 TL (index factor 1.35 for local currency) (index factor 1.07 for foreign currency)	607.5	138.17	121.38	246.13	204.86	482.36	372.33	832.06	791.34 2305.25	1513.91

* LC = Local Currency
FC = Foreign Currency

Note: Expenditures for 1980TL have been taken from Annex 10 of the original appraisal reports.

ANNEX 24(b)

FINANCIAL EVALUATION (COMMERCIAL PROFITABILITY)

10^6 TL

Items	Before 1982	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
A. CASH INFLOW 1. Sales Revenue (from Annex 20)	0	0	0	0	2775	5550	5550	5550	5550	5550	5550	5550	5550
B. CASH OUTFLOW 1. Total Investment Outlay *(from Annex 18)	See previous page	*1935.2	*1672.5	*207.2	*342.1	*466.7							
2. Operating Cost (from Annex 16)					975.0	2771.7	2771.7	2771.7	2771.7	2771.7	2771.7	2771.7	2771.7
3. Tax (from Annex 22)					169.4	926.57	941.66	965.0	980.03	1002.6	1034.36	1057.0	1080.0
NET CASH FLOW			-1672.5	-207.2	987.8	1385.03	1836.64	1813.2	1798.27	1775.7	1743.9	1721.3	1698.3

Items	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
A. CASH INFLOW 1. Sales Revenue (from Annex 20)	5550	5550	5550	5550	5550	5550	5550	5550	5550	5550	5550
B. CASH OUTFLOW 1. Total Investment Outlay *(from Annex 18)											(963.0)
2. Operating Cost (from Annex 16)	2771.7	2771.7	2771.7	2771.7	2771.7	2771.7	2771.7	2771.7	2771.7	2771.7	2771.7
3. Tax (from Annex 22)	1103.0	1125.9	1148.9	1156.3	1156.39	1156.39	1156.3	1156.3	1156.3	1156.3	1156.3
NET CASH FLOW	1675.3	1652.3	1629.3	1621.9	1621.9	1621.91	1621.9	1621.9	1621.9	1621.9	[illegible]

IRR = 11% approximately

ANNEX 25

SENSITITIVY ANALYSIS

Tests for change in NPV of the projects are to be based on:

Case I	Increase in Investment Costs	-	10%
Case II	Increase in Operating Costs	-	10%
Case III	Decrease in Sales Revenue	-	10%

(All costs and revenues are in 10^6 TL).

A. NPV of original market price Cash Flow - (Rate of discount 10%
Year 0 - 1973)

1. Discounted Revenue: 10% Discount Rate

1973 - Year 0

1985 - Year 12

2775 (0.3186) = 884.115

5550 (9.479 - 6.8137) = 14792.415

Total = 15676.530

2. Discounted Investment Costs

= 6.075 + 138.17 (0.9091) + 121.38 (0.8264) + 246.13 (0.7513) + 204.86 (0.683) + 432.36 (0.6209) + 372.33 (0.5645) + 832.06 (0.5132) + 2305.25 (0.4665) + 1935.2 (0.4241) + 1672.5 (0.3855) + 207.24 (0.3505) + 342.1 (0.3186) + 466.7 (0.2897)

= 4351.00

3. Discounted Operating Costs

975 (0.3186) + 2771.7 (9.479 - 6.8137)

= 310.64 + 7387.41

= 7698.05

4. Discounted Tax: 2934.23

NPV = 15676.53 - 4351 - 7698.05 - 2934.23

= +693.25

B. Changes in NPV

CASE I - INCREASE IN INVESTMENT COST BY 10%

$$NPV = 15676.53 - 1.1\,(4351) - 2934.23 - 7698.05$$

$$= +\,258.15$$

$$\text{PERCENTAGE CHANGE} = \frac{693.25 - 258.15}{693.25} \times 100 = 62\%$$

CASE II - INCREASE IN OPERATING COST BY 10%

$$NPV = 15676.53 - 4351 - 1.1\,(7698.05) - 2934.23$$

$$= -\,76.55$$

$$\text{PERCENTAGE CHANGE} = \frac{693.25 - (-76.55)}{693.25} \times 100 = 111\%$$

