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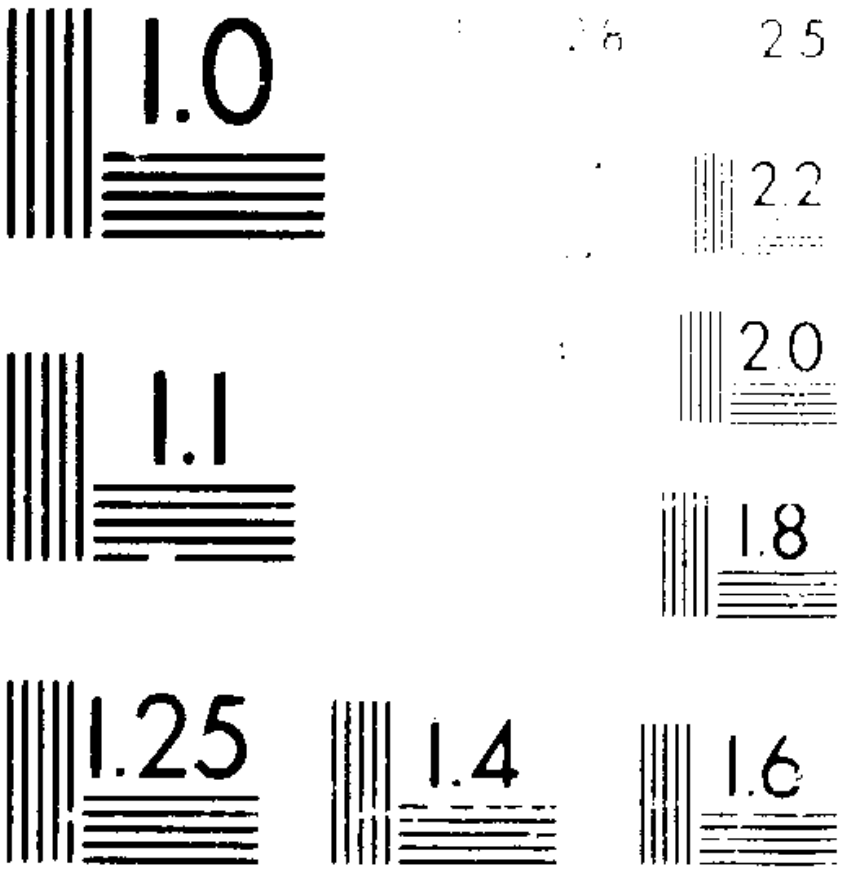
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FINAL REPORT
FEB. 24, 1985

TECHNOLOGY MANAGEMENT INTERNATIONAL LIMITED

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UNIDO Project No:84/38-DP/PAK/82/018

UNITED NATIONS
INDUSTRIAL DEVELOPMENT
ORGANISATION (UNIDO)

TECHNOLOGY MANAGEMENT
INTERNATIONAL LIMITED.
(TECHMA), Lahore, Pakistan

Feasibility Study -

ON

PAKISTAN.

Assistance in Production of Special and Quality Steels using existing industrial facilities in PAKISTAN Financed by UNIDO Under Contract NO:84/38-DP/PAK/82/018

1985

ACKNOWLEDGEMENTS

Techma wishes to thank UNIDO in providing an opportunity to carry out this feasibility study on special and quality steels. We are grateful for the support, cooperation and assistance provided by staff of MIRDC/UNIDO especially Mr. J.P. SCHOTSMANS (Chief Technical Advisor) Dr. G.M. ZIA (Managing Director), Mr. MUNIR AHMED (Deputy Chief Engr) Mr. ZUBAIR ALAM (Senior Engineer) during planning, survey, analysis and compilation of this assignment.

We would also like to thank Dr. K.S. STEPHENS UNIDO (Senior Industrial Field Development Advisor) and UNIDO-VIENNA for their help and support.

TERMS OF REFERENCE

TECHMA was appointed by UNIDO to carry out feasibility study entitled "Assistance in Production of Special and Quality Steels". The terms of reference are:

A. Data on country's need on Special and Quality Steels, breakdown by Steel grades, as well as by shape and size of steel products.

B. Data on existing capacities and techno-technological structure of country's steel industry.

C. Data on present costs of production of steel products in the country and their compatibility in the existing conditions of country's steel market.

SUMMARY

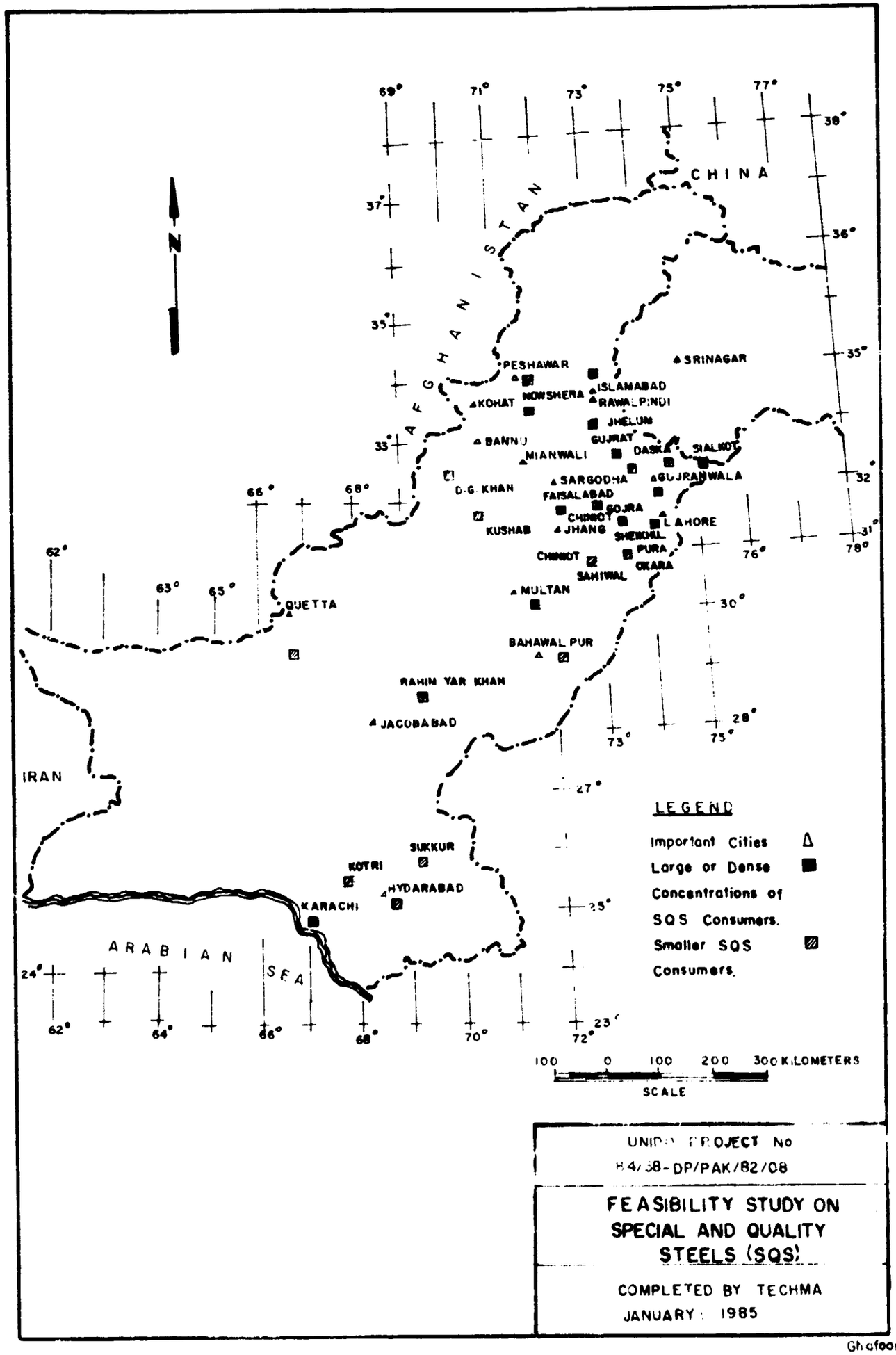
A statistically designed sample was prepared and detailed survey was carried out of the major centers of demand for special and quality steels. The special steels were categorised into thirteen varieties including special carbon, heat treating, free cutting, case hardening, spring, cold work tool/die, hot work, stainless-Cr, stainless-NiCr, Silicon, Hadfield and special forging steels. In addition two varieties of quality mild steels were also considered. The data collected was analysed and estimates were made for the overall demand which was further broken-down into various shapes and sizes for all types of steels mentioned. Forecasts were made for the future demands for special and quality steels for 1984/85, 1985/86 and 86/87 The total demand for 1983/84 based on the present survey is estimated at 61,027 tons for special steels and 21,465 for quality steels. The estimated future forecasts for special and quality steels were calculated as:

	Special Steels	Quality Mild Steel
1985	69,258	23,990
1986	78,473	26,800
1987	89,550	29,970

The data on imports for special steels for the year 1983/84 is estimated at 63000 tons which compares favourably with the estimated demand of 61,027 tons.

The production costs for three types of special and quality steels mild steel, alloy steel and spring steel have been estimated at Rs.4,721 Rs.6,828 and Rs.5,297 respectively.

Fourteen existing units have been surveyed inorder to identify the potential to produce special and quality steel. This will require detailed rehabilitation, modernization and revamping programme to bring them to required standards interms of equipment and ancilliary facilities for the production of selective grades of special and quality steels.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UNIDO PROJECT No
84/38-DP/PAK/82/08
FEASIBILITY STUDY ON SPECIAL AND QUALITY STEELS (SQS)
COMPLETED BY TECHMA
JANUARY 1985

Ghafoor

CONTENTS

INTRODUCTION

1. Iron & Steel Forecasts:

A number of consultants both National and International have carried out studies on past consumption and future demands for Iron & Steel using various techniques and acceptable criteria for forecasting. Amongst them is a study carried out by light engineering Corporation of Pakistan (LEC) in 1977. According to this study the total demand forecast for ingots/billets for the year 1984/85 is 1.106 million tons. This demand forecast was however, based on official records of imports and the existing operating capacity of various rolling mills installed in the country.

A comprehensive study of the supply and demand situation for steel in Pakistan was carried out by Kobe Steel Ltd. in 1981 This study was done in compliance with the UNIDO - project DP/PAK 79/020 "Master Plan for Ir n & Steel". For the determination of demand the Investigators used the available official statistical data for the period 1972/73 to 1979/80 and the data given in the Pakistan's five year plan for the period 1978/79 to 1982/83 as the basis and forecast the projected demand by using various internationally recognised correlations. Such as the steel consumption method, the steel intensity method, and the Time trend relationship. Kobe's steels forecasts for the average consumption of Iron & steel by the three methods mentioned were as follows:

...p/2..

Method	Forecasts 1984/85 (Tons)	1989/90	Growth Rate %
1. Apparent consumption	1,861,000	2,627,000	7.6
2. Steel Intensity	1,771,000	2,393,000	6.9
3. Time Trend	1,647,000	2,081,000	5.5

In Pakistan's sixth 5-year plan, the total consumption of Iron & Steel for the year 1984/85 is estimated at 1,916,257 tons.

II. Steel Production Facilities

The development of Iron and steel industry in Pakistan has been rather slow. In 1947, at the time of independence, there was only one steel mill in the country. This was operated by Pakistan Railways and had a very small capacity in the region of 2000 tons per annum. During the last forty years, the steel industry developed slowly mainly in the private sector where small furnaces were installed based on the processing of scrap. In early 1970's the development of a steel factory (Pakistan steel mills Karachi, PAS-MIC) based on Russian Technology was planned. This factory is now nearing completion and has a design capacity of 1.1 million tons.

The small plants in the private and public sectors produce about 640,000 tons of Iron and steel which is in addition to the capacity of PASMIC karachi..

The public sector companies involved with the processing of Iron & Steel are as follows:

PUBLIC SECTOR COMPANIES

1. Karachi Shipyard
2. Wah Industries Wah

3. HFF Taxila
4. Pakistan Railways Lahore
5. PECO Lahore
6. SSP Karachi

Total Melting capacity = 228,000 tons/year

There are a large number of Iron & steel industries in the private sector with a total melting capacity of 418,000 tons/year. These may be classifed as follows:

1. Melters

There are about 32 companies in this category. These companies operate mostly electric arc and a few Induction Furnaces with a capacity of 0.5 to 10 tons per heat.

2. Semi-integrated Steel Mills

There are about 20 mills which have melting and rolling facilities and the capacity of furnaces operated by these range between 0.5 to 15 ton/heat. The factories also operate electric arc or induction type furnaces.

3. Re-rollers

There are a very large number of re-rolling facilities and the total number of such companies is more than 100. These factories operate on ingots or billets supplied by the melting units.

The total Iron and steel production in Pakistan including the design production capacity at PASMIC is estimated at 1.75 million tons/year.

III. Special and Quality Steels (SQS)

The present level of metallurgical technology in Pakistan is rather poor. With exception of PASMIC, all the steel is made in electric furnaces using local and imported scrap. Capacity utilization of existing facilities varies widely depending upon the market supply and demand situation. The production generally relates to non-flat products mainly for concrete reinforcing bars or hot rolled section for the steel structure. Even in these cases there is very little quality control, the operation being considered as the "State of the Art".

There are very few companies which produce special steel. The Special Steels of Pakistan Ltd. (SSP) was designed for total production of 60,000 tons of special and quality steels per annum. The facilities consists of two 10/12 tons electric arc furnaces, one 3/4 ton electric arc furnace, Ingot conditioning and steel casting equipment. The plant was set up in 1970's, but never became fully operative and was ultimately shut down.

In view of the easy acceptance of low grade steel product in the construction industry and the lack of competition, the steel manufacturers has not given any importance to the problems of quality improvements and the information of requisite technology to achieve this objective. However, in view of the commissioning of PASMIC and the consequential emergency of competition, the private industrialist is becoming more and more aware of the quality products and is looking for diversification of its products. One such area is the production of special and quality steels. The production of SQS products however, requires a full awareness of the problems relating to quality. In order to achieve this it is necessary

that appropriate conditions are created which would include the selection of production process, availability and adoptation of suitable production technology, and the establisment of adequate quality control.

Dr. Kemal Kapetanovic, UNIDO consultant carried out an assessment of the Iron and Steel Industry in Pakistan (Report No.DP/PAK/82/018/A/01/37 and recommended a number of measures with a view to utilizing the existing facilities in the private and public sector for the production of special and quality steel. This included factors such as low import taxation on the raw materials, high import taxes on finished SQS products, technical assistance to the producers, improving the facilities at MIRDC and fiscal policy measures to promote the use of research services etc.

Dr Kapetanovic also recommended the preparation of a Feasibility Study inorder to determine the demand for SQS products in Pakistan.

Previous Marketing Forecasts for SQS Products

A study dealing with the problem of the function of Special Steel of Pakistan ltd. Karachi and carried out by Japan International Co-operation Agency (JICA). They estimated the demand for SQS by interviewing the prominent users of special steel products, as well as by analysis of the relevant statistical data available for the period 1974/75 to 1978/79. Their estimated demand forecasts are as follows:

1979/80	40,400	tons
1983/84	75,300	tons

Other attempts were made to forecast the demands for special steel products. As assement of demand was made by the Planning Commission of Pakistan on the assumption that SQS constitutes about 4 percent of the total demand of Iron & Steel in a developing country. On this basis the total demand for SQS has been estimated as 55000 tons for 1984/85.

The most recent estimation of demand for SQS products was made by NDFC. They estimated the demand for round bars, flats, billets, sheets, forgings, castings separately and determined the total demand as 61,968 tons.

In order to plan and encourage the production of special grade quality steels, Dr. Kapetanovic recommended a comprehensive feasibility study to be carried out by a consultant and TECHMA was appointed by UNIDO to carry out this study. The terms of reference for this study are:

A: Data on country's need on Special and Quality Steels, breakdown by steel grade, as well as by shape and size of steel products.

B: Data on existing capacities and techno-technological structure of country's steel industry.

C. Data on present costs of production of steel products in the country and their compatibility in the existing conditions of country's steel market.

The concept of "Quality of Steel" is based on the kind, quality and level of the properties the steel is expected to have in order to be suited for its processing, as

well as its final use. This involves three groups of the properties describing shape, structure and the surface of the steel products. The reference point for the evaluation of these properties is plain carbon steel product mainly up to a level of 0.25% carbon content, as obtained by conventional methods of technology without any particular measures to achieve some particular properties in its processing and use. Having this in mind, the concept of "Quality and Special Steel" in the framework of this document is applied for:

all steels being subject to any additional requirements on their structure in respect to its composition, uniformity, grain sizes, cleanliness on non-metallic inclusions etc.

all steels to be processed under particularly severe conditions by hot or cold deformation like hot or cold heading, drop forging, high speed machining etc.

It is therefore, stated that, under the heading "Quality and Special Steels" (QSS) following steels are to be involved.

all carbon steels intended for processing by hot or cold deformation involving high compression steps like heading, drop forging etc.

They are to be additionaly marked by HD (Heavy Deformation).

all carbon steels for any heat treatment like carburising, hardening and tempering, patenting etc.

HSLA i.e. high strength low alloy steels having a refined structure and improved mechanical properties,

alloy steels of all kinds,

all steels for heavy forgings.

SECTION 2 : RESEARCH DESIGN AND METHODOLOGY

In a series of planning discussions between MIRDC personnel and Techma staff held during August 1984, it was increasingly apparent that, unless the existing wide range and specifications of special steels was not reduced to a manageable number of steels grades/types, it would be practically impossible to design a meaningful survey effect.

Accordingly, MIRDC/UNIDO personnel agreed that all quality and special steels would have to be categorised (conveniently if not entirely accurately) under the following grades:

Special Steels	Quality Mild Steels
1. Special carbon steel	1. Deep drawing quality
2. Heat treating	2. Welding electrode steel
3. Free cutting	
4. Case hardening	
5. Spring steel	
6. Cutting tool	
7. Cold-work tool/die steel	
8. Hot-work " "	
9. Stainless - Cr	
10. Stainless - NiCr	
11. Silicon steel	
12. Hadfield steel	
13. Special steel forgings	

The above grade classification was felt to be adequate for the purpose of identifying various end-use sectors where such special steels are used.

Accordingly, after detailed discussions with metallurgical experts and steel engineering personnel, the following end-use sectors in Pakistan were identified:

1. Automotive and tractor assembly, and/or parts manufacturing
2. Railways
3. Cycle manufacturing
4. Motor cycle assembly, and/or parts manufacturing
5. Cement industry machinery, parts and grinding media
6. Sugar industry machinery and components/parts
7. Agricultural machinery and implements
8. Chemical and fertiliser industry equipment, components.
9. Electrical machinery assembly and manufacturing
10. Machine tools manufacturing
11. Textile and jute products machinery and components.
12. Diesel engines industry
13. Fastner (Nuts, Bolts, screws etc.) manufacturing

14. Cutlery, kitchen-ware and utensils industries
15. Surgical instruments industry
16. Beverage industry equipment and parts
17. Tube well pump, manufacturing.
18. Engineering firms own workshop consumption
19. Miscellaneous manufacture of machine parts, gear, spindles, etc.
20. Defence sector
21. Construction equipment manufacturing

The next step in the research design process was to determine how to obtain reliable information on special steels consumption from each of these end-use sectors, within given time deadlines and constraints.

