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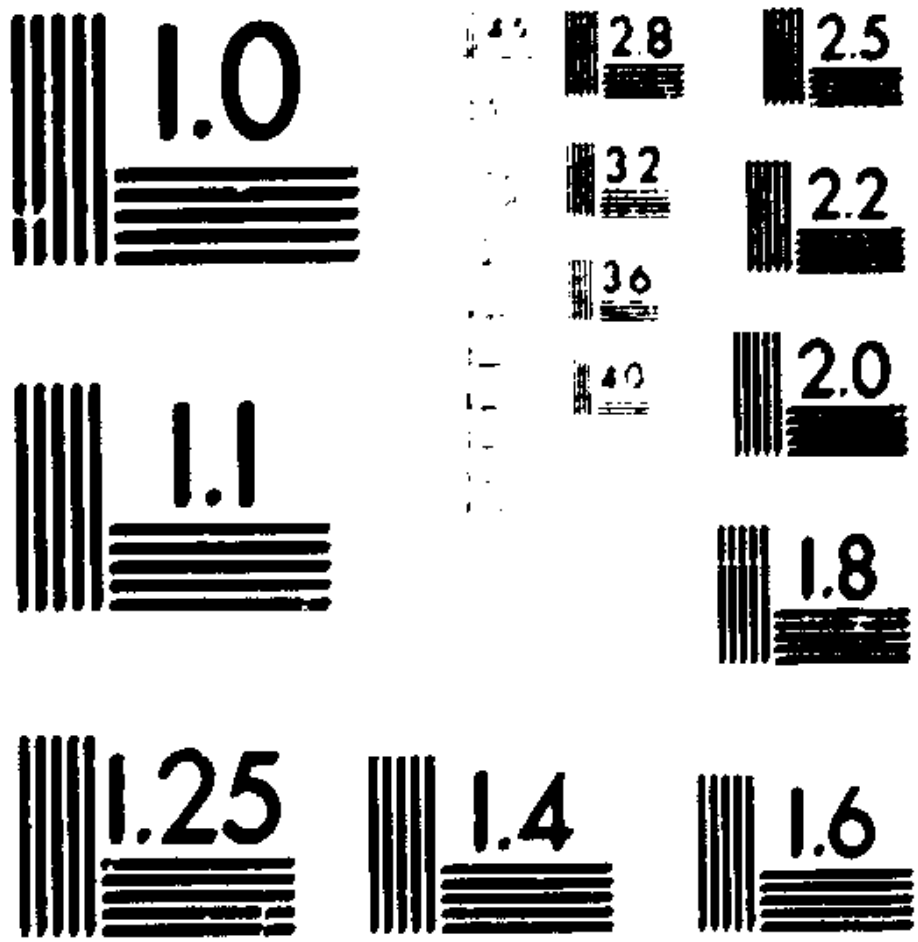

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PLANNING FOR CAPITAL GOODS INDUSTRIES - A NEW METHODOLOGY

by

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CHAPTER - 1

NEED FOR AN INTEGRATED CONCEPT OF PLANNING

1.1 Even a casual study of international trade statistics would show that developing countries occupy a dismal position in production and trading of engineering goods in general and capital goods in particular. In fact, the state of this industry bears a direct relationship with industrial and technological development.

1.2 The new economic order envisaged in the Lima Declaration clearly visualised a new concept of international division of labour and realisation of the latter is dependent to a large extent, on the growth of capital goods industry in developing countries. In fact, strategic value of development of this sector will increase with the inevitable growth in their overall industrialisation since industrial integration (and import substitution) and technological independence will depend on the capacity and capability of this sector to provide machinery and plant and their spare parts. This sector, quite obviously has a crucial role in efficient operation and growth of the entire industrial system.

1.3 Most developing countries have set up process industries with foreign collaboration but continue for long periods to be heavily dependent on foreign supplies of equipment for their operation. By its very nature the development of this sector ensures that transfer of technology is in real terms.

1.4 The fact that economies of most developing countries are marked by dependence on agriculture or exploitation of their natural resources, increasing pressures of population and a slender industrial base, has resulted in increasing recognition of the need for an integrated concept of planning.

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The objective of self-sustaining growth desired by them requires careful assessment of linkages between inputs and outputs of different sectors of economy. Sound concepts of planning based on scientific analysis of accurate data have become a pre-requisite for investment decisions and assessment of need and potential for horizontal and vertical growth of engineering and other industries.