CASE III - DECREASE IN REVENUE BY 10%

$$NPV = 0.9\,(15676.53) - 4351 - 7698.05 - 2934.23$$

$$= -\,874.40$$

$$\text{PERCENTAGE CHANGE} = \frac{693.25 - (-874.4)}{693.25} \times 100 = 226\%$$

ALTERNATIVE WAY OF EXPRESSING RESULTS OF SENSITIVITY ANALYSIS

C. Changes in Variables to make NPV zero:

CASE I

62% NPV is caused by 10% change Investment Cost

1% NPV is caused by $\frac{10}{62}$ change Investment Cost

100% NPV is caused by $\frac{10}{62} \times 100$ change Investment Cost

= 16.12% change Investment Cost

More than 16.12% change (increase) in Investment Cost makes negative NPV.

CASE II

111% NPV is caused by 10% change Operating Cost

100% NPV is caused by $\frac{10}{111} \times 100$ change Operating Cost

= 9% change Operating Cost

More than 9% change (increase) in Operating Cost will make negative NPV.

CASE III

226% NPV is caused by 10% change in Revenue

100% NPV is caused by $\frac{10}{226} \times 100$ change in Revenue

= 4.4% change in Revenue

More than 4.4% decrease in Revenue will make negative NPV.

Hence, from the calculations above the variables can be ranked in order of sensitivity, as follows:

- Sales Revenue - most sensitive
- Operating Cost - next sensitive
- Investment Cost - least sensitive

ANNEX 26

COMMERCIAL PROFITABILITY WITHOUT TAX

NPV AT 21.5%

DISCOUNTED REVENUE

= 2775 (0.0996) + 5550 (0.4395)

= 2715.62

DISCOUNTED INVESTMENT COST

= 6.075 + 113.72 + 82.22 + 137.22 + 93.99 + 182.19 + 115.72 + 212.84 + 485.49 + 335.37 + 238.5 + 24.33 + 33.05 + 37.1 - 2.5

= 2095.32

DISCOUNTED OPERATING COST

= 975.6 (0.0996) + 2771.7 (0.4395)

= 1315.33

NPV WITHOUT TAX (with year 0 as 1973)

= 2715.62 - 2095.32 - 1315.33

= -695.03

ANNUAL SUBSIDY FOR THE 20 YEARS LIFE OF THE PROJECT (after 1982)

= 695.03 (CF for 11 years) x (CRF for 20 years)

= 695.03 (8.526) (0.2195)

= 1300.75

NPV AT 15%

DISCOUNTED REVENUE

= 2775 (0.1869) + 5550 (1.1585)

= 6948.32

DISCOUNTED INVESTMENT COST

= 6.075 + 120.15 + 103.91 + 161.83 + 117.14 + 239.83
+ 160.96 + 315.77 + 753.59 + 550.18 + 413.27 + 44.54
+ 63.94 + 75.84 - 10.5

= 3116.53

DISCOUNTED OPERATING COST

= 975.6 (0.1869) + 2771.7 (1.1585)

= 3393.35

NPV

= 6948.32 - 3116.53 - 3393.35

= +438.44

$$IRR = 15 + \frac{615\ (438.44)}{438.44 + 695.03} = \underline{17.51\%}$$

ANNEX 27

CALCULATION FOR ERR

Shadow price factors for different items of Cash Flow

1. REVENUE

FOB price for pig iron	=	$190 per tonne
CIF price for pig iron	=	$190 per tonne (approx.)
We shall take the border price as	=	$190 per tonne
	=	TL 18500 per tonne

There is no change in the revenue values for ERR calculations.

2. CASH FLOW FOR ERR

Construction Period

10^6 TL

Year	Total Annex 24(1)	LC	CF (SCF)	Shadow Price	FC	CF	Shadow Price	Total in Shadow Price
1973	6.075	4.131	0.685	2.83	1.942	0.55	1.07	3.90
1974	138.17	98.95	0.685	64.35	44.22	0.55	24.32	88.67
1975	121.38	82.54	0.685	56.53	38.84	0.55	21.36	77.89
1976	246.13	167.37	0.685	114.39	78.76	0.55	36.00	157.70
1977	204.86	139.30	0.685	95.42	65.56	0.55	36.00	131.47
1978	482.36	328.00	0.685	224.68	154.36	0.55	84.89	309.58
1979	372.33	253.18	0.685	173.43	119.15	0.55	65.53	238.96
1980	832.06	565.80	0.685	387.57	266.26	0.55	146.44	534.00
1981	2305.25	1567.57	0.685	1073.78	737.68	0.55	405.73	1479.50
1982	1935.20	803.34*	0.685	550.29	1122.00	0.537	602.51	1152.80
1983	1672.50	1251.64*	0.685	857.37	418.00	0.555	231.99	1089.36
1984	207.24	207.24	0.685	141.96	-	-	-	141.96

* Stamp Duty of 10% on the item of import expenditure deducted from the total of local currency in 1982 and 1983. Stamp Duty deduction prior to 1982 neglected as the figure is very small.