The goal of obtaining reliable information on a wide variety of topics (namely, grades and specification of special steels consumed quantities actually consumed of each specification in 1982-83 and 1983-84, what it was used for, how much of this end product was made either consumed special steels during the past two years, first process of treating special steels during use, shape and size of special steel consumed) could only be realistically met if certain significant practical considerations were taken into account. These consideration are explained below:

RESEARCH DESIGN CONSIDERATIONS

1. The first and perhaps the most important, consideration in drawing up a feasible research design, was the fact that special steel consumers in all the above mentioned sectors are geographically spread out over a vast area (e.g. Karachi, Hyderabad Multan, Faisalabad, Rawalpindi, Islamabad, Lahore, Sialkot, Wazirabad, Gujranwala and Peshawar).

   Thus in the given time deadlines and cost limits it was virtually impossible to cover evenhalf of special steel consuming areas.

2. The second consideration was the certainty that each field interview with a given respondent would have to reveal two major aspects: a) was he a user of special steel to begin with, and b) what special steels did he actually use, Since the nature of investigation involved a technical subject, and a complex one, it was evident that each interview might take upto 3-4 hours.

3. A third consideration was the fact that all the required information may not be possessed by a single individual in the respondent, firm/organisation. It was evident that not only engineering/production people but also procurement and top management personnel would be included in the interviewing process.

4. A fourth consideration related to the highly likely possibility of coming across respondents who may not have adequate knowledge of the grades or types of special steels they were using.

5. A fifth consideration was the fact that since many respondents would be in the public sector, the field investigators would have to deal with much procedural red-tape in being guided to the right person and in obtaining relevant data.

6. The final consideration concerned the ability of field investigators to understand the technical nature of information being given by their respondents.

The above mentioned were the major considerations that influenced the research design.

IDENTIFICATION AND SELECTION OF RESPONDENT ORGANISATIONS

In consultation with MIRDC/UNIDO personnel, it was felt that, in view of the above considerations, it would be appropriate and cost efficient to adhere to the primary principle of obtaining reliable information and not merely visiting a large number of respondents.

Accordingly, TECHMA consultants, MIRDC/UNIDO personnel and engineering industry professionals identified the larger firms and organisations in various end-use sectors. This is shown as Exhibit 1. A total of 38 major engineering organisations and firms were identified in the public and private sectors, located at Lahore, Karachi, Gujranwala, Wah, Taxila and Islamabad-Rawalpindi.

It was felt that a sample size less than 30 major steel and/or engineering firms would not be feasible from the point of view of obtaining reliable information on the extensive range of types and specifications of special steels consumed in various end-use sectors. Like-wise, a sample size of 40 firms or larger would have most probably violated time and cost constraints.

As it turned out, after completion of field work six firms/organisations either found it difficult to provide detailed information, or asked that questionnaire be sent by mail, or the person who was alleged to have the required information simply could not make himself available. Thus the following firms identified as part of the sample are not included in the final analysis.

1. Sulaiman Engineering Company, Lahore.
2. National Spring Manufacturing Company, Lahore.
3. Punjab Steel, Lahore.
4. Pakistan Automobile Corporation, Karachi.
5. Zulshan Engineering, Islamabad.
6. Winding Machinery Company of Pakistan, Karachi.

This report's findings are therefore, based on detailed information provided by 32 large engineering firms.

INFORMATION COLLECTION

Questionnaire Information:

Almost three weeks (from August 05-27, 1984) of detailed planning discussions were required to draw up a field investigation questionnaire. This was approved for execution on August 27, 1984. This initial approved questionnaire format (shown as Appendix A) then explained in detail to the investigators entrusted with the work of actual interviews.

This Format was pre-tested with two respondents (namely, Ittefaq Foundries and Ittefaq Brothers) during the course of two lengthy interviews, totalling 5 hours. It was then apparent that substantial changes were required in the format.

As a result a revised and approved questionnaire format (shown as Appendix B) was drawn up and used eventually throughout the actual survey. This final questionnaire consisted of three parts , as shown below (also in appendix B)

Part A: Interview schedule for purchase/stores departments of responding firms. This contained details on grade of special steels purchased, specifications, shapes size, and quantities produced in 1982-83 and 1983-84.

Part B: Interview schedule for production departments of responding firms, giving data on the end-products made with respective kinds of special steels purchased, the treatment process used for special steels expansion plans, and addition of new products using special steels.

Part C: Interview schedule for special steel end-product user.

Thus in effect, the field investigators had to be prepared to administer either one or all the parts of the questionnaire depending on the situation of the respondent.

Field Investigator's Training:

Alongside the preparation of the questionnaire, great care was taken to provide field investigators with some knowledge of grades, shapes and size of special steels and their application in actual engineering works. Thus investigators spent a total of 9 hours with MIRDC staff for this purpose. Though this training period was not sufficient, it did provide a minimum base. Their real familiarisation with the products, of course, came during actual field interviewing and data collection.

Field Interviews and Data Collection:

Rather strict control of time and travel coordination was required to complete field interview within given deadlines. Thus in the first phase, 12 Lahore respondents were interviewed in 10 working days. Though a target of 3 hours per respondent was set, this could not be adhered to because of excessively lengthy contact times required with public sector respondents such as Pakistan Railways, State Cement Corporation and Punjab Small Industries Corporation. Alongwith Lahore respondents, five firms of Gujranwala were interviewed in series of repeat contacts. In fact the highest number of repeat visits was required with three four firms primarily because of their extreme reluctance to provide detailed responses

In the second phase, investigators obtained information from five large organisations located in the Rawalpindi area (Islamabad, Taxila and Wah). Since all these responding organisations (except Rastgar Industries) are public sector bodies, investigators were only able to obtain interviews through extensive use of personal contacts.

In the third phase, the same investigators (who were fairly well-trained in the complex nature of special steels demand) interviewed eight large public and private sector engineering enterprises at Karachi, including Pakistan Steel. Field work at Karachi was generally restricted because of certain disturbances which caused curfew to be imposed precisely in those areas where respondent firms were located.

It may be pointed out that in no case was it possible to obtain access to the right interview through "blind" contact. In about all cases field investigators gained access to the right person through references. However, respondents at Pakistan Ordnance Factory refused to provide any information on special requirements of certain kinds of special steels.

Also in some cases, respondents preferred to use the interview time to obtain clarifications from the interviewers concerning the three-part questionnaire and its details, Thus they took their own time (mostly ranging from 7-12 days) to fully complete the questionnaire and forward it, on their own, to the investigators.

TREATMENT OF INFORMATION OBTAINED

Information obtained through part A pertains to special steels purchased by steel engineering firms who either make end-products (for further use by their customers) out of such steel, and/or are such steel for their own workshops consumption. Accordingly, since the production departments of such organisation did not usually possess information on purchased quantities, this was obtained from respective purchase departments.

This data was then analysed in relation to data obtained in part B, which provided information or end-products made with the specified special steels. In those areas (e.g. Pakistan Railway, Pakistan Steel, Pakistan Ordnance Factory) where end-product information was not important and/or unavailable, such relationships could not be ascertained.

The information obtained in both parts A & B was then summarised to arrive at an estimate of the proportion of total end-product output and therefore, special steel consumption accounted for the surveyed organisation. Estimates were based on three inputs; (a) published information available on national production of these items using special steels as mentioned by respondent organisation, namely, cycle, tractors, cars heavy vehicle, machine tools, diesel engines, tubewell turbine pumps, fasteners, transformer, switchgear, electric motors, fans and exhaust's (b) relevant industry personnel estimates of total national production of machinery, equipment and parts for the sugar, cement, textile, jute, beverage, chemical, fertilizer and agricultural implements industries; (c) published data on the size and number of engineering workshops in the country in order to estimate total workshop consumption of various special steels; (d) published data and industry personnel estimates on the future 3-5 year growth outlook for the industries and products mentioned above.

This estimate of the projection of national production output (of specific engineering goods) accounted for by the surveyed firms is shown as Exhibit 2, with weighted average of 60% based on actual survey.

The information obtained in part C was mainly designed to serve as a "safety-net" for inability to get information from other sources. Thus, whereas it was not possible to obtain information from their individual suppliers of special steel products, by using part C however, extensive information was obtain on consumption of special steels end-products from State Cement Corporation (grinding media, machinery parts, forgings), Pakistan Railways (Springs, Spring-leaves, tools) Punjab Small Industries Corporation (surgical instruments, cutlery, utensils, hand tools.

EXHIBIT - 1

IDENTIFICATION OF RESPONDENTS IN VARIOUS END - USE SECTORS

END-USE SECTOR	RESPONDENT IDENTIFIED
1. Automotive, truck & tractor parts components.	a. Allwin Engineering, Karachi b. Agri Autos, Karachi c. Pakistan Machine Tool Factory, Karachi d. Ittefaq Foundries, Lahore. e. Heavy Foundry & Forge, Taxila f. Heavy Mechanical Complex, Taxila g. Steel Castings Gujranwala n. F.W. Fabricators, Lahore i. Spinning Machinery Corp., Lahore. j. Sulaiman Engg., Lahore k. National Spring Manufg. Lahore l. Pakistan Automobile Corp., Karachi
2. Railways	a. Pakistan Railways Main Workshop Lahore Deputy Chief Controller (Purchase) Lahore b. Punjab Steel Lahore c. Sulaiman Engg., Lahore
3. Cycle Manufacturing	a. Pakistan Engineering Co. Lahore b. Pakistan Cycle Industrial Corp., Socy. Lahore c. Army Welfar Engg., Lahore
4. Cement Machinery, Equipment	a. State Cement Corp., Lahore b. Heavy Mechanical Complex, Taxila c. Steel Castings Gujranwala d. Ittefaq Foundries, Lahore e. Rastgar Engineering Islamabad

Exhibit - 1

5.	Sugar Machinery, Components	a. Heavy Mechanical Complex, Taxila b. Karachi Shipyard, Karachi c. Star Moghal, Gujranwala d. Steel Casting Gujranwala e. Ittefaq Foundries ltd; Lahore.
6	Agricultural Machinery	a. Ittefaq Foundries Lahore b. Ittefaq Brothers, Lahore
7.	Chemical & Fertilizer Equipment	a. Steel Castings Gujranwala b. Karachi Shipyard, Karachi c. Heavy Machanical Complex, Taxila
8.	Electrical Equipment Machinery	a. Johnson & Phillips, Karachi b. Pak Electron, Lahore c. Climax, Gujranwala d. Siemens Karachi e. Pakistan Engg. Company, Lahore f. Anwar Industries Gujranwala g. Pakistan Switchgear, Lahore
9.	Machinery Tools Manufacturing	a. Pakistan Machine Tool Factory, Karachi. b. Pakistan Engg. Corporation, Lahore
10.	Taxila and Jute Manufacturing Equipment	a. Spinning Machinery Company, Lahore b. Winding Machinery Company, Karachi c. Zulshan Engg., Islamabad d. Steel Castings, Gujranwala e. F.W. Fabricators, Lahore f. Ittefaq Foundries , Lahore
11.	Diesel Engines Manufacturing	Pakistan Engineering Company, Lahore

Exhibit - 1

12.	Fasteners Industry	a. MBI Industries, Karachi b. Service Industries, Gujranwala
13.	Cutting Kitchen-ware & Utensils Manufacturing	Punjab Small Industries Corporation, Lahore
14.	Surgical Instrument Manufacturing	Punjab Small Industries Corporation, Lahore
15.	Beverage Industry Machinery Parts	Star Moghal, Gujranwala Pak Tool Industry Mian Mir, Lahore.
16.	Tubewell Pumps & Parts Manufacturing	Pakistan Engineering Company, Lahore
17.	Defence Sector Equipment Parts	a. Pakistan Ordnance Factory Wah. b. Pakistan Machine Tool Factory, Karachi c. Heavy Mechanical Complex Taxila
18.	Engineering Own Workshop Consumption	Pakistan Railways, Heavy Mechanical Complex, Pakistan Engineering Company, Karachi Shipyard, Pakistan Machine Tool, Climax, Siemens, Steel Casting, Service Industries, Ittefaq Foundries, F.W. Fabricators, Pakistan Steel.

EXHIBIT - 2

ESTIMATE OF PROPORTION OF TOTAL NATIONAL PRODUCTION OF CERTAIN ENGINEERING GOODS ACCOUNTED FOR BY SURVEYED ORGANISATIONS

End-Use Sector	Surveyed Organisations	Estimated Proportion of End-product Output Accounted for
Automotive & tractor parts, components.	1. Allwin Engineering 2. Agri Autos 3. Pakistan Machine Tool 4. Steel Castings Tool 5. Heavy Foundry & Forge 6. Heavy Mech. Complex 7. Spinning Machinery Co.	65 %
Cycle Manufacturing	1. PCICS 2. PECO 3. Army Welfare Engg.	80 %
Railway Carriage & engine parts	1. PR Purchase Deptt. 2. PR Workshops	75 %
Cement equipment & machinery	1. State Cement Corp. 2. Heavy Machanical Complex 3. Steel Castings Ltd., 4. Ittefaq Foundries 5. Rastgar Industries	70 %
Sugar manufacturing equipment	1. Heavy Mech. Complex 2. Karachi Shipyard 3. Star Moghal Industries 4. Steel Castings 5. Ittefaq Foundries Lahore	35 %
Agricultural machinery	1. Ittefaq Foundries 2. Ittefaq Brothers	15 %

EXHIBIT - 2

Chemical Fertilizer.	1. Steel Castings 2. Karachi Shipyard 3. Heavy Mech. Complex	33 %
Electrical Equipment machinery and parts	1. Johnson & Philips 2. Pak Electronic 3. Climax 4. Siemens 5. PECO 6. Anwar Industries 7. Pakistan Switchgear	70 %
Machine Tools manufacturing	1. Pakistan Machine Tools 2. PECO	30 %
Textile & Jute manufacturing equipment	1. Spinning Machinery Company 2. Steel Castings 3. F.W. Fabricators 4. Itteaq Foundries	30 %
Diesel Engine manufacturing	1. Pakistan Engineering Company 2. Ittefaq Brothers	15 %
Fasteners Industry	1. MBI Industries 2. Searose Industries	40 %
Cuttlery Utensils & Kitchenware manufacturing	1. Punjab Small Industries Corporation	60 %
Surgical Instruments	1. Punjab Small Industries	65 %
Beverage Industry equipment & parts	1. Star Moghal 2. F.W. Fabricators 3. Pak Tool Industry Lahore.	15 %

EXHIBIT - 2

Tubewell Pumps & parts manufacturing	1. Pakistan Engineering Co.	20 %
Defence & Armaments	1. Pakistan Ordnance Factory 2. Pakistan Machine Tool 3. Heavy Rebuild Factory	50 % (Balance not given by respondents)
Mechanical parts & Machinery components, all types	1. Ittefaq Foundries 2. Heavy Mechanical Complex 3. F.W. Fabricators 4. Heavy Foundry & Forge	Difficult to Estimate

PARTIAL DATA ON CERTAIN END-USE SECTORS

It must be appreciated that the present sample of 32 firms does not entirely represent all end-use sectors. The following special steel end-use engineering sectors are either under-represented, or not represented at all:

1. Hand tools (not represented)
2. Utensils (under-represented)
3. Local manufacture of certain car-parts (under-represented)
4. Agricultural implements (severly under-represented)
5. Printing and paper fabrication/cutting equipment manufacturing (not represented)
6. Diesel engines industry (under represented)
7. Chemical and fertilizer equipment components (under-represented)
8. Beverage machinery components (under-represented)
9. Hot-work tool and die-making (under-represented)
10. Motor cycle assembly-cum-progressive manufacture (not represented)

These sectors which are either not represented at all or are severely under-represented could not be covered due to two reasons: a) the highly fragmented nature of the said sectors, and their geographical dispresion; (b) given time deadlines and cost constraints.

However, in the demand estimation this omission has partially been removed by making allowance estimates. In the case of printing and paper fabrication/cutting equipment sector, it was only later discussed during the actual servey that certain firms located at Gujrat, Gujranwala and Lahore are, in fact, using some goods of special steels. At this stage it was too late to enlarge the sample and include one or two out of these (estimated) 10-12 printing and paper fabrication/cutting equipment makers.

SECTION 3: TOTAL DEMAND FOR SPECIAL & QUALITY STEELS

One of the most important terms of reference of the present study was the determination of total demand for special and quality steel in Pakistan.

Based on our field survey data, it is estimated that the total demand for special steel in Pakistan (including all special steel grades/types) during 1983-84 was 61,000 tons: demand for quality mild steel (of deep drawing quality and electrode quality) was about 21,500 tons.

Reference to Exhibit 3 will show that among the various grades of special steel, the largest shares of demand are taken by requirements for

Spring steel	16.5%	of	total	demand
Stainless (NiCr.) steel	11.8%	"	"	"
Heat treating steel	10.1%	"	"	"
Special carbon steel	10.0%	"	"	"
Silicon steel	9.8%	"	"	"
Stainless Cr. steel	8.1%	"	"	"

Together, these above mentioned grades account for 66% of total special steel demand. In a subsequent section of this study (section 4) demand for these steels generated by various end use sectors is shown.

A slight reservation must be stated at this point; it is our considered opinion that this special steels demand estimate (for 1983-84) of 61,000 tons is probably a conservative figure. This is largely because of three reasons, as stated below:

Firstly, as stated in Exhibit 5, our estimate of defence requirements of special steels (data impossible to pinpoint accurately) is 2079 tons, which according to informed industrial, engineering and steel trade personnel is probably a 70% under estimation. Therefore, the best estimate(under these circumstances) of Defence demand may be placed at around 8,500 tons annually. However, in our

study, we have based our estimate of 2079 tons solely on precise and detailed (though limited) information provided by Pakistan Ordnance Factory, Heavy Rebuild Factory, and Pakistan Machine Tool Factory.

Secondly, certain end-use sectors were under-represented in our sample survey due to cost constraints of the client. These sectors were hand-tools, agricultural implements and machinery, printing and paper/board fabrication equipment, and motor cycle assembly-cum-manufacturing. It is highly likely, therefore, that special steel demand generated by these sectors has been fully accounted for. Our subsequent information indicates that this un-accounted for demand is around 2,000 tons (for 1983-84)

Finally, as shown in Exhibit 5 according to the World trade manual (United Nations) exports of special steels to Pakistan from 26 industrialised countries during calender 1980 were 52,343 tons. Thus if total demand for special steels in 1983-84 is 61,000 tons, this would imply an annual growth in demand, during 1980 to 1984, of about 5.3% per year. Even accounting for the recession of 1981-82, this annual rate of increase in special steels, is likely to be a slight under-estimation. It is more probably (in view of the substantial growth in the sugar, cement, tractor, automobile, motor-cycle, paper/board fabrication and cutting, tubewell pumps, electrical machinery and agricultural implements industries) that the actual growth in special steel demand in Pakistan during 1980-84 was around 6% annually.