1.5 All sectors of economy are directly or indirectly linked with capital goods. Construction and irrigation require earth-moving equipment, agriculture depends on agricultural machinery, consumer goods need general purpose or special purpose machinery and plant, while growth of industrial sub-sectors like Power, Steel, Fertilizers, Chemicals, Mining is possible only with timely availability of requisite types and numbers of capital goods, peculiar to them.

1.6 Based on goals of socio-economic development, it is necessary to work out the demand pattern of commodities and services and this has to be used for a projection of demand of capital goods in such a manner that it can provide summation of national demand of each type of machinery and plant arising out of plans for growth of different sectors of economy and industry and at the same time provide a dependable projection of the type of manufacturing facilities required for them. This is what has been achieved by the UNIDO-sponsored Capital Goods Development Project in Turkey - under the guidance and direction of the author.

1.7 Irrespective of semantics on industrial planning as government policy, the need for a clear perception of anticipated demand of capital goods of different categories and types by countries, regions and finally,

on a global basis is obvious. This planning methodology makes it possible for developed and developing countries to plan their future course of action on imports/exports or technical cooperation in the field of capital goods. UNIDO's possible role in assisting the developing countries in applying this is obvious.

1.8 The significance of the methodology developed, tested and applied by the author can be gauged from the fact that it has effectively contributed to the development of an integrated concept of planning in as much as it has -

(i) provided the linkages between industrial growth and demand for Capital Goods;

(ii) made possible a long-term view of when and which items can be economically manufactured indigenously and which should be imported;

(iii) resulted in clear-cut decisions on product-mix of heavy engineering and machine-tool building plants in the public/joint sector.

(iv) provided a clear perception of the likely growth of different sub-sectors of Capital Goods industry to the private sector;

(v) made it possible to plan for reduction, and ultimately elimination of net imports of machinery and plant;

(vi) given a basis for deciding on rival claims from Capital Goods industry on available resources;

(vii) led to definite direction on improving utilisation, modernisation and expansion of existing units in public and private sectors;

(viii) provided a base for manufacture of spares for imported equipment (e.g. for power or transport sectors);

(ix) made it possible to plan the growth of small scale and ancillary industries;

(x) provided data for planning for technical and managerial manpower, including engineers and artisans, for this crucial sector;

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(xi) resulted in clear-cut schemes for evolution of concrete proposals for TCDC and sub-regional and regional cooperation in production sharing;

(xii) provided a sound base for global projections of demand-capacity balances for capital goods, to a detail just adequate for their rational, technological analysis - essential for a meaningful delineation of policies for North-South cooperation;

(xiii) indicated the guidelines for science and technology growth;

(xiv) made it possible for an integrated blue-print to be drawn up for acquisition of new technologies.

CHAPTER - 2

RATIONALE OF A NEW METHODOLOGY

2.1 Programming of capital goods manufacture involves forward and backward linkages of a number of independent parameters related to user sectors and raw materials and semi-wroughts. In most developing countries, machine building projects have been taken up on the basis of ad-hoc recommendation made by aid-giving countries or summary consideration of technological requirements of one or two user sectors. While this method is partially valid for special purpose equipment for a particular industry (for example, textile equipment for textile industry), a different approach has to be used where same or similar manufacturing capacities have to be used to produce equipment for a large number of industrial sub-sectors, and investment decisions require conceptualisation of quantitative and qualitative aspects of demand and capacity in terms of technological parameters of basic manufacturing operations (e.g. steel fabrication, castings, forgings) which are common to a large number of capital goods for different user industries.

2.2 Most previous efforts by developing countries to plan capital goods industries have been marked by decisions taken to set up manufacturing units to produce a certain product-mix without adequate emphasis in the planning process on optimal utilisation of facilities. From the pooint of view of production facilities, capital goods can be divided into two broad categories, namely:-

(1) Machinery for which the emphasis is on machining of parts and components which may be castings, forgings or steel sections and their assembly.

(2) Steel-fabricated equipment where the emphasis is on plate-work including cutting, bending, welding, rivetting etc.

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For planning facilities for machinery, the crucial aspect is a concept of demand by numbers, according to their specifications. An intimate knowledge of production technologies would enable one to determine which items can be conveniently manufactured with a given set of facilities in one unit so that manufacture is economical.