Notes

1. Break-up of total cost into LC and FC are in the ratio of 0.68:0.32 from 1973 to 1981 (refer Annex 11 on Fixed Investment Cost)

2. Prior to 1982 the ratio of FC between Services (here 'Research and Project Preparation') and Capital Goods (here 'Machinery and Equipment') is 36:673.4 (i.e. 0.05:0.95) CF for Services is considered to be 1 whereas for Capital Goods - 0.527. Hence, weighted average CF = (0.05 x 1 + 0.95 x 0.527) = 0.55.

3. In 1982 the ratio of FC between Capital Goods (here 'Machinery and Equipment') and Intermediate Goods (here 'Refractory Material') is 0.68:0.32. CF for Intermediate Goods is 0.5598. Hence, weighted average CF = (0.68 x 0.527 + 0.32 x 0.5598) = 0.537.

4. In 1983 the ratio of FC between Capital Goods and Intermediate Goods is 0.13:0.87. Hence, weighted average CF - (0.13 x 0.527 + 0.5598 x 0.87) = 0.555.

3. OPERATING COSTS

1) ORE

This item can be considered as non-traded because the grade of Turkish ore is below world standard.

Hence, marginal social cost will comprice mainly:

a) Extraction (machineries and labour, in the ratio 0.6ᵔ:0.35 approx.)

b) Transportation

3) Profit Margin

As there is no data for the break-up, we will assume the ratios among the above three items as:

0.6 : 0.20 : 0.20

Commercial Market Price of Ore = 1859 TL per tonne

Therefore, we have

	Value	CF	Shadow Price
Extraction: Machineries	725.0	0.527	382.0
Labour	390.0	0.66	257.4
Transportation	372.0	0.685	254.8
Profit Margin	372.0	0	-
			894.22

$$CF_{ORE} = \frac{894.22}{1859} = 0.48$$

This figure is very near 0.50 worked out as conversion factor for 'mining' by the World Bank Staff Working Paper No. 392 (May 1980).

2) SINTER

This can be considered as 'metal products' whose conversion factor will be 0.54 when 1981 data is used.

3) LIMESTONE AND MANGANESE

These are non-traded items. They are mainly of 'mining' category. Their conversion factor will, therefore, be like that of ore, i.e. 0.48.

4) <u>COKE</u>

This item from imported coal. Therefore CIF price will be used for ERR purpose

$$CF = \frac{\text{CIF price}}{\text{market price}} = \frac{6549 \text{ TL}}{9030 \text{ TL}}$$

$$= 0.72$$

5) <u>ELECTRICITY AND WATER</u>

These are non-traded items and the conversion factor for them will be SCF, i.e. 0.685.