Thus, in the light of the above-mentioned considerations, it is justified to provide two estimates of aggregate special steel demand for 1983-84, in the format shown below:

SECTION - 3

Level of Special Steel Demand (1983 -84)
(in metric tons)

Demand Generated By	Based on Survey Information Only	Survey under-estimation Accounted for
Industrial and commercial use	58,948	60,950
Defence requirements	2,079	8,500
	61,027 tons	69,450 tons

The subsequent sections of this study, however, are based upon our conservative demand estimate of 61,027 tons because detailed survey information (used for further analysis on end use sectoral demand, consumption by shape and size, and stated future requirements) pertains to this demand level.

Therefore, in this study we shall treat the conservative demand estimate as the "most likely" reference point.

EXHIBIT - 3

TOTAL ESTIMATED DEMAND FOR SPECIAL AND QUALITY STEELS IN PAKISTAN 1983-84

Special Steel Grade	Estimated Demand (M / Ton)	Gage of Total	Total Metric Tons
Special carbon steel	6,015	9.9	
Heat treating steel	6,170	10.1	
Free cutting steel	3,260	5.3	
Case hardening steel	4,000	6.6	
Spring Steel	10,040	16.5	
Cutting tool steel	4,452	7.3	
Cold-work tool & die steel	2,600	4.3	
* Hot-work tool & die steel	180	0.3	
Stainless Cr. steel	4,950	8.1	
Stainless NiCr. steel	7,200	11.8	
Silicon steel	6,000	9.8	
Hadfied steel	1,250	2.0	
Special steel forgings	4,910	8.0	61,027
		100.0	
Quality Mild Steel Type			
Deep drawing quality	10,465		
Welding electrode quality	11,000		21,465

Source - (Based on field survey data from Karachi, Lahore, Taxila, Rawalpindi, Islamabad, Sialkot and Gujranwala)

* Majority of Steel goods producers,workshops and consumers are using improper steel (Rail track) which is available in abundance from Pakistan Railways. Therefore, actual demand is highly likely to be greater than 180 tons annually.

SECTION 4: DEMAND FOR SPECIAL AND QUALITY STEELS BY VARIOUS END-USE SECTORS

In all a total of 21 end-use sectors (or industries) generating the Bulk of demand for special and quality steels have been identified in this study. A brief overview of their aggregate demand for all grades/types of special and quality steels is shown Exhibit 4, below:

EXHIBIT - 4

SUMMARY OF END-USE SECTORS' DEMAND, 1983-84 FOR SPECIAL AND QUALITY STEELS

(In Metric tons)

End-use Sector	Aggregate Demand		%age of Total
	Special	Quality	(Special Steel Only)
Auto, truck, tractor parts	9,334	165	15.3 %
Railways	5,993	-	9.8
Cycle Manufacturing	2,171	4,990	3.6
Cement equipment, parts	6,027	-	9.9
Sugar mfg. equipment, parts	3,056	-	5.0
Agricultural machinery, implements	3,202	-	5.2
Chemical, fertilizer equipment	975	-	1.6
Electrical machinery	6,710	1,630	11.0
Machine tools	907	-	1.5
Textile, Jute mfg. equipment	288	-	0.5
Diesel engines	100	-	0.2
Fasteners industry	2,100	3,525	3.4
Cutlery and utensils	2,348	-	3.8
Surgical instruments	7,070	-	11.6
Cutting tools, hand-tools	2,068	-	3.4
Tubewell, turbine pumps	785	-	1.3
Industrial equipment, parts	3,742	-	6.1
Paper/board cutting, fabrication	1017	-	1.7
Engineering workshops' consumption	1,055	155	1.7
Defence requirements	2,079	-	3.4
Welding electrodes	-	11,000	-
TOTAL.	61,027	21,465	100.0

Exhibit 5, later in this section, provides details of which grade and type of Speical and Quality Steel is in demand in various end-use sectors. However, as indicated in Exhibit 4, the following end-use sectors generate the bulk of special steel demand;

Automotive, truck, tractor parts	15.3% of total demand
Surgical instruments	11.6% " "
Electrical machinery, parts	11.0% " "
Cement manufacturing equipment, parts,	9.9% " "
Railways	9.8% " "
Industrial machinery, spares parts.	6.1%

Put together, these end-use sectors account for about 64% of the total special steel demand generated (in 1983-84) in Pakistan. These sectors constitute the major users of spring steel, case hardening steel, stainless (Cr and Ni Cr) steel, silicon steel, special steel forgings, heat treating steel and cold-work tool/die steel.

SECTION 5: ANALYSIS OF SPECIAL AND QUALITY STEEL DEMAND BY SHAPES AND SIZES

Great care was taken in the course of field investigation, to ensure that all respondents provided comprehensive information of all the shapes and sizes of various special/quality steel grades used by them. Seven respondents who did not provide this detailed information were visited several times to obtain complete data on this aspect.

As a result it has been possible to present a fairly detailed analysis of the shapes and sizes used of various special/quality steels. Exhibit 6 presents a summary of this data while subsequent Exhibits 7 to 18 present detailed classifications of shape and size for all individual grades/types of special and quality steels used in Pakistan.

EXHIBIT - 5

END-USE SECTORS DEMAND FOR SPECIAL AND QUALITY STEELS, 1983-84

End-use Sector	Steel Grade Used	Demand 1983-84 (in M/Tons)	Total (all Grades, Tons)
Automotive, truck & tractor components.	Special carbon steel	1,173	
	Heat treating steel	1,068	
	Free cutting	39	
	Case hardening	2,628	
	Spring steel	3,450	
	Cold-work tool/die steel	46	
	Stainless-Cr. steel	80	
	Stainless-NiCr steel	150	Special Steel 9,334
	Forgings of special steel	700	
	Deep drawing quality	165	Quality Steel 165
Railways	Special carbon steel	80	
	Free cutting	2	
	Case hardening	10	
	Spring steel	5,880	
	Cutting tool steel	7	
	Cold-work tool/die steel	8	
	Hot-work tool/die steel	3	Special Steel 5,993 tons
	stainless-Cr. steel	3	
Cycle manufacturing and parts	Special carbon steel	30	
	Free cutting steel	1,043	
	Case hardening	774	
	Spring steel	252	
	Cold-work tool/die steel	60	Special Steel 2,171 tons
	Hot-work tool/die steel	12	
	Deep drawing quality	4,990	Quality Steel 4,990 "

Exhibit - 5

Cement mfg.equipment, parts, components.	Special carbon steel	553	
	Heat treating steel	560	
	Stainless-Cr.steel	425	
	Stainless-NiCr.steel	1,209	
	Special steel forgings	2,630	Special Steel 6,027 tons
	Hadfield steel castings	650	
Sugar mfg.equipment, parts, components.	Special carbon steel	313	
	Heat treating steel	434	
	Cold-work tool/die	36	
	Stainless-Cr. steel	350	Special Steel 3,056 tons
	Stainless-NiCr. steel	1,923	
Agricultural machinery & implements	Special carbon steel	2,600	
	Heat treating steel	452	
	Cold-work tool/die steel	100	Special Steel 3,202 tons
	Special steel forgings	50	
Chemical and fertilizer mfg.equipment, parts, components	Heat treating steel	390	
	Stainless-NiCr. steel	80	
	Special steel forgings	255	Special Steel 975 tons
	Hadfield steel castings	250	
Electrical machinery, equipment and parts	Heat treating steel	535	
	Free cutting steel	30	
	Spring steel	25	
	Cutting tool steel	10	
	Cold-work tool/die steel	110	Special Steel 6,710 tons
	Deep drawing quality	1,630	Quality Steel 1,630 "
	Silicon steel	6,000	

Exhibit - 5

Machine tools, parts manufacturing	Special carbon steel	160	
	Heat treating steel	328	
	Free cutting steel	102	
	Case hardening steel	107	Special Steel 907 tons
	Cutting tool steel	130	
	Cold-worktool/die steel	80	
Textile & jutes goods mfg. equipment, parts, components	Special carbon steel	8	
	Free cutting	95	
	Case hardening	93	Special Steel 288 tons
	Cold-work tool/die	45	
	Stainless-Cr.steel	47	
Diesel engines and parts manufacturing	Heat treating	10	
	Case hardening	80	Special Steel 100 tons
	Cold-work tool/die	10	
Fasteners industry	Heat treating	185	
	Free cutting	1,885	Special Steel 2,100 tons
	Cold-work tool/die	30	
	Deep drawing quality	3,525	Quality Steel 3,525 "
Cutlery, kitchenware & utensils industries	Cutting tool steel	1,100	
	Cold-work tool/die	300	
	Hot-work tool/die	30	Special Steel 2,348 tons
	Stainless NiCr. steel	918	
Surgical instruments	Cutting tool steel	850	
	Cold-work tool/die	200	
	Stainless-Cr. steel	3,970	Special Steel 7,070 tons
	Stainless-NiCr. steel	2,050	

Exhibit - 5

Cutting tools, Artisans tools, & Hand-tools manufacturing	Cutting tool	1,500	
	Cold-work tool/die	460	
	Hot-work tool/die	20	
	Stainless NiCr.	50	Special Steel 2,068 tons
	Special steel forgings	38	
Tubewell, turbine pumps manufacturing and parts	Special carbon steel	660	
	Heat treating	55	Special Steel 785 tons
	Stainless-NiCr. steel	70	
Industrial machinery, equipment fabrication, parts manufacture, including construction equipment.	Special carbon steel	140	
	Heat treating	615	
	Spring steel	150	
	Cutting tool steel	27	
	Cold-work tool/die steel	500	
	Hot-worktool/die steel	20	
	Stainless-Cr. steel	40	
	Stainless-NiCr. steel	750	
	Special steel forgings	1,150	Special Steel 3,742 tons
	Had-field steel castings	350	
Paper/board cutting & fabrication equipment, & parts mfg.	Cutting tool steel	700	
	Cold-work tool/die steel	225	
	Hot-work tool/die steel	5	Special Steel 1,017 tons
	Special steel forgings	87	
Engineering/steel workshop's own consumption for tooling, dies, moulds, punches, press tools, etc.	Special carbon steel	202	
	Free cutting	35	
	Case hardening	238	
	Spring steel	133	
	Cutting tool steel	73	Special Steel 1,055 tons
	Cold-work tool/die	337	
	Hot-work tool/die	37	Quality Steel 105 "
	Deep drawing quality	155	

Exhibit - 5

Defence equipment, parts	Special carbon steel	96	
	Free cutting	29	
	Heat treating	1,538	
	Case hardening	70	
	Spring steel	150	
	Cutting tool steel	55	
	Cold-work tool/die	53	Special Steel 2,079 tons
	Hot-work tool/die	53	
	Stainless-Cr. Steel	35	
Welding electrodes	Electrode rimmed steel quality		11,000 tons
	TOTAL SPECIAL STEEL ALL GRADES, ALL END-USE SECTORS		61,027 tons
	TOTAL QUALITY MILD STEEL, ALL END-USE SECTOR		21,465 tons

(Source : Based on field survey data interviews with industry experts and metallurgical engineering personnel)

NOTE: It is highly likely that the estimate of total special steel consumption by the defence sector is understated. The Japan International Cooperation Agency (JICA) study, 1980, estimated Defence demand for special steels at around 11,800 tons annually; a brief study by the National Development Finance Corporation (NDFC) in 1982 put Defence requirements of special steel at about 15,800 tons. Though POF personnel were reluctant to provide complete data, it is highly likely that the limited data provided by them, understates actual requirements by around 75%. Therefore, our estimates of Defence demand is, for 1983-84, about 8,500 tons.

EXHIBIT - 6

SPECIAL/QUALITY STEEL DEMAND, CLASSIFIED BY SHAPES AND SIZES

(In Metric Ton)

Steel Grade	Shape	Demand 1983-84 (M/Tons)
Special carbon steel	Round bars, rods	1,770
	Plate, sheet	1,145
	Strips	660
	Ingots	805
	Tubes, pipes	145
	Flat bars	85
	Castings	930
	Angles, sections	475
Case Hardening	Round bars, rods	3,845
	Tubes, pipes	145
	Plate, sheet	
Heat treating	Round bars,rods	2,325
	Plate, sheet	2,025
	Castings	1,005
	Ingots	560
	Tubes, pipes	110
	Hex bars	95
	Square bars	45
	Flat bars	5
Free cutting steel	Round bars, rods	2,155
	Hex bars	930
	Square bars	120
	Octagonal bars	50
	Plate, sheet	5

Exhibit - 6

Spring steel	Flat bars	7,900
	Square bars	1,400
	Round bars, rods	380
	Plate, sheet	350
	Strips	10
Cutting tools steel	Round bars, rods, square bars,	4,450
	Flat bars	2
	Including steels used for manufacture of tools for surgical utensils and cutting	
Cold-work tool/ die steel	Flat bars	2,425
	Round bars, rods	110
	Plate, sheet	- 55
	Square bars	6
	Octagonal bars	4
Hot-work tool/die	Round bars, rods	66
	Plate, sheet	71
	Flat bars	26
	Square bars	17
Stainless-Cr. steel	Flat bars	4,222
	Round bars, rods	114
	Plate, sheet	214
	Hex bars	70
	Castings	330
Stainless-NiCr. steel	Plate, sheet	5,124
	Tubes, pipes	1,044
	Castings	960
	Round bars, rods	70
	Strips	1
	Hex bars	1

Exhibit - 6

Silicon steel	Sheets	5,040
	Strips	960
Deep drawing and cold heading quality.	Round bars, rods	2,730
	Plate, sheet	3,375
	Strips	4,165
	Flat bars	195
Welding electrode quality	Rods	11,000
Special steel forgings		4,910

(Sources: (1) Field survey data, 1984
(2) Interviews with metallurgical, steel engineering personnel.

SPECIAL CARBON STEEL

Most responding organisations provided detailed information on specification, standards, of individual grades of special and quality steel used by them. In close consultation with MIRDC/ UNIDO personnel these specifications given were then clarified under various grades of special and quality steels.

The following specification provided by respondents are under the heading of special carbon steel:

x - 17	ST 52-3	Bohler Extra with
BS-M40	S 58C	C 1.1 %
EN 8	C 35D	Si 0.2 %
EN 8C	C 4 5	Mn 0.2 %
EN 15	C 45K	Xc 38
EN 16T	SAE 1020	
BS 1407	SAE 1045	
AISI - 1314	AISI C 1060	

The bulk of special carbon steel demand occurs for round bars and rods of 10-80mm dia and of 150-180mm dia-meter, as well as in the shape of plate/sheet of thickness 1-2.5mm and 6-20mm. Special carbon steel strips are mostly of width 50-200mm with thickness 0.2 - 1.5mm.

Details of shapes and sizes used are given in Exhibit - 7.

EXHIBIT - 7

SPECIAL CARBON STEEL: ANALYSIS OF DEMAND 1983-84 BY SHAPE AND SIZE

(Demand in Metric Ton)

Shape	Size (in mm)	Estimated 83-84 Annual Demand	Sub.Total
Round bars, rods	Dia upto 10 mm	30	
	10 - 40 mm	350	
	40 - 80 mm	945	
	80 -100 mm	30	
	100 -150 mm	65	
	150 -180 mm	320	
	180 -220 mm	30	1,770
Plate, sheet	Thick 1 - 25 mm	480	
	3 - 6 mm	75	
	6 - 20 mm	485	
	21 - 40 mm	55	
	41 - 80 mm	50	1,145
Strips	Width 50-100 mm, Thick 0.2-1.5 mm	360	
	Width 100-199 mm, Thick 0.2.-1.5mm	160	
	Thick 1.6-3.5 mm	110	
	Width 200-299 mm, Thick 1.6-35 mm	30	660
Ingots	76.2 x 101.6 mm	200	
	152.4 x 152.4 mm	335	
	177.8 x 203.2 mm	270	805

Exhibit - 7

Tubes, pipes	O/D 25-50 mm W/thickness 6-10 mm	5	
	O/D 50-70 mm W/thickness 10-19mm	5	
	20-30mm	135	145
Flat bars	Width, upto 25 mm Thick, upto 10 mm	55	
	Width 51-80 mm Thick, 10-20 mm	30	85
Castings			930
Angles, sections	150 mm x 150 mm	225	
	Other sizes	250	475
	TOTAL SPECIAL CARBON STEEL:		6,015

HEAT TREATING STEEL

The following specifications provided by respondents are included;

50 - B	25 CD4	12Cr Ni 3A	20 Cr	C	= 0.5-0.7%
SAE-4140H	35 CD4	18Cr2Ni4WA	40 Cr	Mn	= 0.7 - 1%
SAE-8620	35 NC 15	20Cr 2Ni 4A	45 Cr	Si	= 0.2-0.4%
SAE-8620H	30 NC 11	20Cr Ni 4Va	50 CrV4	S&P	= 0.04%Max.
SAE-8622H	30 NCD 16	30Cr Mn SiA	42 CrV6	Cr	= 1.8-2%
AISI-5140	A 37CD	38Cr Si	34CrMo4	NI	= 0.2-0.3%
AISI-9840	Low-alloy hardenable	Cr 15			
AISI-51	ASTM-A569				

The bulk of demand for heat treating steel owners for round bars and rods (in dia ranging from 10-150 mm), for plate & sheet (mostly of 4-6 mm thickness) and castings. Details are shown in Exhibit 8.