2.3 From another angle, the demand may be for special purpose machinery required for one sector alonge (eg. textile machinery)

OR machinery which is required by more than one sector (eg. earth-moving machinery which may be required for construction of buildings, roads and railways as well as mining;

OR general purpose machinery which is required by all related sectors for manufacture/repairs (eg. metal-cutting or metal forming machine tools for metal-working industry). These are also characterised by the fact that these are also machines to produce other machines.

2.4 It is necessary to have a clear conception of what kind of data is required for macro-level planning, that is, a broad decision of product-mix of new and existing manufacturing plants based on techno-economic considerations At this stage, heavy reliance is necessarily on professional knowledge, experience and judgement on the type and scale of manufacturing facilities required to economically manufactur a given set of machines. Other items which require same facilities can be added subsequently to achieve higher economies of scale. The starting point for any analysis of this type, however, is to have a picture of the national demand ACCORDING TO MAJOR SPECIFICATIONS

- item wise,
- year wise,
- in numbers (quantity),
- by weight and
- by value.

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2.5 FABRICATED EQUIPMENT.

2.5.1 In the case of steel fabricated equipment, the objective is to form an idea of the kind of facilities required, taking into account three major parameters as limiting factors, namely

Weight of equipment,
Material,
and Max. plate thickness.

Individual numbers of equipment in this case are of relatively less importance for decision-making but the national demand in terms of the above parameters can be compiled only from codified details of individual items for each plant which in turn are related to the production process, technology and plant size of the user industry. It was, therefore, considered necessary to work out for each new investment in user sectors, the demand for each item in terms of a suitable code,

year wise,
by weight,
and by value.

Different permutations of national demand could then be computed. This seemed to be the best way to compute permutations and combinations of three basic parameters namely weight, material and max. plate thickness of all steel fabricated equipment on a national basis. This data is essential for logical planning of this sector.

2.5.2 From this basic data, it is possible to form an idea of the type and scale of capacity required for each of the production processes including

cutting, rivetting,
stamping, welding,
pressing, treatment,
bending, assembly,
rolling, and testing.

2.5.3 This conceptualisation will include the type of equipment required for each production process which may be general purpose machinery for each production process, machinery with special features for high quality/accuracy, special purpose machinery and material handling facilities, in particular, crainage. It was noted that a new methodology was necessary to provide the relevant data related to these factors an appraisal of which is necessary for the initial policy decisions of plant capacities to be set up in terms of weights and materials.

2.6 A procedure had to be adopted to provide data for demand, for each user, in such a way that it provides an idea of major specifications and permits an arithmetic total of demand of each type from all users.

2.7 Consideration of those factors led to the conclusion that all machines would have to be classified and codified to provide demand data in a manner that a summation is possible either manually or where large amount of data is involved, with computers.

2.8 It was with this background that the concept of a 15-digit code for all machinery and plant covered by the project in Turkey, was evolved. The basic considerations in designing the coding system were:-

(i) It should be based on some internationally used system of classification and codification,

(ii) it should be able to provide not only the picture of demand but also the type of manufacturing facilities required,

(iii) it should be capable of being used internationally,

(iv) its codes for each item should cover all possible ranges of major specifications, normally contemplated by their user industries.

2.9 Different methodological approaches had to be designed for different types of capital goods. While demand analysis of capital goods for process industries was based on demand pattern of commodifies and goods they produce, requirements of general purpose machines like metal cutting machine tools were based on macro-level economic parameters like GNP. In the case of Railways, demand of rolling stock was related to the growth pattern of passenger and freight traffic while for castings and forgings, relationships were built up between the user sectors and different elements of production of their capital goods.

2.10 The most critical aspect of the evolution of the new methodology was to determine the depth to which an analysis of demand and capacity should be conducted. Knowledge and experience of production technologies of capital goods and a concept of the needs of macro-level planning was necessary to ensure that the methodology which had to synthesize a large number of some mutually dependent and some independent parameters does not incorporate too many details and become counter-productive for macro-level planning and yet makes available to decision makers, basic techno-economic data for logically-sound decisions on future investments. A constant interaction by all national experts with international experts working on the project was necessary to ensure that their work remains on course and is pragmatic and realistic.

2.11 Two international codes were used as the basis for programming of capital goods in Turkey. The 4-digit "International Standard Industries Classification (ISIC) of All Economic Activities" for classifying and codifying parameters of process industries in a 9-digit code and the "Standard International Trade Classification Rev. 2 (SITC)" for classifying and codifying all capital goods in a 15-digit code.