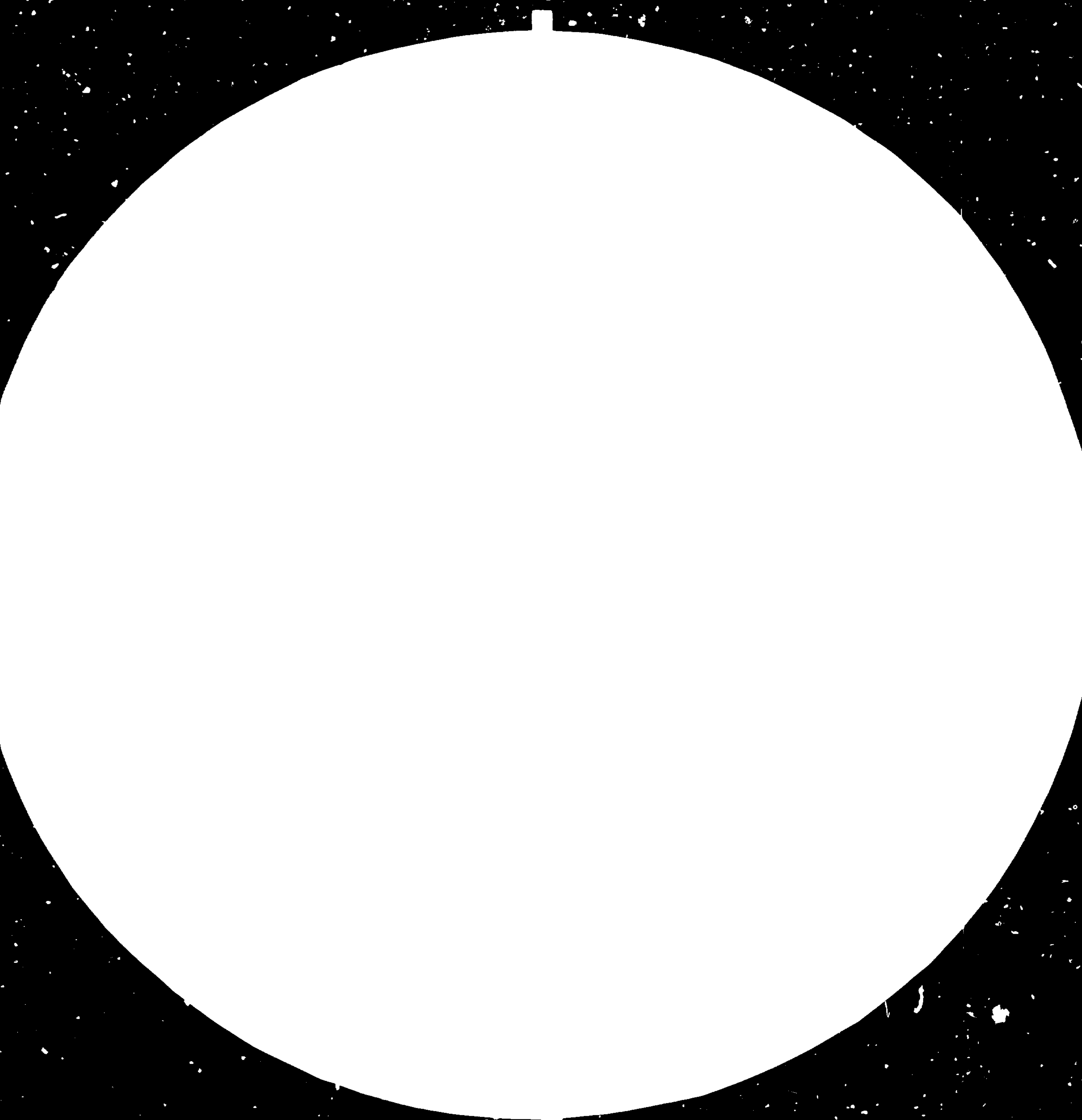
6) <u>DIRECT LABOUR</u>

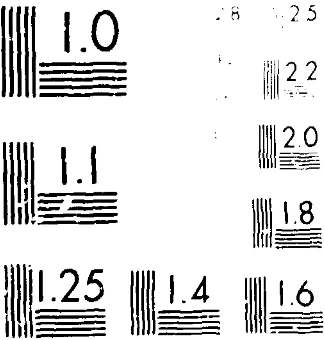
Shadow wage factor of urban formal sector will be relevant. This is 0.66.

7) <u>MISCELLANEOUS AND OVERHEADS</u>

SCF of 0.683 will be used.

83.07.14




2.5
2.2
2.0
1.8
1.0
1.1
1.25
1.4
1.6

OPERATING COSTS (SHADOW PRICING)

(Data from Annex 15a)

	CF	$6x10^5$ tonnes per year	Value	$7.5x10^5$ tonnes per year	Value	$9x10^5$ tonnes per year	Value
Ore	0.48	0.086	0.041	0.101	0.048	0.104	0.049
Sinter	0.54	0.192	0.103	0.212	0.114	0.217	0.117
Limestone	0.48	0.007	0.003	0.003	0.001	0.003	0.001
Manganese	0.48	0.003	0.001	0.003	0.001	0.003	0.001
Coke	0.72	0.493	0.355	0.464	0.334	0.475	0.342
Electricity	0.685	0.021	0.014	0.029	0.019	0.030	0.02
Water	0.685	0.004	0.003	0.005	0.003	0.005	0.003
Direct Labour	0.66	0.068	0.044	0.061	0.040	0.052	0.034
Miscellaneous	0.685	0.031	0.021	0.036	0.024	0.036	0.024
Overheads	0.685	0.095	0.065	0.086	0.059	0.075	0.051
		1.000	0.65	1.000	0.643	1.000	0.642