EXHIBIT - 8

HEAT TREATING STEEL : ANALYSIS OF DEMAND 1983-84
BY SHAPE AND SIZE
(Demand in Metric Ton)

Shape	Size (in mm)	Estimated 1983-84 Annual Demand	Sub. Total
Round bars, rods	Dia upto 10 mm	120	
	10-40 mm	920	
	40-80 mm	420	
	80-100 mm	390	
	100-150 mm	390	
	150-180 mm	85	2,325
Plate, sheet	Thick 1-2.5 mm	10	
	2.6- 4 mm	35	
	4-6 mm	1,630	
	6-20 mm	250	
	21-40 mm	20	
	41-80 mm	80	2,025
Castings			1,005
Ingots	76.2 x 101.6 mm	160	
	177.8 x 203.2 mm	400	560
Tubes, pipes	O/D 25-50 mm; W/thick 5.5-12 mm	5	
	O/D 50-70 mm; W/thick 10-30 mm	105	110
Hexagonal bars	Dia 10-20 mm	40	
	20-40 mm	45	
	40-60 mm	10	95

Exhibit - 8

Square bars	10-20	mm	10	
	20-40	"	16	
	40-80	"	12	
	100-150	"	7	45
Flat bars	Width 81-120	mm		
	Thick 21-40	"		5

TOTAL HEAT TREATING STEEL - 6,170 tons

EXHIBIT - 9

FREE CUTTING STEEL; ANALYSIS OF DEMAND 1983-84 BY SHAPE AND SIZE

(Demand in Metric Tons)

Shape	Size (in mm)	Estimated 1983-84 Annual Demand	Sub. Total
Round bars, rods	Dia upto 10 mm	1,135	
	10-20 "	665	
	20-40 "	285 + 55 = 340	
	40-60 "	15	2,155
Haxagonal bars	Dia upto 10 mm	120	
	10-20 "	675	
	20-40 "	135	930
Square bars	Upto 10 mm	42	
	10-20 "	75	
	20-60 "	3	120
Octagonal bars	Dia 30 - 40 "		50
Plate, Sheet	Thick 15-20 "	1	
	20-30 "	1	
	50-60 "	3	5
		TOTAL FREE CUTTING STEEL-	3,260

CASE HARDENING STEEL

The following specifications provided by respondents are included:

EN - 351	15 Cr Ni6
AISI - 5120	19 Ni Cr Mo4
10 NC 12	SAE- 1112
16 Mn Cr 5	SAE - 4320

The overwhelming bulk of demand volume for case hardening steel occurs in the form of round bars and rods ranging from diameter 15.5 - 120 mm, though a negligible quantity of demand exists for rods of 8-9.5 mm diameter. A small portion of demand goes into tubes/pipes of outer dia 80-90 mm with small thickness 20-25 mm. Further details are given in exhibit 10..

EXHIBIT - 10

CASE HARDENING STEEL: ANALYSIS OF DEMAND 1983-84
BY SHAPE AND SIZE
(Demand in Metric Tons)

Shape	Size (in mm)	Estimated 83-84 Annual Demand	Sub. Total
Round bars, rods	Dia 18 - 20 mm	290	
	20 - 40 "	770	
	40 - 60 "	855	
	60 - 80 "	625	
	80 -100 "	635	
	100 -120 "	630	
	120 -195 "	40	3,845
Tubes, pipes	O/D 80 - 90 mm W/Thick 20-25 "		145
Plate, sheet	Thick 6-20 mm		10
	TOTAL CASE HARDENING STEEL-		4,000 tons

SPRING STEEL

The following specifications are included in this category, as mentioned by respondents :

EN - 45	SAE - 9260
EN - 43 B	56 - Mn
AISI - 9262	60 Si Z Mn A
AISI - 9254	65 Si Z Mn WA

The large bulk of spring steel demand exists for flat bars of width 51-80 mm with thickness ranging from 5-50 mm, and of width 81-120 mm and thickness from 10-50 mm. Spring steel demand also exists for square bars of 60-81 mm . Details are given in Exhibit 11.

EXHIBIT - 11

SPRING STEEL: ANALYSIS OF DEMAND 1983-84 BY SHAPE AND SIZE

(Demand in Metric Tons)

Shape	Size (in mm)	Estimated 1983-84 Annual Demand	Sub. Total
Flat bars	Width 51 - 80 mm; Thick 5 - 9 "	1,450	
	10 - 20 "	1,625	
	21 - 50 "	1,800	
	Width 81 -120 "; Thick 5 - 9 "	120	
	10 - 20 "	845	
	21 - 50 "	820	6,660
Square bars	60 - 80 mm^2		1,400
Round bars, rods, and coils.	Dia upto 10 mm	1,230	
	10 - 20 mm	250	
	40 - 60 "	60	
	100 -120 "	80	1,620
Plate, sheet	Thick 1.1 - 2.5 mm	8	
	2.6 - 4 "	7	
	6 - 20 "	200	
	21 - 40 "	70	
	41 - 80 "	65	350
Strips	Width 7 - 20 mm; Thick 2 - 3.4"		10
	TOTAL SPRING STEEL:-		10,040 tons

CUTTING TOOLS STEEL

The following specifications provided by respondents are included herein:

T 7 A	High speed C-60
High Speed with	EN 31
C=0.76%	Bohler rapid Mo Extra V 36
Cr= 4.25%	VEW-K 510
W = 18%	AISI- M45
V = 1.1.%	AISI - M 4

Oil-hardening, non-distorting with C = 0.7%
Mn = 1.25%
Cr = 0.5 %
W = 0.5 %
V = 0.2 %
Si = 1.25%

The overwhelming bulk of demand is for round bars and rods from dia 20 - 80 mm. Details are given in Exhibit 12.

EXHIBIT - 12

CUTTING TOOLS STEEL-ANALYSIS OF DEMAND 1983-84
BY SHAPE AND SIZE
(Demand in Metric Tons)

Shape	Size (in mm)	Estimated 1983-84 Annual Demand	Sub. Total
Round bars, rods	Dia upto 20 mm	2	
	20 - 40 "	1,483	
	40 - 80 "	2,960	4,445
Flat bars	Width 19 - 76 mm; Thick 12 - 16 "	2	2
Square bars	10 - 40 mm^2	5	5
	TOTAL CUTTTING TOOLS STEEL:-		4,452

COLD WORKED TOOL AND DIE STEEL

The under mentioned specifications are included:

AISI - D3	SKD - 9
AISI - D2	Bohler Special K
20 NC 6	SL - 25
35 NCD 16	Bohler V 6 N
VEW - K 107	
SKD- 11	

The bulk of demand is for flat bars of width 51-80mm and thickness 21-40 mm; of width 81-120 mm and thickness 20-80mm; and width over thickness 41-80 mm. There is a small demand volume for round bars in diameter ranging from 6.5-60mm. Further details are given in Exhibit 13.

EXHIBIT - 13

COLD-WORKED TOOL & DIE STEEL: ANALYSIS OF DEMAND 1983-84 BY SHAPE AND SIZE

(Demand in Metric Tons)

Shape	Size (in mm)	Estimated 1983-84 Annual Demand	Sub. Total
Flat bars	Width 51 - 80 mm; Thick 10 - 20 "	17	
	21 - 40 "	885	
	41 - 60 "	18	
	Width 81 -120 mm; Thick 10 - 20 "	15	
	20 - 80 "	680	
	Width over 120 mm; Thick 21 - 40 "	20	
	41 - 80 "	790	2,425
Roundbars, rods	Dia 6.5 - 20 mm	26	
	20 - 40 mm	44	
	40 - 60 "	24	
	60 -120 "	11	
	Over 120 "	5	110
Plate, sheet	Thick. 6 - 20 mm	4	
	21 - 40 "	21	
	41 - 80 "	22	
	Over 80 "	8	55
Square bars	10 - 60 mm^2	6	6
Octagonal bars	20 - 30 mm dia	4	4
	TOTAL COLD-WORKED TOOL & DIE -		2,600 tons

HOT WORKED TOOL AND DIE STEEL

Only two specification standards were mentioned by respondents. These are VEW-W320 and Bohler WK2. Others only mentioned that they used "hot worked tool or die" steel. Demand exists mostly for round bars in diameter ranging from 25-80 mm; for plate and sheet of 55-75 mm thickness, and flat bars of width from 70-120 mm and thickness 30-80 mm. Further details are shown in Exhibit 14.

EXHIBIT - 14

HOT-WORKED TOOL & DIE STEEL-ANALYSIS OF DEMAND 1983-84 BY SHAPE AND SIZE

(Demand in Metric Tons)

Shape	Size (in mm)	Estimated 1983-84 Annual Demand	Sub. Total
Round bars, rods	Dia 20 - 40 mm	12	
	40 - 60 "	21	
	60 - 80 "	26	
	80 -100 "	7	66
Plate, sheet	Width 300-900 mm; Thick 55-75 "	71	71
Flat bars	Width 70-80 mm; Thick 30-40 "	12	
	Width 81-120 mm; Thick 41-80 "	14	26
Square bars	100-150 mm^2		17
	TOTAL HOT-WORK TOOL & DIE		180

NOTE This estimate of annual demand for hot-worked tool and die steel is likely to be lower than actual demand, which some metallurgical experts place at between 250-310 tons annually. However, it must be realised that, in Pakistan, the appropriate steel is seldom used for hot-forging purposes by most smaller foundries and steel-making firms in the unorganised small-scale sector.

STAINLESS Cr -STEEL

The following specifications as mentioned by respondents are included;

Z 12 C13	EN - 57
Z 30 C13	EN - 56A
Z 40 CSD 10	2 Cr 13
AISI 410	3 Cr 13
AISI 420 AISI 416 AISI-TP 420	4 Cr 10 Si 2lMo

The large bulk of demand exists for stainless Cr steel flat bars of width 10.5 - 25 mm and thickness 5 mm, and of width 25-50 mm with thickness 10-20 mm. A demand of about 214 tons exist for sheet of 4-6 mm thickness, and for round bars in diameter between 6-40 mm. Further details are shown in exhibit 15.

EXHIBIT - 15

STAINLESS Cr. STEEL - ANALYSIS OF DEMAND 1983-84 BY SHAPE AND SIZE

(Demand in Metric Tons)

Shape	Size (in mm)	Estimated 1983-84 Annual Demand	Sub.Total
Flat bars	Width 10.5 - 25 mm; Thick. less than 10 mm	1,364	
	Width 25 - 50 mm; Thick 10 - 20 mm	2,812	
	21 - 40 mm	46	4,222
Round bars, rods	Dia 6 - 20 mm	30	
	20 - 40 mm	80	
	40 - 80 mm	4	114
Plate, sheets	Thick 4 - 6 mm	204	
	6 - 20 mm	10	214
Hexagonal bars	Dia 10 - 40 mm		70
Castings			330
		TOTAL STAINLESS Cr. STEEL:-	4,950 tons

STAINLESS - NiCr STEEL

The following specifications as mentioned by respondents are included herein;

AISI - 321	FISCN- 25-12
AISI - 304	
AISI - 368	
AISI - 314	EN - 58A
AISI - 316	EN - 58G

The bulk of demand is for sheets of thickness ranging from 2.6 - 6 mm, and a substantial demand/quantity also exists for sheets of 0.5 - 2.5 mm and 6-20 mm thickness. A sizeable portion of demand is for tubes and pipes of outer diameter 40-90 mm with wall thickness of 15-40 mm, as well as castings of stainless NiCr steel.

Details are given in Exhibit 16.

EXHIBIT - 16

STAINLESS NiCr.STEEL-ANALYSIS OF DEMAND 1983-84
BY SHAPE AND SIZE
(Demand in Metric Tons)

Shape	Size (in mm)		Estimated 1983-84 Annual Demand	Sub. Total
Plate, sheet	Thick 0.5-0.7	mm	3,577	
	0.8-2.3	"	1,260	
	2.4-6.0	"	117	
	6-20	"	140	
	21-40	"	30	5,124
Tubes, pipes	O/D 40 - 50	mm		
	Wall thick-ness 6-12	"	174	
	O/D 50 - 70	mm		
	W/thick-ness 15-30	"	407	
	O/D 80 - 90	mm		
	W/thick-ness 20-35	"	348	
	O/D 90 - 105	mm		
	W/thick-ness 20 - 40	"	115	1,044
Castings				960
Round bars, rods	Dia upto 20	mm	5	
	20 - 40	"	43	
	40 - 80	"	22	70
Strips	Thick 0.2-1.5	mm		1
Hexagonal bars	Dia 20-40	"		1
	TOTAL STAINLESS NiCr. STEEL -			7,200 tons

SILICON STEEL

No specifications are mentioned by the responding user organisations, they only stated it as either "silicon steel" or as "silicon electrical steel". The large bulk of demand is for silicon steel sheets of 0.5 - 2.5 mm thickness with width ranging from 700 - 1800 mm. A sizeable portion of demand is for strips of 100 - 150 mm width and 0.2 - 1.5 mm thickness.

Details are shown in Exhibit 17.

EXHIBIT - 17

SILICON STEEL-ANALYSIS OF DEMAND 1983-84 BY SHAPE AND SIZE

(Demand in Metric Tons)

Shape	Size (in mm)	Estimated 1983-84 Annual Demand	Sub. Total
Sheets	Width 700-1000 mm; Thick 0.5-2.5 "	2,016	
	Width 1000-1800 mm; Thick 0.2-2.5 "	3,024	5,040
Strips	Width upto 100 mm; Thick 0.2-1.5 "	67	
	Width 100-150 mm; Thick 0.2-1.5 "	893	960

TOTAL SILICON STEEL- 6,000 tons

QUALITY MILD STEEL

The following specifications mentioned by respondents have been included under the category of quality mild steel:

SAE - 1008	JIS -G-3141
SAE - 1015	JIS-G-3503
JIS - G 3101	

Demand for deep drawing quality exists in the form of round bars and rods diameter between 10-20 mm, for plate and sheet of thickness between 0.5-4 mm and for strips of 0.2 - 3.5 mm thickness with width ranging from 44-206 mm. A small portion of demand is for flat bars fo width from 51-95 mm, and thickness 10-20 mm. Welding electrode quality steel is used in the form of rods of 5.5 mm dia, practically the entire volume demand is for this size.

Details are given in Exhibit 18.

EXHIBIT - 18

QUALITY MILD STEEL: ANALYSIS OF DEMAND 1983-84 BY TYPE, SHAPE AND SIZE (Demand in Metric Tons)

Type	Shape	Size (in mm)	Estimated 1983-84 Annual Demand	Sub.Total
Deep drawing	Round bars, rods	Dia upto 9 mm	545	
		10 - 20mm	2,165	
		20 - 40mm	20	2,730
	Plate, sheet	Thick 0.5-2.5mm	2,045	
		2.6-4 mm	710	
		4-6 mm	530	
		6-20 mm	90	3,375
	Strips	Width upto 100mm, Thick 0.2-1.5mm	1,730	
		Thick 3.6-6mm	45	
		Width 100-200mm, Thick 0.2-1.5mm	735	
		Thick 1.6-3.5mm	1,580	
		Width 200-300mm, Thick 1.6-3.5mm	75	4,165
	Flat bars	Width 51-95mm, Thick 10-20mm		195
Welding electrode quality	Rods	Dia 5.5mm (usually)		11,000
		TOTAL QUALITY MILD STEEL:-		21,465 tons

Section 6: ESTIMATED FUTURE GROWTH OF SPECIAL AND QUALITY STEELS END-USE SECTORS 1985-87

This section attempts to formulate the ground base for providing an estimate of future growth in use and consumption of special steels in Pakistan. In this section, the matter of usage rate factors is also dealt with.

AUTOMOTIVE AND TRUCK/BUS PARTS, COMPONENTS

Available data on the manufacture-assembly of automotive vehicle in Pakistan suggests varying growth rates for specific types of vehicles, as shown in Exhibit 19.

EXHIBIT 19

MANUFACTURE/ASSEMBLY OF AUTOMOTIVE VEHICLES IN PAKISTAN

Year	Trucks, Buses	Jeeps	Light Comm.Veh.	Passenger Cars
1977-78	3,668	1620	1,394	7,914
78-79	5,359	1219	8,347	5,277
79-80	6,325	1641	5,961	(na)
80-81	3,412	1682	8,391	(na)
81-82	3,360	1511	11,170	(na)
Average Growth Rate 78-82	(-2%)	(-1.7%)	10.2% 1979-82	(na)

Source: (1) Pakistan Automobile Corporation, Karachi.
(2) Pakistan Statistical year book 1981.

As the data indicate, the manufacture-assembly of trucks buses and jeeps was hard hit by the 1981-82 recession, therefore it would not provide a reliable estimate of future 3 years production to merely extrapolate the stated historical percentage rates.

In view of these facts that (i) Pakistan automobile corporation has undertaken substantial expansion of its passenger car Light commercial vehicles, and jeep manufacturing/assembly, (ii) Nissan, Hino and Lorries all have large facilities for progressive assembly operations well in hand; and (iii) the local manufacture of replacement auto and bus/truck parts is a currently high growth business, the following growth rates for various vehicles manufacture/assembly may be regarded appropriate for the period 1985-1987.

	Probable Annual Growth
Truck and bus assembly, production	5.5. %
Jeeps (4x4) production	7 %
Light commercial vehicles	10.5 %
Passenger cars	12 %

These forecast rates may be treated as conservative, in view of the general growth trend in the face of under mentioned population, gauged from the data in Exhibit 20 :

EXHIBIT 20

IMPORTS OF CKD, SKD AND COMPLETE UNITS

OF MOTOR VEHICLES IN PAKISTAN

YEAR	PASSENGER CARS	COMPLETE TRUCKS, LORRIES	TRUCK & BUS CHASSIS
1979	12,455	17,624	3,054
1980	19,393	10,650	5,033
1981	14,562	17,818	4,764
1982	21,074	25,246	2,795
4-year Average growth	19.2%	12.7%	7.4%

(Note: For truck/bus chassis growth computed by taking average of 1981 and 1982 imports relation to 1979 imports)

Source: Year book of International Trade Statistics 1982, UN Publication.

Special Steels Usage Rate Factor for Vehicles

According to PACO sources and the Japan International Cooperation agency (JICA) study of 1980, the undermentioned is the progress on having locally manufactured special steel parts installed in trucks and buses.

Period between	Weight of Special Steel Parts in Bedford Trucks, Buses
1972-79	132 Kg per vehicle
1979-80	333 " " "

Average annual rate of increase in using locally manufactured special steel parts in such trucks and buses works out to about 12%. The forecast weight (in kg) of special steel parts per vehicle expected to increase by between 16% - 17%. This in our view is somewhat optimistic; the actual increase is more likely to be around 12%

TRACTOR MANUFACTURE/ASSEMBLY, PARTS MANUFACTURING

During the past four years, there has been significant expansion in the manufacture/assembly of four tractors and tractor parts, Upto January 1980, tractor manufacture/assembly was confined to the public sector, namely, PACO (Fiat, Awami Autos (ford), Millat (Massey Ferguson) and Bela Engineers (URSUS). Now, since 1980 to date, four private sector tractor manufacturing-cum-assembly units have entered business, namely, FECTO (Belarus) IMT Associated Tractors (IMT-540), Allied Engineering Services (Ford 3610), and Al-Ghazi Tractors (Fiat), Also, two private sector tractor units are under consideration; the Behpani groups of Kwait Plant (John Deere) and Imtiazi Engineering Ltd (International Harvester).

At least upto 1987, tractor production in Pakistan will consist of assembly -cum-manufacture of tractors imported in CKD and semi-Knocked down (SKD) condition. Public sector production is shown below for 1981 and 1982. The stated capacity in the public sector is 15,000 units per year.

Year	Total Public Sector Production
1981	9,372 units
1982	13,400 "

Source: Economic Review January 1984

Of public sector units, Millat Tractors is the largest and its past six years production growth (shown below) provides a fair indicator of how the tractor industry is likely to grow over the next three years (upto 1987).