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2.12 As a preliminary exercise SITC Rev. II was studied and a choice was made of relevant items under section 7 (Machinery and Transport Equipment) besides subgroup 692 (Metal containers for storage and transport) for expansion to a 15-digit code.

2.13 PRIORITIES -

ANNEXURE-I gives a list of major divisions, divisions and major groups of industries covered by the ISIC code. Considering constraints of time and resources, a selective approach was adopted to identify high-priority sectors. The sectors chosen for detailed analysis including infrastructure are indicated in **ANNEXURE-II.** A chart showing the strategy followed is at **ANNEXURE-III.**

2.14 CLASSIFICATION AND CODIFICATION OF CAPITAL GOODS

2.14.1 The focal point of new methodology had to be a manageable coding system which -

- is based on an international system,
- is based on logic that can provide the essential technological data which can define the demand,
- covers the entire range of major specifications encountered in different industries for each equipment,
- uses internationally used nomenclatures,
- incorporates principal manufacturing characteristics which can provide a lead to the type of capacity that will be necessary to produce it,
- can be used internationally,
- follows a design which will make it amenable to computerisation.

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2.14.2 Classification and codification of capital goods is the most difficult and challenging part of development of the new methodology. It involves coordination of concepts of technological specifications of various items of machinery and plant used by different user sectors. When codifying steel vessels,not only types of vessels (eg. pressure vessels, lined vessels) but also major specifications like capacity, ranges of temperature,used by ALL industries had to be incorporated in the codes. All major items of equipment covered by the project were codified.

2.14.3 The purpose of classification of machines was to identify machines with similar functions and capacity, in one group and by the same code number, so that it is possible to get arithmetic summation of demand and manufacturing capacity for them. After considerable research, it was concluded that the optimum number of digits taking into account the minimal information required for most of the capital goods would be a 15-digit system starting with the 5-digit SITC code. In the new code, first 14 digits were allocated for machine definition, the last digit being used for information on wehther it is imported or indigenously manufactured. Coding criteria in 15 digits machine coding system is given in the table below by code levels.

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Codification criteria and related code cells

Code cells	Codification criteria
1 2 3 4 5	
9 9 9 9 9	SITC Group name
6 7	Machine name
9 9	
8	Major specification
9	(Capacity)
9	Major specification
9	(Optional)
10	Major specification
9	(Optional)
11	Type
9	
12	Manufacturing
9	Characteristic (Weight)
13	Manufacturing (Principal)
9	Characteristic (Material)
14	Manufacturing
9	Characteristic
15	Origin
9	

2.14.4 For nomenclature, use was made, by and large, of "Commodity Indexes for SITC (Rev. II" UN's Statistical Paper series M No. 38/ Rev.

2.14.5 A thorough research into the importance of each specification of each item for different users was necessary to determine which three major specifications would be the most representative and which definition of types (upto 9) could cover most of the demand. In cases where only one or two specifications could adequately represent the equipment (eg. only Power in KW-for item 716.23)- "Generating Sets with Internal Combustion Piston Engines", only these were used to keep the programme as simple as possible without sacrificing the objectives of the exercise. In case of manufacturing characteristics, the choice as far as steel fabricated

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equipment is concerned, was obvious. Three parameters that need to be codified are:

- weights of equipment (for crainage);
- materials (facilities for stainless steel would be different than for mild steel); and
- max. thickness of plate (extra thick plates 50 mm would require facilities different from those for thin sheets and plates).

A sample of codes developed for fabricated equipment is at **ANNEXURE-IV** and one for machines is at **ANNEXURE-V.**

2.15 CONSIDERATION OF CAPACITY PARAMETERS.

Existing installed capacity is generally available in terms of weight and needs to be further analysed from the point of view of the other two parameters, namely, grade of material and maximum plate thickness capable of being processed first in each major unit and then in the country as a whole. In countries with mixed economies, generally, the simpler fabrications (eg. mild steel, below 20 mm thickness and below 5 T weight of equipment) can be left to be developed by the market forces. There will, however, be exceptions for example, when the total demand is limited and may have to be planned along with higher complexity items in one economic sized unit. This concept also necessitated a new methodology which would permit a demand-capacity balance according to ALL the basic, technological parameters, which are necessary to conceptualise capacity.