INCREMENTAL OPERATING COST: 50% Utilisation

50% Utilisation

(14017.6x0.643x750,000)-(15896x0.65x600,000)

$= 560.55 \times 10^6$ TL

100% Utilisation

(13677x0.642x900,000)-(15896x0.65x600,000)

$= 1703.13 \times 10^6$ TL

4. CONVERSION FACTOR FOR WORKING CAPITAL

(Data from Annex 17b)

			CF	
1.	Accounts Receivable:	81.3	0.643 1/	52.27
2.	Raw Materials (Ore):	40.5	0.48 2/	19.44
3.	Auxiliary Materials:	44.5	0.669 3/	29.77
4.	Finished Product:	81.3	1.0 4/	81.30
5.	Cash in Hand:	94.5	0.643 5/	60.76
		342.1		243.54

$$CF = \frac{243.54}{342.10} = 0.71$$

Working Capital Value:	1985	-	242.89 TL
	1986	-	331.35 TL

Notes:

1. Accounts receivable is due to production cost and therefore CF = 0.643.
2. Ore's CF = 0.48.
3. Auxiliary material is composed of sinter, limestone, manganese and coke. Weighted average conversion factor for 7.5×10^5 tonnes/year production works out to 0.669.
4. Pig iron's shadow price is same as market price.
5. 'Cash in hand' is for production cost and hence its CF = 0.643.

5. KARABÜK PIG IRON PROJECT (EXTENSION TYPE AND MODERNISATION)- ERR

(Based on Shadow Prices)