As shown below Millat's production of tractors has grown at an average of around 14.6% annually over the 6-year period 1978 to 1983.

EXHIBIT 21(a)

GROWTH IN TRACTOR PRODUCTION

MILLAT TRACTORS

(CKD Assembly)

Year	Production (Nos.)
1978	5,650
79	3,884
80	4,204
81	4,972
82	7,684
83	11,180
Average annual growth	14.6%

Source: Company annual report, 1983)

A lower growth trend is indicated by imports data, but higher growth was experienced in tractor production/assembly from CKD and SKD condition. This is shown below in Exhibit 22.

EXHIBIT 22

IMPORTS AND PRODUCTION OF TRACTORS IN PAKISTAN

(Built-up, SKD and CKD)

Year	Imports	Production
1976-77	15,098	
77-78	15,213	8,237
78-79	18,056	5,260
79-80	25,597	6,545
80-81	15,796	8,804
81-82	15,348	12,367
82-83	22,907	17,800 (estimated)
(Average annual growth)	7.2%	16.7%

(Source: Economic Review, January 1984)
Monthly Statistical Bulletin, June 1983.

However given the fact that large private sector units are now also in production; that Millat Tractors is expanding annual capacity to 20,000 units, that local demand for tractors is expanding by about 17% - 19% annually, it is highly likely that future production of tractors in Pakistan (over the period 1985 to 1987) will grow at an annual rate of around 16%.

Special Steels Usage Rate for Tractors

Production personnel at Pakistan Tractor Corporation and Pakistan Automobile Corporation estimate that the unit requirement of special steels is about 380KG - per tractor, provided locally manufactured components constitute 85% of total tractor parts.At present (1984), the position on the use of locally-produced components is as shown below:

Make	Local Components	
	1984	Projected 1986-87
Massey Ferguson	65%	80%
Ursus	40%	40%
Fiat (Al-Ghazi)	30%	50%
Ford 3610	-	40%
Belarus (FECTO)	18%	40%
IMT	27%	47%
International Harvester	-	35%

(Sources: Economic Review, January 1984. PP 21-25)

It is likely that over the period 1985 to 1987, the demand for locally produced tractor components will increase at an annual average of around 22%.

Agricultural Machinery and Implements

In light of available data published by Investment advisory Centre of Pakistan Punjab economic Research Institute the PICIC survey of agricultural equipment manufacture, and the monthly "Economic Review", the total production in 1982 of various types of agricultural implements (cultivators, tillers, border discs wheat threshers, maize shellers, dulls, etc.)and tractor-drawn implements was around 15,000 pieces annually. The existing capacity (1983-84) among the 60 odd large implement manufacturing concerns

is about 36,000 units. In the un-organised sector, capacity for implements and tools production is an estimated 70,000 pieces annually.

Annual increase in production output of such implements and machinery is estimated at about 15% per year upto 1987. An indication of the incerase in production is available from the size of exports from Pakistan.

EXHIBIT 23

PAKISTAN EXPORTS OF AGRICULTURAL MACHINERY AND IMPLEMENTS

Year	Million Rs.
1976-77	0.4
77-78	0.5
78-79	1.5
79-80	1.3
80-81	6.8
81-82	1.4
Average annual growth	28.5%

(Source: monthly foreign trade statistics, various issues)

Annual increase in demand for agricultural implemets (mainly tractor-drawn) may be estimated from sales data of Millat Tractors, one of the largest implement makers in the country.

EXHIBIT 24

MILLAT TRACTORS ANNUAL SALES

OF AGRICULTURAL IMPLEMENTS

Year	(In million Rs)
1978	3.03
79	3.01
80	6.83
81	11.56
82	18.64
83	18.25
Average annual growth	43.2%

(In constant terms, growth averaged 21% annually)

No data exists on the special steels usage rates in implements production, however, the PC-1* proformas of several approved projects in this sector suggest use of special carbon steel, cold-work tools and die steel, cutting tool steel, and small quantities of case hardening steel.

* Planning Commission

MOTORCYCLE AND SCOOTER MANUFACTURE/ASSEMBLY

Growth in this sector may be gauged from the data given below in Exhibit : 25

EXHIBIT 25

PAKISTAN PRODUCTION OF MOTORCYCLES & SCOOTERS

Year	Quantity	
1977-78	37,408	
78-79	51,798	
79-80	65,953	
80-81	53,174	
81-82	24,903	
82-83	31,300	(estimated)

Production and marketing personnel of Sind Engineering Ltd (makers of Suzuki motorcyles) and Atlas-Honda Ltd. suggest that the 1981-82 version had a heavy damping effect on demand during the period June 1981 to August 1983. It is estimated that , though the same growth rate will not be achieved during 1985 - 1987 as was experienced during 1977 - 1980 (about 17%), an annual increase in production of around 14% is highly likely.

SPECIAL STEELS USAGE RATE IN MOTORCYCLES

According to PACO sources and Atlas-Honda production personnel, the approximate weight of special steel parts produced locally is about 22kg per motorcycle (as of 1984). These parts typically require special carbon steel and other special steel round bars in dia, ranging, from 14-90 mm.

CYCLE MANUFACTURING

The output of cycles in Pakistan is shown below in Exhibit 26 :

EXHIBIT 26

PAKISTAN PRODUCTION OF CYCLES

Year	Quantity
1977-78	244,675
78-79	280,094
79-80	279,375
80-81	327,291
81-82	399,094
82-83(estimated)	411,800
Average annual growth	11%

(Source: Monthly statistical Bulletin:March 1983)

The cycle industry's general expectation is that growth in production over 1985 to 1987 will average around 13% per annum, in view of the fact that Pakistan's economy appears to have largely rulled out of the effects of the 81-82recession.

ELECTRICAL MACHINERY MANUFACTURING

Not much current data exists on the future outlook of this industry. However, from the responses of organisations surveyed (namely. Johnson and Philips, Siemens, Pak-Electron, Climax, Anwar industries among the largest in the industry) indicate that their production output over 1985-1987 will probably grow at between 16% - 18% per year. The major increase in production are expected for switchgear, distribution transformers, electric motors and electric fans.

CEMENT MANUFACTURING EQUIPMENT

Two indicators provide an estimate of growth in this sector. One is the historical growth in cement production, the second is the four large cement plants in various stages of completion, and the expansion of cement equipment production capacity in both public and private sectors.

EXHIBIT 27

PAKISTAN PRODUCTION OF CEMENT

Year	Qty.,Million Tonnes
1977-78	3.22
78-79	3.02
79-80	3.34
80-81	3.54
81-82	3.66
82-83	3.68

State Cement Corporation requirements suggest that their demand for forged steel and high chrome grinding media will increase by 14% and 35% respectively, Demand for cement equipment parts and components is likely to increase at around 3% per year at best , as most such demand is for emergency or slow-moving spares.

SUGAR MANUFACTURING EQUIPMENT, SPARES

Sugar production in Pakistan has grown remarkably over the last six years (1977-78 to 1982-83) from 860,000 tonnes to around 1.28 million tonnes. This means an average annual growth of about 8.3%. However, it is necessary to point out that, during the last four years, production of sugar increased at around 28% per year.

This figure is close to the growth rate suggested by our respondents for production of sugar equipment spares and parts, namely, about 22%.

FASTENERS MANUFACTURING

The available evidence (IACP study, 1982) suggests that capacity utilisation in the organised sector ranges between 65% - 70%, while output (in 1982) was about 8,000 tons. The best published estimate of fasteners production growth over 1984-1987 is around 15%.

This estimate is slightly lower than the growth plans indicated by MBI Industries (Karachi) and Searose Industries (Gujranwala), the two largest fasteners manufacturing firms in Pakistan. Their expected growth in production for 1984-85 and 1985-86 averages 16%. This is the growth rate this study shall consider.

CUTLERY AND UTENSILS MANUFACTURING

This industry manufactures a wide range of products, kitchen and house hold utensils, table cuttlery, hunting and kitchen knives and within each product group there exists numerous individual items. The industry is concentrated at Wazirabad, Sialkot and Gujranwala, with a few small units in Karachi, Hydrabad and Lahore. A total approximately 300 units exists in this industry.

The sectoral report (Volume II March 1983) of the Planning Commission's Export working group provides information on cutlery and utensils value of production as shown in Exhibit 28. Production value has been adjusted to constant rupees.

EXHIBIT 28

TOTAL PRODUCTION OF CUTLERY AND UTENSILS
IN PAKISTAN, 1977-78 TO 1982-83

(in Rs. Million)

YEAR	VALUE OF PRODUCTION	ADJUSTED (Constant 1975-76 Rs)
1977-78	400	305.6
78-79	425	299.4
79-80	450	278.2
80-81	480	259.7
81.82	510	298.6
82-83	544	328.0
Average annual growth, 1978 to 1982-83		2.3%

Sources: Sectoral report , volume II, Expert Working Group March 1983. Monthly statistical Bulleton, March 1983.

Although, publication of the cutlery and utensils manufacturers association state a production growth rate for 1983-88 at about 8%, it is highly likely that it will not exceed 3%,

SURGICAL INSTRUMENTS

Pakistan has about 450 surgical instruments manufacturer of which about 15 are large-and medium-scale units with high quality production. This industry's output data is shown in Exhibit 29. Estimated future production growth for period 1985-87 is about 12% based on available estimates of the surgical Instruments manufacturing Association(1983) and the Lahore chamber of Commerce reports (1982).

EXHIBIT 29

PRODUCTION OF SURGICAL AND MEDICAL INSTRUMENTS IN PAKISTAN

(in million Rs)

Year	Value of Production	Production in Constant 75-76 Value
1977-78	182	139
78-79	234	165
79-80	266	164
80-81	293	159
81-82	322	189
82-83	380	229
Average annual growth, 1977-78 to 1982-83		10.5%

Sources: Pakistan Economist, Special report, October 1982 Expert working Group Sectoral report, March 1983.

CUTTING TOOLS, HANDTOOLS AND ARTISANS TOOLS INDUSTRIES

Available data (Investment Advisory centre of Pakistan industry profiles 1981-82) and brief interview with (Lahore Chamber of Commerce personnel suggests that the existing capacity of these handtools is around 40,000 tons annually, most of it in the small-scale and unorganised sector, about 28,000 tons. There is no available data on the past historical production growth of this industry. However, an estimate of future production growth can be made from available imports data (see Exhibit 30) on hand-tools and cutting-tools, the assumption that imports reflect demand and demand would influence production growth to some extent.

EXHIBIT 30

IMPORTS OF HANDTOOLS AND SMALL TOOLS INTO PAKISTAN

(in Metric Tons)

Year	Quantity
1977 - 78	99
78-79	83
79-80	222
80-81	206
81-82	313
82-83	363
Average annual growth	29%

(Source: Foreign Trade statistics of Pakistan, various issues, 1979 to 1984.)

Thus it is likely that local production growth of this industry will probably proceed, during 1985-87, at approximately 15%. It is assumed that imports reflect demand for more specialised, high-quality tools not currently produced in Pakistan. As a result of inudstrialisation and urbanisation, this demand is likely to increase more rapidly than that for locally-produced hand-tools, cutting tools and artisans tools local production will probably increase at a more sedate pace.

MACHINE TOOLS MANUFACTURING PARTS FABRICATION

The production of machine tools is linked fundamentally to industrial equipments, auto parts and tools manufacturing requirements. Therefore it may be appropriate to reason that (i) changes in industrial investment and output will affect demand for machine tools, and (ii) there will be a time lag between such

such changes in industrial output/investment and the eventual production of machine tools.

An accurate assessment of future machine tools production in Pakistan can only be made after several forecast models of the industrial economy have been examined There is not sufficient data available to do this. Therefore, an approximate estimate of future machine tools production in Pakistan (1985-1987) may be drawn from data on industrial valueadded at constant factor cost and data on gross fixed capital production. This is shown in Exhibit. 31.

EXHIBIT 31

INDUSTRIAL OUTPUT VALUE AND GROSS FIXED CAPITAL FORMATION, PAKISTAN

(in Rs. million)

Year	Value of Industrial output (constant factor cost)	Gross Fixed Capital Formation
1977-78	6,976	29,015
78-79	7,513	31,412
79-80	8,259	38,861
80-81	9,110	41,003
81-82	10,310	46,893
82-83	11,225	53,513
Average Annual Growth	10%	13%

Source: Pakistan Economic survey 1983-84, Govt. of Pakistan National Accounts of Pakistan 1978-79 to 1982 - 83)

The demand for machine tools is more likely to be influenced by volume of industrial production since fixed capital formation. (in public and private sector enterprises) is largely through imported technology and equipment. Thus not withstanding the probable time-lag between growth in industrial production and demand for additional machine-tools and replacement parts thereof, it is estimated that production of medium tools in Pakistan will proceed, over 1985-1987, at an annual rate of around 10%. This is possibly an optimistic estimate, given the fact that Pakistan Engineering Company (one of the country's largest producers of machine tools) forecasts a growth in production of about 8% per year for the next two years.

TEXTILE AND JUTE MANUFACTURING EQUIPMENT

Future production of such equipment can only be estimated from the past performance of the Spinning Machinery Company, and Winding Machinery Company. According to personnel working in these public sector enterprises, growth in output of these two units was forcast at 5 % annually for 1983-84 to 1987-88.

Fixed assets formation in the large and small textile manufacturing sectors may be estimated from the data of Exhibit - 32.

EXHIBIT - 32

GROSS FIXED CAPITAL FORMATION IN TEXTILE INDUSTRY

(in million Rs.)

Year	Large-Scale Sector	Small-Scale Sector	Total	Total Adjusted at Constant 75-76 Rs.
1978-79	Rs. 341	Rs. 280	Rs. 621	513
1979-80	357	316	673	510
1980-81	268	369	637	450
1981-82	263	376	639	448
Average annual growth rate.				(-4.4 %)

Over the next three years (1985-1987), given the current expansion visible in the textile and jute industry in Pakistan (as shown in Exhibit 33), it is estimated that the prodution of textile and jute spinning, weaving, winding equipment/spares will have a growth rate of around 8%.

EXHIBIT - 33

TEXTILE AND JUTE INDUSTRY PRODUCTION IN PAKISTAN

Year	Yarn ('000' Tonnes)	Cloth (Million sq. Meters)	Jute Goods (Tonnes)
1977-78	298	391	7,414
1978-79	328	339	8,356
1979-80	363	342	11,495
1989-81	375	308	11,750
1981-82	430	325	11,895
Average annual Rate of growth	9.6 %	(-4.5%)	12.5

(Source - Pakistan Economic Survey 1983)

DIESEL ENGINES AND PARTS MANUFACTURING

Almost 65%-70% of the production output in this industry takes place in the small-scale (and unorganized) sector. The past production record of PECO (a major producer) suggests that growth in output of diesel engines and parts has been around 20% during 1981-82 to 1983-84. PECO'S production above increased from 592 engines (1980-81) to 847 in 1981-82; an increase of about 43%. Its capacity is 3035 engines; this is approximately 15%-20% of total production capacity in Pakistan, which means between 15,000-20,000 diesel engines could be locally-produced at full capacity operations.

The estimated future growth in production is likely to be around 12% over 1985-87, in view of the fact that a large proportion of diesel engines are used for agricultural tubewells (see Exhibit 34 below).

TUBEWELL PUMPS AND PARTS MANUFACTURING

Data in Exhibit 34 provides a reliable basis for estimation of growth in production output of tubewell pumps; in this sector, demand has an almost immediate impact on the production of tubewell pumps.

EXHIBIT - 34

NEW AGRICULTURAL TUBEWELLS INSTALLED IN PAKISTAN

	Number installed during year		
Year	Diesel	Electric	Total
1977-78	3,087	5,733	8,820
1978-79	4,062	4,580	8,642
1979-80	5,094	3,689	8,783
1980-81	4,189	1,971	6,160
1981-82	4,601	1,534	6,135
1982-83 (est.)	3,540	1,000	4,540
Average growth 1977-82	10.5%	(-28%)	

(Source:Pakistan Economic survey 1983-84, Agricultural Census Organisation; US-AID Rural Electrification Project Report 1982-83, WAPDA Annual Reports 1977-78 to 1981-82).

Demand for new tubewells is highly likely to increase over the next 3 years (1985-87) in light of expanded rural electrification pgrogramme, additional SCARP projects, lower operating cost of diesel-run pumps, and execution of the Left Bank Outfall Drainage (LBOD) project of WAPDA.

However, it is estimated that tubewell pump production and installation will not increase by more than around 8% per annum, over the next three years.

CHEMICAL AND FERTILIZER MANUFACTURING EQUIPMENT, PARTS

Exhibit 35 shows the production output of the chemical and fertilizer industry; this provides a basis for estimating the growth in production of locally-fabricated chemical/fertilizer machinery spares and components.

However, a conservative growth estimate is advised because of the part that Pakistan does not yet have an adequately developed technoloy for such machinery and parts fabrication.

EXHIBIT - 35

CAPITAL PRODUCTION AND FIXED/FORMATION IN CHEMICAL INDUSTRIES

Year	Production ('000'tonnes) Chemicals	Fertilizer	Fixed Capital Formation (in Rs. Million)
1977-78	161.1	327.8	(na)
1978-79	171.7	365.5	120
1979-80	185.3	441.7	187
1980-81	200.1	644.8	339
1981-82	214.6	782.5	146
1982-83(est.)	207.8	840.0	168
Average Annual Growth	5.3%	20.7%	8.8%

Note: Fixed capital formation data only refers to chemical industry, and is given in constant 1975-76 rupees.

Sources: (Pakistan Economic Survey 1983-84
Statistical Bulletin, March 1983. Govt. of Pakistan

Based on the annual growth of fixed capital formationand the prod-duction output of the large-scale sector, it is likely that demand for locally-fabricated chemical equipment and parts (generated both by large and small-scale-sectors) will be around 8% per year over the next 3 years.

GENERAL INDUSTRIAL MACHINERY AND COMPONENTS FABRICATION

For this sector, only an approximate growth estimate of production/ fabrication can be given. Two available indicators are data on (i) fixed capital formation in large-scale and small-scale industry in the shape of machinery and equipment; and (ii) the past increases in the total production/fabrication of machinery and equipment by the State Engineering Corporation, comprising of 10 units. Over the period 1980-82, the corporation's output of fabricated and manufactured machinery/ equipment increased by 17.6% (Annual Report 1981-82, Expert Advisory Cell, Ministry of Production).

Data on overall growth in investment in machinery and equipment is given in Exhibit - 36.