2.16 CONCLUSION.

A methodology incorporating classification of process industries (9 digits) and their linkage through computer with 15-digit codes for their capital goods

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is essential to determine plant wise, industry wise and national total demand which with the essential technical details ensures a logical, scientific approach to planning of capital goods industries. This was evolved, tested and applied, for the first time in the Capital Goods Project in Turkey, under the guidance and supervision of the author. It was felt that methods used so far by developing countries and for that matter even in planned economies, fell short of these minimum technological details for a realistic appraisal of demand and capacity of capital goods and which were necessary for sound investment decisions.

Another important consideration was that the system should be flexible and in the context of dynamic aspects of industrial planning, should facilitate easy introduction of changes in plans, priorities, technologies and plant sizes so that revisions in national demand, if necessary, could be obtained from updated computer files in a matter of hours. A major consideration in the conceptual framework of the entire methodology was that it should be capable of application in all developing countries with minimal further work. This includes the system of classification and codification of capital goods and industries as well as a number of assumptions that are necessary for demand-capacity calculations such as provision for maintenance and breakdowns, and ready reckoners for computing cost of each item of capital goods for a given base year.

CHAPTER - 3

METHODOLOGY FOR PROCESS INDUSTRIES WITH SPECIAL REFERENCE TO POWER SECTOR

3.1 Manual for planning of Capital Goods Industries written by the author (UNIDO Publication No.IO.584-June'83) gives the details of the methodology followed. However, a brief explanation of the documentation developed is necessary to appreciate the subsequent steps of demand assessment. This methodology was applied to Fertilizers, Chemicals and Petrochemicals, Mining (coal, ferrous, non-ferrous, chemicals), Sugar, Pulp & Paper and Cement. Some modifications had, however, to be made for the power sector.

3.2 Since the emphasis is on future requirements, only such details as are relevant to FUTURE PLANTS were conceptualised in details. Requirements for renewals and replacements of existing plants were separately estimated.

3.3 The various formats used for arriving at details of machinery and plant required for each new manufacturing unit of a process industry, have been described in details in the Manual. The basic steps are:-

(i) Classification of Product (extension of 4-digit ISIC code).

(ii) Preparation of a Modular Production Chart.

(iii) Classification of Production activities.

(iv) Classification of Technologies for each Production stage.

(v) Classification of Plant sizes for each Production stage.

(vi) Preparation of a process flow diagram to identify machinery and plant for each technology-capacity combination for each stage.

(vii) Preparation of a plant survey form to work out the 15-digit code for each item of machinery and plant in the process flow diagram, their numbers required and cost data. (The 15-digit codes and quantities are also shown in the process flow diagram for easy cross reference).

3.4 CLASSIFICATION OF INDUSTRIES AND THEIR PARAMETERS.

3.4.1 A tree explaining the codification system applied to process industries is shown in the figure below. Codification of industrial sectors was done according to ISIC (International Standard Industrial Classification).

CODE CELLS	
1 2 3 4	
9 9 9 9	Industry Sector ISIC
5	
9	Product
6 7	
9 9	Product stage
8	
9	Technology
9	Capacity for critical
9	equipment

3.4.2 The nine-digit code adapted for classifying and codifying the basic parameters of industry activities in power sector, is shown below:-

Code cells	Certificate criteria
1 2 3 4	ISIC Industry code
9 9 9 9	
5	Energy type/Voltage
9	
6 7	Production stage
9 9	
8	Technology
9	
9	Capacity for critical
9	equipment

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3.4.3 The 4-digit ISIC code which includes power generation transmission and distribution is

4101 - Electric light and power
The generation, transmission and distribution of electric energy for sale to household, industrial and commercial users. Included are electric power plants which sell a significant amount of electricity to others, as well as produce electricity for their parent enterprise and which can be reported separately from the other units of the parent enterprise.