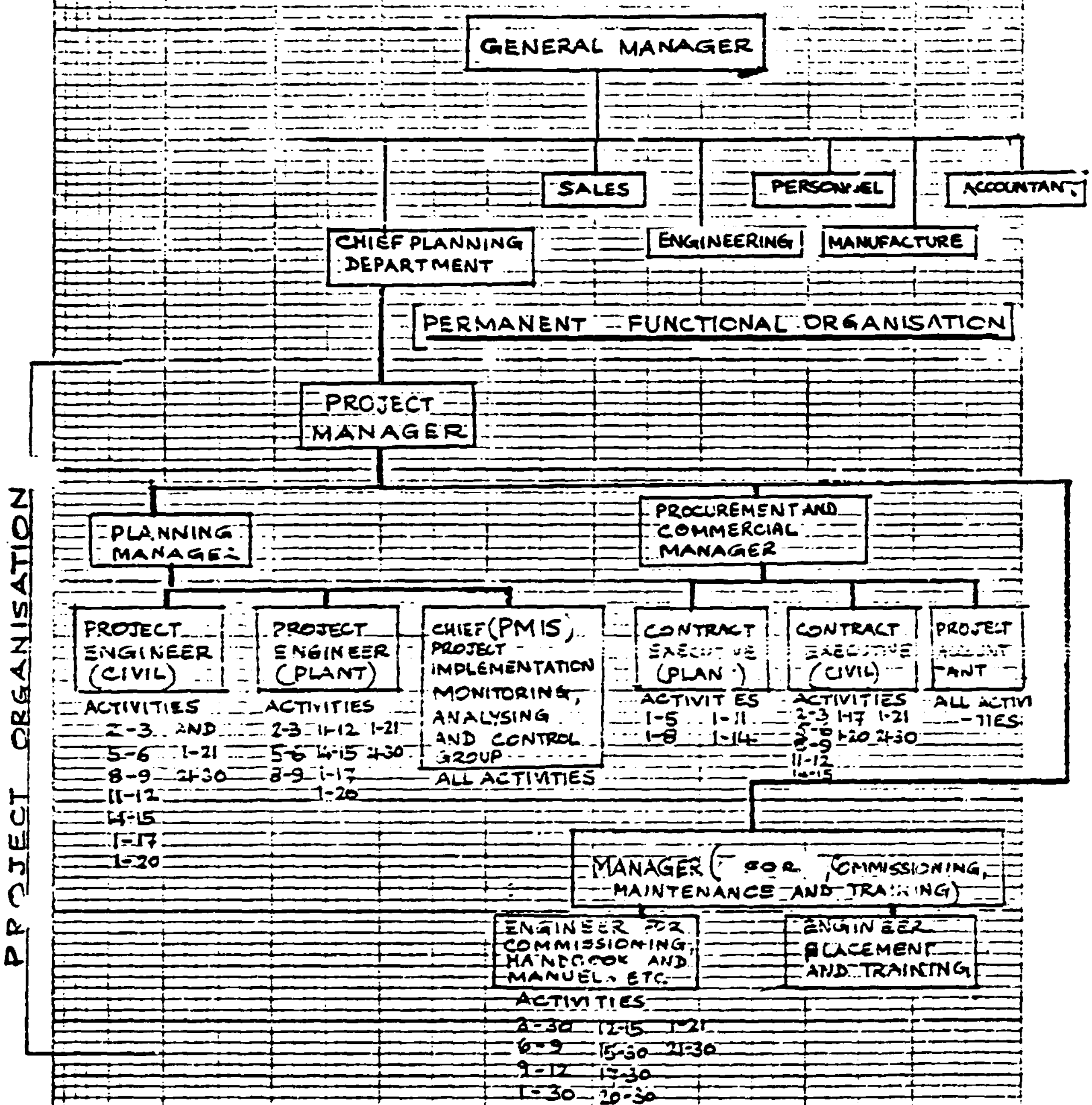
10^6 TL

Items	Before 1982	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
A. CASH INFLOW																								
1. Sales Revenue	0	0	0	0	2775	5550	5550	5550	5550	5550	5550	5550	5550	5550	5550	5550	5550	5550	5550	5550	5550	5550	5550	5550
B. CASH OUTFLOW																								
1. Total Investment	See previous page	1152.8	1089.36	141.96	242.8	331.55																		[illegible]
2. Operating Cost			.		560.5	1703.13	1703.13	1703.13	1703.13	1703.13	1703.13	1703.13	1703.13	1703.13	1703.13	1703.13	1703.13	1703.13	1703.13	1703.13	1703.13	1703.13	1703.13	1703.13
		1152.8	1089.36	141.96	1971.5	3515.52	3846.87	3846.87	3846.87	3846.87	3846.87	3846.87	3846.87	3846.87	3846.87	3846.87	3846.87	3846.87	3846.87	3846.87	3846.87	3846.87	3846.87	[illegible]

ERR = 26% approximately

ANNEX 28

PROJECT MANAGEMENT ORGANISATION



FOR ACTIVITIES - REFER TO ANNEX - 10-1, 10-2, AND 10-3.

ANNEX 29

PROJECT MANAGEMENT GROUP

1. Divisional Manager (Projects) under the General Manager (responsible for the project implementation): General Directorate Planning Department Chief.

The present incumbent graduated from ITU Faculty of Mechanical Engineering in 1964. He is working in Karabuk Plants for 16 years. He was Director, Research Planning, and Assistant Director, Establishment.