EXHIBIT - 36

GROWTH IN INVESTMENT IN MACHINERY AND EQUIPMENT IN PRIVATE INDUSTRY

Year	Total large-and small-scale industry (Rs. Million)	Adjusted Value (in constant 75-76 Rupees) (Rs. Million)
1978-79	1,882	1,554
1979-80	2,448	1,855
1980-81	2,952	2,086
1981-82	3,362	2,356
Average annual growth		14.9 %

(Source: National Accounts of Pakistan, 1978-79 to 1981-82)

In light of the responses given by certain surveyed organisation's (Star Moghal, Iffefaq Foundries, Heavy Machanical Complex, Karachi Shipyard, Steel Casting's Ltd.,) and based on the above data, it is estimated that growth in locally-produced machinery and general equipment will be around 15% per annum over the next 3 years.

PAPER/BOARD FABRICATION AND CUTTING EQUIPMENT

The only available data suggest that growth in this sector is likely to be around 20% over 1985-87. This includes fabrication of printing equipment (see Exhibit - 37).

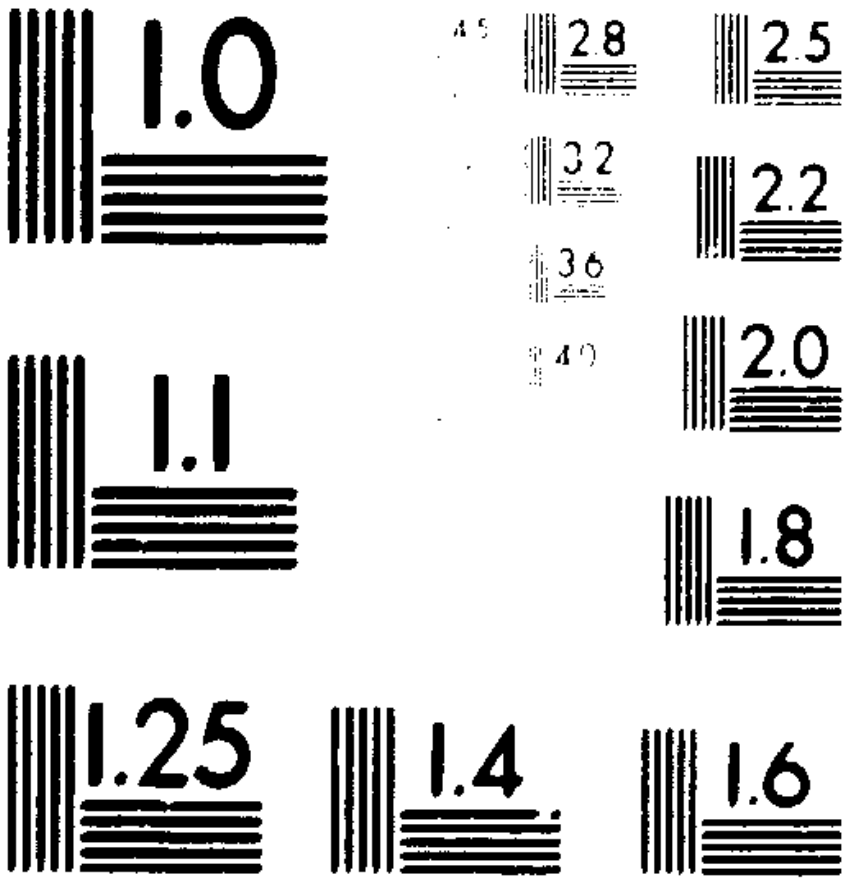

EXHIBIT - 37

GROWTH IN INVESTMENT IN PRINTING EQUIPMENT AND PAPER/BOARD FABRICATION MACHINERY

(in Rs. Million)

Year	Total	Adjusted Value in Constant 75-76 Rupees)
1978-79	Rs. 37.1	Rs. 30.7
1979-80	37.3	28.3
1980-81	58.0	41.0
1981-82	83.0	58.2
Average annual growth		23.8%

(Source: National Accounts of Pakistan, 1981-82)

DEFENCE AND RAILWAYS SECTORS

The only available evidence from Federal Budget figures (for 1978-79 to 1981-82) suggests that (in constant terms), general government fixed capital expenditure on equipment and parts has increased at an annual average rate of around 10.3%. Investment in transport equipment and machinery at the federal level grew at an annual average of about 19.7% (including investment in NLC transport equipment).

Therefore, it may be reasonable to assume that, over 1985-87, defence expenditure on parts/equipment will grow (in real terms) at around 12% in Railways, growth is estimated to be much slower at around 7% annually.

ENGINEERING WORKSHOPS' OWN REQUIREMENTS

Such requirements are distinct from special steel inputs required for sold products. It is practically impossible to estimate growth in such requirements precisely apart from the fact that overall growth in industrial output and machinery/equipment fabrication will probably determine such requirements. In view of the analysis shown in Exhibits 31 and 36 (above), it is estimated that workshops' own requirements of special steels will increase at approximately 14% per annum.

Exhibit - 37

WELDING ELECTRODES

A fairly reliable estimate of demand for electrode quality steel may be made by examining the (price-adjusted) growth in sales volume of two of Pakistan's largest producers of industrial oxygen and welding electrodes; Pakistan Oxygen Ltd., and Pakistan Industrial Gases Ltd., (both at Lahore). Their combined sales of industrial oxygen and welding electrodes (according to their annual reports for 1978-79 to 1982-83) grew at an average annual rate of around 9%.

Therefore, this rate of growth has been used to forecast output/demand of welding electrodes.

CONCLUSION

The above data and analysis, as contained in Exhibit 19 to 37, forms the basis for forecasting expected demand for various special steels in Pakistan during 1985-87.

This forecast is contained in section 7.

EXHIBIT - 38

ESTIMATED FUTURE DEMAND FOR SPECIAL AND QUALITY STEELS, SECTOR-WISE

End-use Sector	Special/Quality Steels Used	Forecast Demand in M/Tons 1985	1986	1987
Automotive,& tractor components (combined sectoral growth : 14.6%)	Special carbon	1,340	1,535	1,760
	Heat treating	1,220	1,400	1,600
	Free cutting	45	50	60
	Case hardening	3,010	3,450	3,960
	Spring steel	3,950	4,530	5,200
	Cold-work tool/die	50	60	70
	Stainless-Cr.	90	105	120
	Stainless-NiCr.	170	200	225
	Forgings	800	920	1,055
	Deep drawings	190	220	250
Agricultural machinery & implements(sectoral growth:15%)	Special carbon	2,990	3,440	3,950
	Heat treating	520	600	690
	Cold-work tool/die	115	135	150
	Forgings	60	65	80
Cycles & parts (sectoral growth: 13%)	Special carbon	35	40	45
	Free cutting	1,180	1,330	1,505
	Case hardening	875	990	1,115
	Spring steel	285	320	365
	Cold-work tool/die	70	75	85
	Hot-work tool/die	14	15	17
	Deep drawing	5,640	6,370	7,200
Electrical machinery & equipment (sectoral growth, 16%)	Heat treating	620	720	835
	Free cutting	35	40	47
	Spring steel	30	34	40
	Cutting tool	12	13	16
	Cold-work tool/die	130	150	170
	Silicon steel	6,960	8,075	9,365
	Deep drawing	1,890	2,195	2,545

Exhibit - 38

Cement machinery & equipment,(sectoral growth:3%)	Special carbon	570	590	605
	Heat treating	580	595	610
	Stainless-Cr.	438	450	465
	(35%)Stainless-NiCr.	1,630	2,200	2,975
	(14%)Forgings	3,000	3,420	3,895
	Hadfiled castings	670	690	710
Sugar machinery & components(sectoral growth: 22%)	Special carbon	380	465	570
	Heat treating	530	645	790
	Cold-work tool/die	45	55	65
	Stainless-Cr.	430	520	635
	Stainless-NiCr.	2,345	2,860	3,490
Fasteners industry (sectoral growth, 16%)	Heat treating	215	250	290
	Free cutting	2,190	2,535	2,940
	Cold-work tool/die	35	40	50
	Deep drawing	4,090	4,745	5,500
Cutlery,utensils (sectoral growth, 3%)	Cutting tool	1,135	1,170	1,200
	Cold-work tool/die	310	320	330
	Hot-work tool/die	31	32	33
	Stainless-NiCr.	945	975	1,005
Surgical instruments (sectoral growth, 12%)	Cutting tool	955	1,065	1,195
	Cold-work tool/die	225	250	280
	Stainless-Cr.	4,445	4,980	5,580
	Stainless-NiCr.	2,295	2,570	2,880
Cutting/hand tools & small tools(sectoral growth, 15%)	Cutting tool	1,725	1,985	2,280
	Cold-work tool/die	530	610	700
	Hot-work tool/die	23	26	30
	Stainless-NiCr.	58	66	76
	Forgings	44	50	58

Exhibit - 38

Machine tools(sectoral growth, 10%)	Special carbon	176	195	215
	Heat treating	360	400	435
	Free cutting	112	123	135
	Case hardening	120	130	142
	Cutting tool	143	160	173
	Cold-work tool/die	88	97	107
Textile,jute machinery & spares (sectoral growth, 8%)	Special carbon	9	9	10
	Free cutting	103	111	120
	Case hardening	100	109	117
	Cold-work tool/die	49	52	57
	Stainless-Cr.	51	55	59
Diesel engines, parts (sectoral growth:12%)	Heat treating	11	13	14
	Case hardening	90	100	112
	Cold-work tool/die	11	13	14
Chemical & fertilizer equipment (sectoral growth, 8%)	Heat treating	420	455	490
	Stainless-NiCr.	86	93	100
	Forgings	275	298	320
	Hadfiled castings	270	290	315
General industrial machinery,spares (sectoral growth, 15%)	Special carbon	160	185	215
	Heat treating	705	815	935
	Spring steel	172	200	230
	Cutting tool	31	36	41
	Cold-work tool/die	575	660	760
	Hot-work tool/die	23	26	30
	Stainless-Cr.	46	53	61
	Stainless-NiCr.	862	990	1,140
	Forgings	1,325	1,520	1,750
	Hadfield castings	405	465	530

Exhibit - 38

Paper/board fabrication & printing equipment (sectoral growth,20%)	Cutting tool	840	1,010	1,210
	Cold-work tool/die	270	325	390
	Hot-work tool/die	6	7	9
	Forgings	105	125	150
Armaments, defence (sectoral growth,12%)	Special Carbon	110	120	135
	Free cutting	32	36	41
	Heat treating	1,720	1,930	2,160
	Case hardening	78	88	98
	Spring steel	170	188	210
	Cutting tool	62	70	77
	Cold-work tool/die	60	66	75
	Hot-work tool/die	60	66	75
	Stainless-Cr.	39	44	49
Railways (sectoral growth, 7%)	Special carbon	86	92	98
	Free cutting	2.1	2.3	2.5
	Case hardening	11	11.5	12
	Spring steel	6,290	6,730	7,200
	Cutting tool	7.5	8	8.5
	Cold-work tool/die	8.5	9.2	10
	Hot-work tool/die	3.2	3.4	3.7
	Stainless-Cr.	3.2	3.4	3.7
Engineering workshops' own consumption (sectoral growth,14%)	Special carbon	230	260	300
	Free cutting	40	45	52
	Case hardening	270	310	355
	Spring steel	150	175	195
	Cutting tool	83	95	110
	Cold-work tool/die	385	440	500
	Hot-work tool/die	42	48	55
	Deep drawing	180	200	230

Exhibit - 38

Welding electrodes (sectoral growth:9%)	Electrode quality	11,990	13,070	14,245
Tubewell pumps,& parts, (sectoral growth, 8%)	Special carbon	710	770	830
	Heat treating	60	65	70
	Stainless-NiCr.	76	82	88

The aggregate (all-sectors) demand for individual grades of special and quality steels is based on the above forecast, and is shown in Exhibit - 39.

As will be noted, the average rate of increase in special steel demand is estimated at around 13.7% during 1985-87. For quality mild steel, it is estimated that requirements will increase at about 11.8% over this period.

Total future demand is summarised below,(in mertic tons)

	Total Special Steel	Quality Mild Steel
1985	69,258	23,990
1986	78,473	26,800
1987	89,550	29,970

EXHIBIT - 39

ESTIMATED FUTURE REQUIREMENT OF SPECIAL AND QUALITY STEEL IN PAKISTAN

(In Metric Ton)

Steel Grade	FORECAS DEMAND IN 1985	1986	1987	Estimated (%) Annual Rate of Growth
Special carbon steel	6,796	7,701	8,733	13.4%
Heat treating	6,961	7,888	8,919	13.2
Free cutting	3,739	4,161	4,990	15.5
Case hardening	4,639	5,189	5,911	12.9
Spring steel	11,047	12,177	13,440	10.3
Cutting tool	4,994	5,612	6,311	12.4
Cold-work tool & die	2,957	3,357	3,813	13.6
Hot-work tool & die	202	224	253	11.9
Stainless-Cr.	5,542	6,210	6,973	12.2
Stainless-NiCr.	8,467	10,036	11,979	19.0
Silicon steel	6,960	8,075	9,365	16.0
Special steel forgings	5,609	6,398	7,308	14.0
Hadfield steel	1,345	1,445	1,555	7.5
TOTAL SPECIAL STEELS:-	69,258	78,473	89,550	13.7
Quality Mild Steel				
Deep drawing	12,000	13,730	15,725	14.5
Electrode quality	11,990	13,070	14,245	9.0
TOTAL QUALITY STEELS:-	23,990	26,800	29,970	11.8

SECTION 8: RESPONDENTS' SPECIFIC REQUIREMENTS OF SPECIAL AND QUALITY STEELS

This section should not be used in conjunction with section 6 and 7. The particular specification mentioned in this section are those stated by surveyed organisations. Therefore, this information may properly be treated as a reliable indicator of the specific kinds of special steel requirement that will be experienced by some end-use sector.

SPECIAL STEEL SPECIFICATIONS FOR TRUCK AND TRACTOR COMPONENTS

(1) Special carbon steel x-17 EN-8, leaded medium carbon steel, ST-52.3, SAE-1020, SAE 1045, EN-16T, EN-8C

a) Round bars dia, 19.3mm, 50-52mm, 6-12.5mm, 8-220mm, 25-30mm
b) Seamless tubes, outer dia 55-65mm
c) Flat bars, 65 x 45mm
d) Plates bars 6-26mm thick, 2-80mm thick,

(2) Heat treating steel, SAE-8620,SAE-8620H, SAE-8622, SAE-8622H, SAE-4140 EN-24, EN-52, 21-4N

a) Round bars, dia 50mm, 80mm, 125mm, 8-16mm, 30-60mm
b) Seamless tubes, outer dia 50-65mm

(3) Spring steel, EN-4313, ASTM-A 229, SAE-9260.

a) Round bars, dia 50mm, 100mm, 10mm
b) Flat bars, 8-18mm, thick and 57.2-101.6mm width

(4) Case hardening steel, SAE-8615.

a) Rounds bars, dia 34-110mm, 25-120mm
b) Seamless tubes, outer dia 80mm, 90mm

(5) Cold-work tool/die steel EN-31

a) Rounds bars, 8-30mm dia

(6) Free cutting SAE-1117

a) Round bars, dia 5-50mm

(7) Stainless-Cr. steel, SUH-3.

a) Round bars, dia 6-7.3mm

Section - 8

SPECIAL STEEL SPECIFICATIONS FOR CYCLE MANUFACTURING

(1) Free cutting steel, JIS-G4804, JIS-G4051, 9SMn28K
   a) Round bars, dia 8.9-41.3mm
   b) Hex bars, dia 9-24mm

(2) Cutting tool steel, Bohler MO Rapid Extra V 30,
   a) Round bars, dia 13-76mm
   b) Square bars, 13-32mm

(3) Special carbon steel
   a) Round bars, dia 10-125mm
   b) Flat bars, 42 x 45mm

(4) Cold-work tool/die steel, Bohler special K
   a) Round bars, dia 38-254mm
   b) Square bars, $45mm^2$
   c) Flat bars, 20-65mm x 153-300mm, 19-42mm x 67-83mm

(5) Hot-work tool/die, Bohler WK2
   a) Round bars, dia 45-63mm
   b) Square bars, $127mm^2$
   c) Flat bars, 54-83mm x 83-121mm

(6) Quality mild steel, JIS-93101, JIS-G3141
   a) Sheet, 0.5-4mm thick, 1.02-2.3mm
   b) Strips, 2.3-2.8mm thick x 195-289mm width
   c) Strips in coils, 0.6-4mm thick x 57-101mm width 1 x 83mm, 0.8 x 101mm

SPECIAL STEELS SPECIFICATIONS FOR SUGAR AND CEMENT MACHINERY

(1) Stainless steel NiCr. AISI-304-314,-368
   a) Plate and sheet, thickness 15-20mm, 1-10mm, 1-1.3mm, 2-6mm, 6-30mm
   b) Round bars, 22.2-63.5mm, 1-30mm dia
   c) Tubes, outer dia 38-102mm
   d) Hex bars, 22.2-38.1mm A/F

(6) Cutting tool steel, VEW-K150
   a) Round bars, dia 12.7mm, 15mm

(7) Hot-worked tool/die steel, VEW-W-320, annealed
   a) Round bars, dia 25-80mm
   b) Flat bars, 30 x 75mm

SPECIAL STEEL SPECIFICATIONS FOR FASTENERS

(1) Free cutting steel, AISI-C1213, AISI-C1144, JIS-G3507
   a) Hexagonal bars, 11.1 - 29.9mm A/F
   b) Wire rod, dia 5.5-7mm
   c) Round bars, dia 8-26mm

(2) Heat treating steel, 42 CRV6,
   a) Round bars, wire rod, 16-24mm dia

(3) Cold-work tool/die steel, JIS-SKD9 and SKD-11
   a) Round bars, dia 11-36mm
   b) Flat bars

(4) Cold-heading medium-carbon quality steel, AISI-1110
   a) Round bars, dia 16-20mm

SPECIAL STEEL SPECIFICATIONS FOR MACHINE TOOLS, DIESEL ENGINES AND TUBEWELL TURBINE MANUFACTURE

(1) Stainless NiCr. steel, AISI-TP420, AISI-416
   a) Round bars of dia 25.4-49.2mm

(2) Case hardening steel, EN-351,
   a) Round bars, dia 35-220mm

(3) High carbon steel, AISI-C1060
   a) Round bars, dia 25.4-38.1mm

(4) Heat treating steel, 34CR MO4,
   a) Round bars, dia 190-230mm

(2) Cold-work tool/die steel,
   a) Flat bars, 25.4 x 101.6mm

(3) Special carbon steel
   a) Flat bars, 114.3 x 152.4mm
   b) Ingots, 3" x 4", 7" x 8"

(4) Heat treating steel, CR-40, low-alloy
   a) Ingots, 7" x 8", 3" x 4" for forgings
   b) Plate and sheet

(5) Manganese steel

(6) Stainless Cr. steel for high chrome guiding media, and casting's of 12%-18% chrome and 2%-3% carbon.

(7) Forged steel grinding media

(8) Hadfiled steel castings, 12%-14%MN, and plates.

SPECIAL STEEL SPECIFICATIONS FOR ELECTRICAL MACHINERY

(1) Silicon steel sheet, EN-45,JIS-2550C, thickness 0.27-0.5mm

(2) Heat treating, ASTM-A569
   a) Sheets 4' x 10', 4' x 8', 6' x 8'

(3) Free cutting steel
   a) Round bars, dia 22mm

(4) Quality cold-worked carbon steel, EN-313
   a) Flat bars, 12.7 x 57.15mm
   b) Sheets, thickness 3-6mm & width 1219-1524mm, and 0.7-2mm thick x 110-1000mm width

(5) Cold-work tool/die steel, hardened and tempered, VEW-K107
   a) Plates 70-150mm thick x 300mm width, 25.4mm thick
   b) Round bars, dia 200mm, 20-30mm, 50.8mm

(5) Cutting tool steel, C-60
   a) Round bars dia 25-30mm, 15mm, 38.1-63.5mm,
   b) Flat bars, 12.7-15.9mm x 19.05-76.2mm

(6) Free cutting steel, 9 Sin 28K,
   a) Hex bars, 17 and 24mm A/F
   b) Round bars, 9.5mm dia

(7) Special carbon steel
   a) Plate, thickness 6-14mm
   b) Angles. Sections, 150 x 150mm

SPECIAL STEEL SPECIFICATION FOR RAILWAYS

(1) Spring steel wire, M-18-55,
   a) Round bars, dia 0.35-5mm
   b) Coils dia 2.8-10mm

(2) Cutting tool steel, high speed
   a) Round bars, dia 12.5mm, 25mm,

(3) Cold-work tool/die steel, standard tool alloy class C,
   a) Round bars, dia 6.5-38mm, 50-152mm,
   b) Square bars, 12.5-38mm^2

(4) Stainless-Cr. steel, EN-57, EN-56A
   a) Round bars, 12.5-32mm dia
   b) Sheet, thickness 25.4mm

(5) Stainless NiCr. steel, EN-58A, EN-58G,
   a) Sheet, 3" x 18 SWG
   b) Round bars, 25-37.5mm dia

(6) Special carbon steel, EN-15
   a) Round bars, dia 25mm, 38mm
   b) Flat bars, 38 x 150mm

(7) Free cutting steel, EN-IA, EN-7A
   a) Round bars, dia 19,25,64mm

SPECIAL STEEL SPECIFICATIONS FOR CUTLERY, UTENSILS, SURGICAL INSTRUMENTS

(1) Stainless steel, AISI-304,410,420
   a) Sheet, 3-5mm thick, 8-12 SWG
   b) Sections, 5x20mm, 12 x 37mm

(2) Cold-work tool/die steel
   a) Cross-sections, 40 x 60mm, 80 x 100mm, 100 x 125mm

SPECIAL STEEL SPECIFICATIONS FOR GENERAL/TEXTILE EQUIPMENT

(1) Case hardening, 16 Mn Cr5, 15Cr Mn 6, 19 NiCr MO4
   a) Round bars, dia 25-35mm, 40-180mm, 210mm,

(2) Special carbon steel, C-45, C-45K,
   a) Round bars, dia 12-70mm
   b) Flat bars, 25 x 40mm

(3) Free cutting steel, 9 S20K, 9S Mn 23K
   a) Round bars, dia 10-13mm, 25-50mm
   b) square bars, 10-24mm^2, 40mm^2
   c) Profile bars, dia 28mm

(4) Cold-work tool.die steel, AISI-D2
   a) Rolled bars

(5) Spring steel, ASTM-A229
   a) Rolled bars, dia 10mm

(6) Cutting tool steel, AISI-4
   a) Rolled bar,

(7) Stainless steel, AISI-304
   a) Rolled sheet, thickness 2mm, 3mm

SPECIAL STEEL SPECIFICATIONS FOR ARMAMENTS AND DEFENCE SECTOR

(1) Heat treating, SO-B-120-W4A, 12 CrNi 3A, 18CR 2Ni 4 WA, 20CP,

20Cr 2Ni4A 20Cr Ni4VA, 30Cr MnSiA, 38CRSi, Cr15, 40Cr, 45Cr, 50Cr VA, Manganese-based oil-hardening, Tungsten-based water-hardening.

a) Round bars, dia 10-14mm, 20-80mm, 8.5-170mm,

b) Wire rod, dia 3.5-8.5mm

c) Hex bars, 12-32mm A/F

d) Sheet thickness 1.5-10mm, 3-6.5mm

e) Flat bars, 20 x 60mm, 6 x 100mm 22 x 88mm,

f) Square bars, 25-80mm

(2) Cutting tool steel, T7-A,

a) Round bars, dia 3-20mm

(3) Free cutting steel, W 18CR 4 V,

a) Square bars, 8mm

b) Wire rod, 6.7mm dia

(4) Stainless steel, 2Cr13, 3Cr13, 4Cr10Si2140,

a) Round bars, dia in mm, 12,55,20,22-32mm

b) Hex bars, 14mm, 28mm

(5) Spring steel, 65 Mn, 60SiZMnA, 65SiZCrWA

a) Round bars, dia 19mm

b) Wire rod, dia 3.2-4.5mm, 1.5-2.5mm

c) Strip, 2 x 20mm, 3.1 -3.4 x 7.5mm,

d) Sheet, 2mm thickness

(6) Case hardening, BS-970,

a) Round bars, 12.7 - 250mm, 8-14mm,

b) Flat bars

c) Square bars

(7) Cold-work tool/die steel, AISI-D3,

(8) Hot-work chrome-based, tungsten-based

SECTION 9: DATA ON SPECIAL AND QUALITY STEEL IMPORTS INTO PAKISTAN

It is extremly difficult to derive a coherent picture of special/quality steel consumption in Pakistan from import data, including data from international as well as internal official import statistics. The major problems in arriving at a reliable estimaate are:

(1) The Pakistan standard Trade classification (PSTC) code and the standard international trade classification (SITC) code numbers used vary substantially, as will be seen from Exhibit - 40.

(2) International trade figures (on special steel exports to Pakistan from all sources) are not available in Pakistan. The latest data available, in the World Trade manual, is for Pakistans 1980 imports from the 26 industrialised countries. This is shown in Exhibit - 40.

(3) Within Pakistan's own officially published input statisics there is a great deal of variation: for certain years some PSTC numbers are given, for other years, they are excluded.

(4) The tremndous variation in import quantities from year to year (e.g., PSTC 6744201, 6725501, 6749200) can perhaps, only be explained by incorrect classifications input at data tabulation stage in the Chief Controller Imports and Experts Office at Karachi; or by incorrect/false declaration of PSTC numbers by steel importers to avoid payment of relevant duties.

Therefore, within these constraints, a few conclusions can be made from available data, given in Exhibit - 40.

EXHIBIT - 40

PAKISTAN IMPORTS OF SPECIAL STEELS

(All data in Metric Tons)

PSTC Code	Steel Type	1982-83	1981-82
6724100	Ingots, alloy & high carbon	53	1
6724300	Ingots, stainless steel	129	-
6724400	Ingots, other alloy steel	90	8,436
6725203	Sheets, bars, high carbon	4	-
6725400	Bloom, billets, stainless steel	-	1,070
6725501	Billets, alloy steel	5,187	14,618
6727601	Coils, stainless sheet	1,055	-
6731200	Wire rod, high carbon	5,483	5,874
31500	Wire rod, alloy steel	1,772	2,891
32201	Bars, high carbon	4,038	4,453
32202	Rods, high carbon	61	340
32501	Bars, alloy steel	3,855	2,949
33700	Angles, shapes, high carbon	26	29
33900	Angles, shapes, alloy steel	112	195
44201	Heavy sheet, high carbon	12,723	6,565
44202	Heavy plate, high carbon	125	172
44301	Heavy sheet, stainless	1,372	2,659
44302	Heavy plate, stainless	39	26
44401	Heavy sheet, alloy steel	1,567	1,783
44402	Heavy plate, alloy steel	821	1,314
45301	Medium plate, stainless	1,369	1,075
45302	Medium sheet, stainless	7,267	7,688
45401	Medium plate, alloy steel	137	429
46200	Sheet, plate, high carbon	306	41
46400	Sheet, plate, alloy steel	825	-
49200	Other sheet, high carbon	9,868	54
50200	Strips, high carbon	935	1,022
50500	Strips, alloy steel	2,715	3,869
70500	Steel wire, alloy steel	1,637	1,705
	TOTAL:-	63,571	69,258

Exhibit - 39

SITC Code	Type	1980
67255	Blooms, alloy steel	18,251
67322	Bars, high carbon	566
67324	Bars, stainless steel	1,319
67325	Bars, alloy steel	2,092
67443	H/plate, stainless	182
67452	M/plate , stainless	544
67463	Thin plate, stainless	7,341
67464	" " , alloy steel	18,755
67492	Plates, high carbon	15
67493	Sheet, stainless steel	167
67494	Sheet, alloy steel	1,110
67502	Strips, high carbon	318
67504	Strips, stainless steel	780
67702	Wire, high carbon	574
6770	Wire stainless steel	121
67705	Wire, alloy steel	208
	TOTAL:-	52,343

Firstly:
Special and quality steel imports are in excess of 60,000 tons annually, perhaps, the best estimate for such imports is around 63,000 tons of during 1983-84.

Secondly:
Pakistan imports around 11,200 tons of stainless steel in plate, sheet, bars, coils and ingots; the major part of this, around 10,200 tons, is imported in the shape of plate and sheet. The data indicate that stainless steel imports have declined from 12,500 tons in 1981-82, to 11,200 tons in 1982-83. The possible explanation for this is, perhaps, a decline in demand by the surgical instruments, cutting and utensils manufacturing sectors in Pakistan during this past period.

Exhibit - 39

Thirdly:
In general, alloy/special steel imports were around 18,700 tons in 1982-83. This has shown a dramatic decline from its imports of about 38,200 tons during the previous year (1981-82). A possible explanation for this shape reduction in alloy/special steel imports might be the visible effects of the 1981-82 industrial and economic recession in Pakistan.

Fourthly:
Special and high carbon steel imports stood at 33,600 tons during 1982-83. This compares very fabourably with the import level of 18,500 tons in the previous 1981-82 year.

Note: Sourcesfor Import Data are: (i) Monthly Foreign Trade Statistics of Pakistan June 1981, June 1982 and June 1983: (ii) World Trade Annual, 1980, United Nations.)

SECTION 10

PRICES OF IMPORTED SPECIAL STEEL PRODUCTS

Before any conclusion can be arrived at on local production, costs of production and locally-produced special steel prices, it would be advisable to examine current (as of July-November 1984) average market prices of imported special steel products.

This data is shown in Exhibit 41 . Average CIF import prices have been taken from unit value figures of the Daily Import list; customs duties, sales tax and import surcharge rates are taken from the *CCIE's customs tariffs manual and various SRO notification from time to time during 1983-1984; data on miscellaneous changes (such as clearing, forwarding port dues, L/c charges, freight, octroi, handling, insurance, trade margins) have been estimated from information provided by commercial and industrial importers of special steel items.

It must be noted that the average prices to users (as shown in Exhibit (41) are subject to monthly fluctuation of 5%-7% depending upon stocks available in the market, seasonal demand for certain special steels (e.g. stainless steel, sheet for utensils) and upon individual buyer's negotiating ability.

* Chief Controller Imports and Exports.

The production of special and quality steels is limited to only a few producers. These are special steels of Pakistan (SSP) Karachi, Nowshera Engineering Nowshera, and HFF Taxila. Out of these two producers SSP Karachi and Nowshera Engineering are not in operation, whereas HFF Taxila were not prepared to divulge information on their cost of production. Therefore, it was not possible to obtain actual cost of production data for special and quality steels. However, the cost of production estimates for three varieties of special and quality steels including carbon steel, Alloy steel & spring steel were prepared with the help of metallurgical experts in the industry. These figures are shown in Exhibits 42. This exhibit gives the breakdown and costs of direct and indirect costs based on 1984 cost data. It can be seen that the cost of production for carbon steel, Alloy steel, and spring steel are Rs.4,721 Rs.6,828 and Rs.5,297 respectively.

Exhibit 43 gives the cost of imported raw materials required for the production of special and quality steels. The landed cost, of all the raw materials have been worked out which includes the C&F cost, the custom duties, sales tax, import surcharge, and various other expenses.

SECTION 11

CUSTOMS TARIFF STRUCTURE

This section is covering the details asked in the terms of reference to establish customs tariff structure and source of which is Customs Tariff Manual and Import Trade Controls 1983, 1984.

CUSTOMS TARIFF STRUCTURE

Source: "Customs Tariff Manual and Import Trade Controls" 1983, 1984)

	ITEM DESCRIPTION	CUSTOMS DUTY	SALES TAX ON DUTY PAID VALUE
1.	Ferro alloys	40% ad.Val.	Free
2.	Alloy steel waste or scrap	40% "	"
3.	Waste/scrap of high carbon steel, stainless steel	70% "	"
4.	Ingots, high carbon steel	50% "	10%
5.	Ingots, stainless or heat-resisting steel	50% "	"
6.	Ingots, of other alloy steel	50% "	"
7.	Blooms, billets, slabs, bars (all less than 3.81 cm sqr or thick) roughly forged pieces of high carbon steel, stainless steel heat-resisting steel, other alloy steel.	50% "	"
8.	Coils for re-rolling, high carbon steel	50% "	"
9.	Coils " " stainless steel heat-resisting steel, other alloy steel	50% "	"
10.	Wire-rod of heat resisting stainless, or other alloy steels	70% "	"
11.	Wire rod of high carbon steel	70% "	20%
12.	Round bars/rods of 7.62 cm. or less dia and hollow mining drill steel, of high carbon, stainless, heat-resisting or other alloy steel.	70% "	20%
13.	Angles, shapes and section of high carbon stainless, heat-resisting or other alloy steels.	70% "	20%
14.	Universal plates of high carbon and alloy steel	70% "	10%
15.	Sheets & Plates, rolled but not further worked, of high carbon stainless, heat-resisting, alloy steel.	70% "	"
16.	Hoop and strips, of high carbon stainless, heat-resisting or other alloy steels	70% "	"
17.	Wire of high carbon steel	70% "	20%
18.	Wire of stainless, heat-resisting, alloy steel	70% "	10%
19.	Seamless tubes and pipes	85% "	"

20.	Blanks for tubes	85% ad. Val.	10%
21.	High pressure hydro-electric condusits of steel	85% " "	10%
22.	Steel tube and pipe fitting's chromium-plated.	85% " "	10%

NOTE: All above imports are subject to 5% surcharge on Customs Duty & sales Sales Tax paid value.

Section 12

Evaluation of Existing Capacity for Production of Special and Quality Steel

Questionnaire was designed in consultation with MIRDC/UNIDO and Techma staff to collect data on existing capacities along with technological structure of the country's steel industry. Following respondents were identified for the survey :

1. Steel castings (Gujranwala)
2. Chenab Engineering works (Faisalabad)
3. Nowshera Engineering Company (Nowshera)
4. Electromolt Limited (Lahore)
5. Punjab Steels Limited (Lahore)
6. Pakistan Steel mills Corporation (Karachi)
7. Karachi Shipyard & Engineering works Ltd (Karachi)
8. Heary Forge and Foundry Engineering Ltd (Taxila)
9. Pakistan Railways Steel Mills (Lahore)
10. Metropolitan Steel Corporation (Karachi)
11. Razzaque Steel Limited (Karachi)
12. Special Steels of Pakistan (Karachi)
13. Ittefaq Foundries
14. Orient Limited

Present survey indicates that Special Steels of Pakistan (SSP) and Heavy Forge and Foundry are relatively better equipped to handle production of partial requirements of demand within the country.

Pakistan Railways, Pakistan Engineering Company, Ittefaq Foundries, Punjab Steel and Chenab Engineering works can be made to suit requirements of special and quality steels by regulating their production schedule and further develop their schedule by optimising various parameters such as principal equipment, profit and loss comparisons, modernisation, Balancing and

rehabilitation programmes, gestation periods etc. It is certainly quite apparent from this preliminary investigation that it will require detailed evaluation studies to be carried out and prepare budgetory investments required either from grass roots and/or through modernisation programmes. It is our considered opinion that among existing facilities, only Special Steels of Pakistan and Heavy Forge and Foundary can be proposed to undertake assignments for such specialised steels. Nowshera engineering company can also be seriously considered for its revival through detailed study for modernisation and can certainly meet the balanced requirements which are outside the terrain of SSP, HFF, Pakistan Railways and Punjab Steel of course with the assistance of UNIDO Advisor MIRDC staff. These producers are seriously contemplating to take up production of Special and Quality Steels. Ittefaq Foundries are considering to venture into special carbon steels for wire rods.

Respondents identified with the survey of existing basic equipment, process equipment and Laboratory facilities with product range etc. is shown in Exhibits (44-46)

Critical appraisal of these facilities clearly points towards Special Steels of Pakistan (SSP) Heavy Forge And Foundary (HFF), Nowshera, engineering as the potential facilities capable to produce certain types of special and quality steels. SSP is primarily geared towards its major part being for polished stainless steel production. Among identified and surveyed respondents Pakistan Steel Mills Corporation (PASMIC) is not critically evaluated because its production is centred towards plain carbon steel and the shear size of production may be a limiting factor to incorprate downstream products as an integral part of this integrated production facility. Further more, Government of Pakistan policy is to encourage private sector to enter more in down stream products of PASMIC.

SECTION: 13

CONCLUSIONS AND RECOMMENDATIONS

1. Most important part of the terms of reference in the present study was the determination of total demand of special and quality steels in Pakistan. Field survey conducted concludes that the following sequential order is attained by grades of special steels.

   i. Spring steel comes at the top representing a share of 16.5% of the total demand.

   ii. Stainless Steels (NiCr) take the next priority representing 11.8% share of the total demand. (more than 70% as sheets)

   iii. Heat treating and special carbon steels are representing almost similar percentages of the market share which is of the order of 10%.

   iv. Lastly is the silicon steel which represents 9.8% of the total demand. (more than 80% as sheets)

   v. Chromium based (420 TYPE) STAINLESS

   Above five grades represent the largest share of the market which is around 58%.

2. A figure of 61000 metric tonnes of special steels and 21,565 of quality mild steel (deep drawing and welding electrode quality) is rather a conservative figure as has been mentioned in the text that Automotive industry alongwith agricultural sector is fairly under represented because of various constraints e.g. time, financial, diversification of products, number of small and unorganised sectors and geographical.

3. It can be safely stated that these projections are based on fairly reliable models and size of the sample is representative with high degree of confidence limit.

4. Second element in this study is the cost of production and almost all manufacturing units are not aware of Industrial accounting procedures and systems and it is extremely difficult to reach to any reliable cost of production.

   Also, both private and public sectors are not willing to part with their cost of production procedure. Production costs based on imported raw materials costs, utilities etc., is given in the text for reference.