2. Project Manager: Karabuk Expansion Group Chief

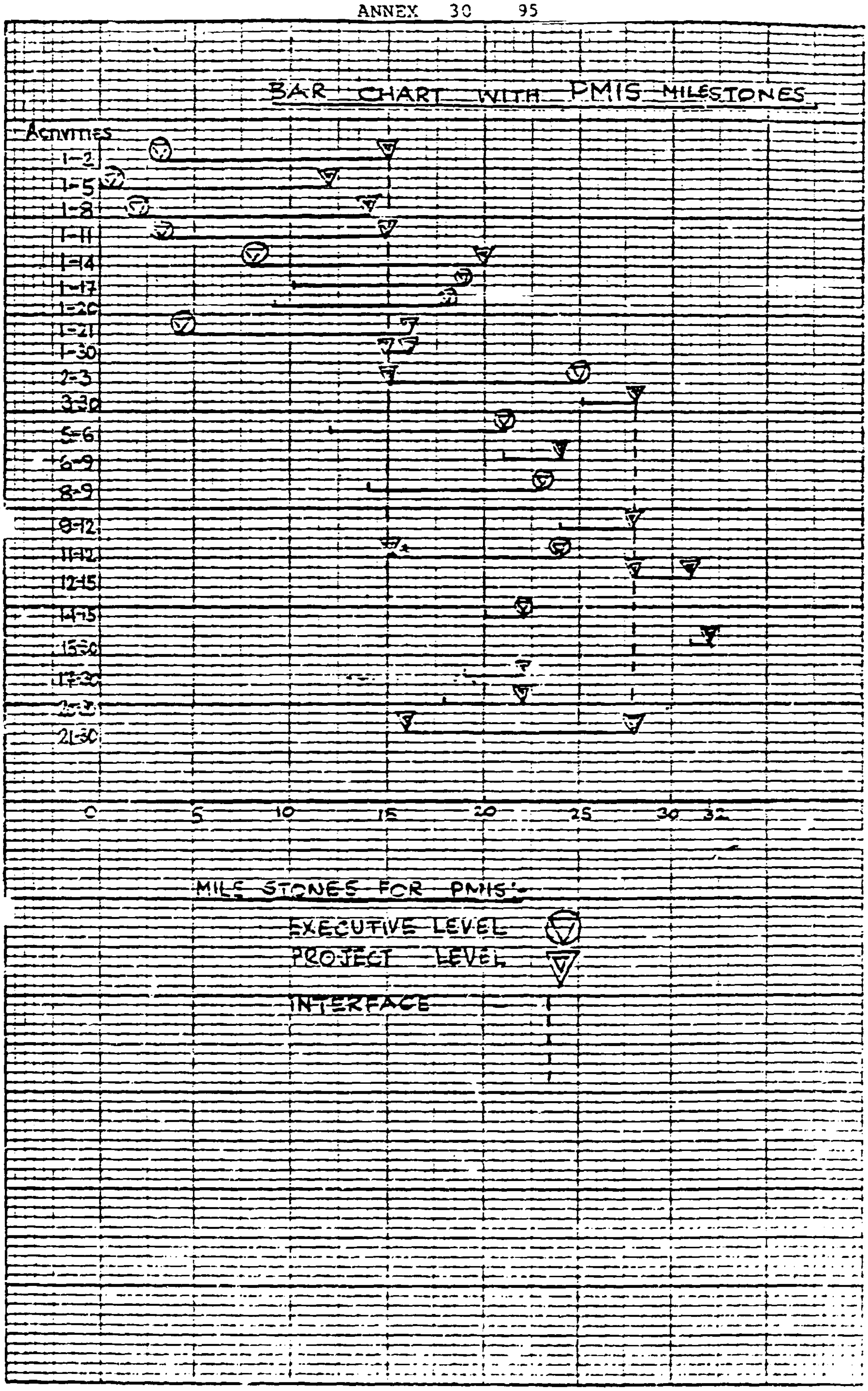
The manager-designate graduated from ITU Faculty of Mechanical Engineering in 1969. He is working in Karabuk Plants for 11 years. He worked as project engineer in the Research Planning Directorate.

3. Work Power

The Enterprise possesses the oldest and most disciplined work power in Turkey. No strikes have occurred to date in this Enterprise where employee-employer relations are very good. The efficiency and discipline of the work force enabled the changing of the brick, armour, and cooling system of blast furnace No. 1 to be achieved in only 68 days in 1979.

4. Local Consultant

The consultant-designate graduated from Berlin Technical University Faculty of Metallurgical Engineering in 1968, and completed his PhD dissertation in 1974. At present, he is an Associate Professor in the same University and an expert consultant of V.D.Eh, and B.F.I. (V.D.Eh is the iron and steel Union, B.F.I. is the Union's research centre). He found out that the low efficiency of blast furnace No. 3, in 1977, was due to clogging of stove bricks and he was responsible for solution of the problem within a fortnight.


BAR CHART WITH PMIS MILESTONES
ACTIVITIES
1-2
1-5
1-8
1-11
1-14
1-17
1-20
1-21
1-30
2-3
3-30
5-6
6-9
8-9
9-12
11-12
12-15
14-15
15-30
17-30
21-30
0
5
10
15
20
25
30
32
MILE STONES FOR PMIS:-
EXECUTIVE LEVEL
PROJECT LEVEL
INTERFACE