5. Evaluation of existing facilities is also carried out for production of Special and Quality Steels. Heavy forge and foundry (HFF) SSP and Nowshera Engineering needs to be rehabilitated and/or modernised and through such programmes reasonable size of demand of special and quality steels can be met. Cost effectiveness must be seriously considered while preparing and evaluating such investments and budgetary costs along with gestation periods, allocation of regulatory measures for production capacity etc.

6. In our opinion, the total costs of production (direct, variable direct overhead, and indirect overhead) is most important from the point of view of determining cost efficiency of special and quality steel production in Pakistan. As such we recommend that a study, designed specifically for this purpose, be carried out among potential producers within Pakistan during 1985-86.

7. Estimated total demand of Special and Quality mild Steels is 82,565 metric tonnes and 23,000 tonnes are in the form of sheets and strip which can only be manufactured by Special Steels of Pakistan (SSP).

EXHIBIT 41

IMPORT TARRIF, STRUCTURE FOR SQS

PRODUCT	CIF AVERAGE IMPORT PRICE	CUSTOMS DUTY RATE	CUSTOMS DUTY AMT	SALES TAX RATE	SALES TAX PLUS DUTY-PAID VALUE	IMPORT SURCHARGE @ 5% OF CIF VALUE	AFTER CLEARING FORWARDING PORT DUES & INS.@3 % OF LANDED COST	AVERAGE PRICE TO USER AFTER FREIGHT & HANDLING CHARGES @ 7%
CARBON STEEL: Ingots	x	50%	1.5 x	10%	1.65 x	0.05 x	1.751 x	1.874 x
Sheet/bars	x	50%	1.5 x	10%	1.65 x	"	1.751 x	1.874 x
Wire Rod	x	70%	1.7 x	20%	2.04 x	"	2.153 x	2.304 x
Flat bars	x	70%	1.7 x	20%	2.04 x	"	2.153 x	2.304 x
Round bars, rod	x	70%	1.7 x	20%	2.04 x	"	2.153 x	2.304 x
Angles, Sections	x	70%	1.7 x	20%	2.04 x	"	2.153 x	2.304 x
Heavy Sheet	x	70%	1.7 x	10%	1.87 x	"	1.978 x	2.117 x
Heavy Plate	x	70%	1.7 x	10%	1.87 x	"	1.978 x	2.117 x
Strips	x	70%	1.7 x	10%	1.87 x	"	1.978 x	2.117 x
STAINLESS STEEL: Ingots	x	50%	1.5 x	10%	1.65 x	"	1.751 x	1.874 x
Billets	x	50%	1.5 x	10%	1.65 x	"	1.751 x	1.874 x
Coils	x	50%	1.5 x	10%	1.65 x	"	1.751 x	1.874 x
Heavy sheet	x	70%	1.7 x	10%	1.87 x	"	1.978 x	2.117 x
Heavy plate	x	70%	1.7 x	10%	1.87 x	"	1.978 x	2.117 x
Medium sheet	x	70%	1.7 x	10%	1.87 x	"	1.978 x	2.117 x
ALLOY STEEL: Ingots	x	50%	1.5 x	10%	1.65 x	"	1.751 x	1.874 x
Wire Rod	x	70%	1.7 x	10%	1.87 x	"	1.978 x	2.117 x
Bars	x	70%	1.7 x	20%	2.04 x	"	2.153 x	2.304 x
Angles, sections	x	70%	1.7 x	20%	2.04 x	"	2.153 x	2.304 x
Heavy sheet	x	70%	1.7 x	10%	1.87 x	"	1.978 x	2.117 x
Heavy plate	x	70%	1.7 x	10%	1.87 x	"	1.978 x	2.117 x
Strips	x	70%	1.7 x	10%	1.87 x	"	1.978 x	2.117 x
General Scrap	x	40%	1.4 x	Free	1.4 x	"	1.494 x	1.6 x (Average price to user, relative to import CIF value is around 2.1 times CIF value)

Source: 1) Daily Import list, office of Chief Controller Imports and Exports. July-November 1984
2) Customs Tariffs and Import Trade Control Manual/SRO notifications, November 1983, and various issues 1984.
3) Interview with commercial Importers December 1984.

EXHIBIT 42

SPECIAL STEEL PRODUCTION COSTS: UNIT CONSUMPTION REQUIREMENT AND ESTIMATED COSTS
(Per Ton Charge)

ITEM DESCRIPTION	CARBON STEEL DIRECT MATERIAL INPUT	CARBON STEEL COST	ALLOY STEEL DIRECT MATERIAL INPUT	ALLOY STEEL COST	SPRING STEEL DIRECT MATERIAL INPUT	SPRING STEEL COST
Steel Scrap	994	2,982	1068	3,204	1078	3234
Fe Si (Kg)	2.5	26	3.9	40	21.7	221
Fe Mn (H) (Kg)	6	81	3.5	38		
Si Mn (L)	2.7	52			7.6	146
Fe Cr (H) (Kg)			8.7	158		
Fe Cr (L) Kg			1.0	25		
Fe Mo (Kg)			2.5	215		
Fe Ni (Kg)			18.2	1,456		
Melting Materials Rs		205		214		275
Fuel (NM^3)	9.5	4	9.5	4	9.5	4
Electrodes (Kg)	6.0	240	6.7	268	6.2	248
Power KWH	700	525	800	600	750	563
Refractory materials Rs.		300		300		300
Other direct costs Rs.		306		306		306
Total direct materials, utilities & other direct costs, per ton of Charges		Rs.4,721		Rs.6,828 SAE-8620		Rs.5,297

All utilities at 1984 costs
Carbon steel 6% (Burning losses)
Alloy and Spring steel 10% (Burning losses)

EXHIBIT 43

ESTIMATED DIRECT MATERIALS AND UTILITIES COST/PRICES FOR SPECIAL STEEL PRODUCTION

IMPORTED
RAW MATERIAL COSTS:

(per tonne, except where indicated)

@10%

I T E M	C&F Price (July 1984)	Customs Duty %	Customs Duty Amt.	Sales Tax Rate %	Sales Tax Amount	Import Surcharge	Misc. Port L/c, Insurance	Inland Freight clearing etc.	Total Landed cost.	Suppliers Avg. Markup	Cost to User P/ton
Purchased Steel Scrap	2,780	40%	1,112	Free	-	195	56	222	4,365	436	4,800
Pig Iron	3,272	40%	1,309	Free	-	229	65	262	5,137	513	5,650
Steel Scrap generated in Mill											
Carbon Steel											3,596
Alloy Steel											5,770
Spring Steel											3,603
Ferro-silicon	5,902	40%	2,361	Free	-	413	118	472	9,266	926	10,192
Ferro-Manganese (H)	6,340	40%	2,536	Free	-	444	127	507	9,954	995	10,949
Ferro-Manganese (L)	8,950	40%	3,580	Free	-	627	179	716	14,050	1,405	15,457
Silicon-Manganese (L)	11,145	40%	4,458	Free	-	780	223	890	17,496	1,749	19,245
Ferro CR (H)	10,540	40%	4,216	Free	-	738	211	843	16,548	1,655	18,203
Ferro CR (L)	14,690	40%	5,876	Free	-	1,028	294	440	22,328	2,233	24,561
Ferro Molybdenum	50,985	40%	20,394	Free	-	3,569	1,020	2,039	78,007	7,800	85,807
Ferro Nickel	42,290	40%	16,916	Free	-	2,960	846	1,270	64,282	6,432	70,710
CaCO3 (Local)	310	-	-	-	-	-	-	12	322	-	322
CaF2 (Local)	2,040	-	-	-	-	-	-	61	2,101	-	2,101
Carbon powder	3,520	40%	1,408	10%	493	246	70	140	5,877	588	6,465

Exhibit 43 Contd.

CaSi Calcium Silicate	15,800	40%	6,320	10%	2,212	1,106	316	474	26,228	2,623	28,851
Aluminium Ingot	20,430	70%	14,301	10%	3,473	1,737	409	610	40,960	4,096	45,056
Fuel (NM^3)	0.44								0.44		0.44
Electrodes	21,800	40%	8,720	20%	6,104	1,526	436	870	39,456	3,945	43,401
Electric Power per KWH	0.73								0.73		0.73
Water per ton of charge	55								55		55

SOURCE: Commercial importers quoted list/unit value rates from monthly foreign trade statistics/Lahore Chamber of Commerce Bulletin.

All cost figures are quoted in rupees

RESPONDENT NAME	ELECTRIC ARC FURNACE	INDUCTION FURNACE	CONTINUOUS CASTING	COGGING MILL	BAR MILL	SHEET MILL	FORGE	PRODUCTS							RAW
								INGOTS	BILLETS	BARS	SHEETS	FORGE	CASTING	SECTION	
1. S.S.P.	2x10T	-	-	x	x	x	x	-	-	x	x	x		-	
	1x3T	-	-	-	-	-	-	-					x		
2. H.F.F.	2x10T 1x3T	1x1.5T					x	x				x	x		
3 Karachi shipyard	1x3T	2x1T						x					x		
4. Pakistan Railways	2x5T	1x1T		x	x			x		x			x	x	
5. PECO	3x10T 1x4T 1x6T			x	x			x		x		x	x	x	
6. Ittefaq Foundries	5x5T	1x2T	x -	x	x		x		x	x		x	x	x	
7. Punjab Steel Limited	>5T>9Tx2		x	x	x			x	x	x			x	x	
8 Kowshera Engineering Company	>5Tx2 >5T>10Tx2			x	x			x		x			x	x	
9. Orient Engineering Works	1x5T				x	x		x		x				x	
10. Electro-molt		1x2T						x							
11. Chenab engineering works	1x 5T				x		x	x		x		x			
12. Steel castings		1x0.5T					x	x				x	x		
13. Metropolitan Steel Corp.				x	x					x					
14. Razzaque Steel Ltd					x					x					

SECTION 1

ELECTRIC ARC FURNACE	INDUCTION FURNACE	CONTINUOUS CASTING	COGGING MILL	BAR MILL	SHEET MILL	FORGE	PRODUCTS							RAW STEEL CAPACITY TYPE
							INGOTS	BILLETS	BARS	SHEETS	FORGE	CASTING	SECTION	
2x10T	-	-	x	x	x	x	-	-	x	x	x		-	50,000
1x3T	-	-	-	-	-	-	-					x		
2x10T 1x3T	1x1.5T					x	x				x	x		60,000
1x3T	2x1T						x					x		2,500
2x5T	1x1T		x	x			x		x			x	x	18,000
3x10T 1x4T 1x6T			x	x			x		x		x	x	x	90,000
5x5T	1x2T	x -	x	x		x		x	x		x	x	x	120,000
>5T>9Tx2		x	x	x			x	x	x			x	x	28,000
>5Tx2 >5T>10Tx2			x	x			x		x			x	x	20,000
1x5T				x	x		x		x				x	5,000
	1x2T						x							3,500
1x 5T				x		x	x		x		x			10,200
	1x0.5T					x	x				x	x		10,000
			x	x					x					

SECTION 2

PROCESS CONTROL — EXHIBIT 45

Respondent	MELTING		ANALYSIS DURING MELTING				Controlled Cooling of ingots	Controlled cooling of rolled product	Billet Conditioning	Temp. Control on Re-heating Furnaces	HEAT TREAMENT		
	Oxygen Lancing	Temp. Measurement °C	C	Mn	S	Other Elements					BARS	FORGE	CASTINGS
1. SSP	x	x	x	x	x	x		x	x	x	x	x	x
2. HFF-Taxila	x	x	x	x	x	x				x		x	x
3. Karachi Shipyard		x	x	x								x	x
4. Pakistan Railways	x		x	x				x		x			
5. PECO		x	x	x									
6. Ittefaq foundries	x	x	x	x	x	x							x
7. Punjab Steels Ltd	x	x	x	x	x	x							x
8. Nowshera Engineering	x		x	x									
9. Orient Engineering		x											
10. Electromoit													
11. Chenab Engg.			x	x								x	x
12. Steel Castings			x	x								x	x
13. Metropolitan Steel Corp.								x		x	x		
14. Razzaque Steel Ltd.													

LABORATORY FACILITIES

EXHIBIT 46

Respondent Name	CHEMICAL					MECHANICAL				METALOGRAPHY	
	Carbon	Sulphur	Photo colorimeter	Spectro Emission	Others	Tensile	Impact	Brinell Hardness	Rockwell Hardness	Micro scope	Dilatometer
1. SSP	x	x	x	x		x	x	x	x	x	
2. HFF	x	x	x	x		x	x	x	x	x	
3. Karachi Shipyard	x	x				x	x	x	x	x	
4. Pakistan Railway	x	x				x	x				
5. PECO	x	x	x	x[1]	x	x	x	x	x	x	
6. Ittefaq foundries	x	x	x			x	x	x	x	x	
7. Punjab Steels Ltd	x	x	x			x		x	x		
8. Nowshera Engg.	x	x									
9. Orient Engg.	X	X	X		X						
10. Electromolt	x	x									
11. Chenab Engg. Works.	x	x							x		
12. Steel Castings	x	x	x			x			x	x	
13. Metropolitan Steel Corporation	x	x				x	x	x	x	x	
14. Razzaque Steel Limited						x					

1 - ordered

APPENDIX A

INTERVIEW SCHEDULE
FOR DEMAND SURVEY ON QUALITY/SPECIAL STEELS

ote for Intrvwr: Please follow these instructions closely in every interview:

1) In some respondent firms, all required information may not be available from a single individual; discrestly find out who are other key production/stores/purchase people who also poss s information.

2) Obtain permission from top man to interview such other persons. Please DO NOT contact such people secretly. If you have problems here, get Coordinator's help.

3) If respondent asks you to come back again, or if he is busy, DO NOT insist on interview. Obtain interview appointment data and leave.

4) If respondent asks to see this schedule, DO hand it over, If he wants to keep it and study it before answering it, by all means AGREE.

5) Provide TOTAL and COMPLETE assurance that all information will be kept absolutely confidential.

6) Be ABSOLUTELY SURE that respondent understands terms such as HSLA steels or Heavy Deformation - but DO NOT make it appear as if you are testing his knowledge.

---

1) Organisation's Name & Address _____

_____

2) Name & Designations of Persons Interviewed (a) _____

(b) _____

(c) _____

3) List all product lines manufacture - whether regularly, job order or adhoc - in the period 1979-80, 1980-81, 1981-82, 1982-83 & 1983-84 (July-June).

_____ _____

_____ _____

_____ _____

_____ _____

(4) For each of the above product lines, determine/obtain undermentioned data: start with CURRENT year 1983-84 first;

Product Line	Ist Step Process	Steel Grade Input	Shape & Size	C/Year Qty.in tons

(5) Obtain exactly the same information for product lines manufacture in 1982-83; even if all product lines are same as 1983-84, please enter information as above. Be especially careful about obtaining correct information for LAS three columns.

Product Line	Ist Process	Steel Grades Input	Shape/Size	Qty.in tons (whole year)

(6) Prices: It is essential for the undermentioned data to be as accurate as possible; ask respondent if it is possible for you to consult/contact

Purchase or Accounts personnel for information on average purchase price per ton during each year.
(refer to Item 4 thru' 8 above for Steel Grades and Shape/Sizes)

Year	Steel Grades Purchased	Shape & Sizes	Average Price	Highest	Lowest
83-84					
82-83					

(7) Discuss with respondent about future (1984-85, 1985-86) manufacturing plans; request respondent to be as specific as possible.

expansion of
current product lines

APPENDIX B

TECHNOLOGY MANAGEMENT INTERNATIONAL LIMITED

TECHNA

DEMAND SURVEY ON QUALITY/SPECIAL STEELS

INTERVIEW SCHEDULE FOR PURCHASE/STORES DEPTTS

Company name & address	
Persons interviewed	

ITEM 1

Quantities and specifications of various kinds of special steels purchased locally or imported during 1983-84 and 1982-83. Please give details on shape and size of the steel grades mentioned.

Grade/type of special steel	Specifications of grade/type	Purchased in shape of	Usual size	Qty.of specification p'chased	
				1983-84	1982-83

Addition of new product lines, if so, what products? What proposed quantity annually? _____

Deletion of any existing product lines? Why? _____

OR

Contraction of any existing product lines? Why? By how much in quantity? _____

(8) Discuss with respondent on their capacity expansion plans/proposals; if respondent is willing, obtain details on proposed capacity output tonnage by product line. Ask respondent to provide details of most likely requirements of Ist & 2nd years of steel, by grade/shape/size.

Proposed Product	Exp. Requirements of Steel			
		Grades	Shapes	Sizes Proc. Mode
_____	Ist Year	_____	_____	_____
		_____	_____	_____
		_____	_____	_____
_____	2nd Year	_____	_____	_____
		_____	_____	_____
		_____	_____	_____

PART B

INTERVIEW SCHEDULE FOR PRODUCTION DEPTTS

ITEM 2

With reference to steel grades and particular specifications mentioned in Item 1, what individual products and/or components (parts) are made from each particular specification mentioned? What was the production output of these end-products during the years 1983-84 and 1982-83?

Steel grade mentioned in (1)	Specifications mentioned in (1)	End-products made with specified steel grade	End-product output in	
			1983-84	1982-83

ITEM 3

With reference to steel grades and particular specifications mentioned in Item 2, please indicate the FIRST STAGE process used for the special steel. (Note:This may be different for different products)

Steel grade mentioned in (2)	Particular specification mentioned in (2)	Ist Process (after heating, if hot-worked)			
		Rolling	Hvy. Defrm.	Maching.	Other

ITEM 4

Is there any plan or proposal to increase the output/production of the presently manufactured product-lines?

YES ☐ NO ☐ NOT DEFINITE ☐

Product-lines planned for increased production	Planned/proposed increased output in production

ITEM 5

Is there any plan/proposal to ADD NEW product-lines which will make use of special Steels?

YES ☐ NO ☐ NOT DEFINITE ☐

Proposed NEW/ADDITIONAL Product-lines & possible quantity	Grades/types of Special Steels to be used in product-line

DEMAND SURVEY ON QUALITY/SPECIAL STEELS

INVESTIGATION SCHEDULE FOR SPECIAL STEEL END-PRODUCT USERS

This questionnaire schedule is meant specifically for data on usage/consumption of end-products made from special steels (e.g., grinding media, automotive springs, etc). 'Special steels' are defined as low and high alloys steels such as spring steels, free-cutting steel, steel for grinding media, silicon steel, tool [illegible] die steel, etc.

Organisation & Location	Industry

Data required below may be filled in either by survey investigator or by concerned authorised personnel of the responding organisation.

Names of End-products of special steels used by resp. organisation	Grade and specification of special steel from which end-product made	Quantity of end-products purchased		
		1983-84	1982-83	198[illegible]

Data required below may be filled in either by survey investigator or by concerned authorised personnel of the responding organisation.

Names of special steels and-roducts used by	Names and addresses of foundries, fabricators and/or manufacturers from which said end-products were purchased within last 3 years.