3.4.4 PRODUCT/ENERGY TYPE/VOLTAGE (5TH DIGIT).

In the case of process industries, the fifth digit indicate a specific product. In power sector, the delineation of product stages (and hence the Capital Goods for them) depends in the first instance on whether the stages belong to the mechanical part or the electrical part. In the case of the electrical part, it further depends on the voltage level. The fifth digit of the 9-digit industry code which is also the first digit of the production stage code represents the following:

4101-0 Power generation, transmission and distribution - mechanical part, non-electrical energy

4101-1 Power generation, transmission and distribution - Electrical part, electrical energy upto 3KV

4101-2 " " electrical energy upto 6 KV
4101-3 " " " " 10 KV
4101-4 " " " " 15 KV
4101-5 " " " " 25 KV
4101-6 " " " " 30 KV
4101-7 " " " " 60 KV
4101-8 " " " " 150 KV
4109-9 " " " " 380 KV

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3.4.5 "MODULAR PRODUCTION CHART" shows relationship of products, intermediate products, by-products and waste products, identified stages of manufacture and does not take into account technologies and capacities of the plant and machinery. Each product (intermediate, by-or waste), distinguished by a clearly identifiable stage of processing or manufacture is indicated in a square or ellipse, the line joining any two, representing a production module.

3.4.5.1 For power generation, transmission and distribution, the M.P.C. has been prepared in two parts:

(I) Mechanical part **(ANNEXURE-VI)** using two digits code from 01 upto 33 which comprises all production processes in power generation plant from the basic energy source upto the mechanical energy on the shaft of turbine.

(II) Electrical part **(ANNEXURE-VII/1, VI/2, VII/3, VII/4)** using two digits code from 01 upto 67, which comprises all production processes in power generation (electrical part), transmission and distribution of electrical energy from the stage of conversion of mechanical energy into electrical energy upto the stage of energy leaving distribution transformer low voltage terminals.

3.4.5.2 Technologies (8th digit)

The technology code was used to identify the basic fuel or the prime energy used for power generation as follows.

Code No.	Description
0-	Transmission or distribution system
1-	Thermal power plant (conventional) - solid fuel
2-	Fuel oil power plant
3-	Natural gas power plant
4-	Waste recovery power plant
5-	Nuclear power plant
6-	Gas turbine power plant
7-	Hydo-electric power plant
8-	Geothermal power plant
9-	Others

Only two technologies, thermal power plant-solid fuel (1) and hydro-electric power plant-potential water energy(7) were chosen. It was felt that demands for specialised capital goods for plants using other technologies (e.g. nuclear plants) are in the near future, likely to be met by imports.

3.4.5.3 Capacity

The capacity classification and codification was based on unit capacity of turbine-generator set for power plant and unit capacity of main step-down power transformer for power substation and rural electrification transformer station.

Code No.	Capacity for unit of turbine-generator set(MW)	Capacity for unit of main step-down transformer(MVA)
1	upto 5	upto 1
2	5-20	1-5
3	20-50	5-16

...20...

4	50-100	16-25
5	100-150	25-50
6	150-200	50-100
7	200-300	100-150
8	300-600	150-200
9	Above 600	Above 200

To simplify capital goods calculation, representative power stations were identified to represent blocks of future power stations and design line capacity for all production stages was based on their capacity. These were:

A. Thermal Power Plants
   1. Soma 165 MW
   2. Yatagan 210 MW
   3. Elbistan 340 MW

B. Hydroelectric Power Plants
   1. Tercan 5 MW
   2. Karacaoren 15 MW
   3. Aslantas 46 MW
   4. Kilickaya 62 MW
   5. Oyapinar 135 MW
   6. Keban 181 MW
   7. Karakaya 300 MW

C. Standard step-down power substation

1.	34.5/15 KV	10 MVA
2.	154/30 KV	25 MVA
3.	154/30 KV	50 MVA
4.	154/30 KV	100 MVA
5.	380/154/15 KV	150 MVA

D. Standard rural electrification transformer stations

1.	15/0.4 KV	100 KVA
2.	30/0.4 KV	50 KVA
3.	30/0.4 KV	100 KVA

3.4.6 For each production module, alternative technologies and capacities of the principal(bottleneck) equipment which determines the capacity of a particular activity, were entered in a chart. Samples of Production Activity Charts developed for the Power Sector are at **ANNEXURE-VIII.**

3.4.7 MODULAR PROCESS FLOW DIAGRAM AND PLANT SURVEY FORM

The diagram and the form record the process flow and relevant details of all equipment for EACH TECHNOLOGY-CAPACITY COMBINATION. The codes for machinery are filled in as codification of capital goods is completed. The latter includes mark, model, weight, thickness of material (in the case of fabricated equipment) country of origin, price in US $, date of price, the basis of price and the price in 1980. Each production module shown in Modular Production Diagram is blown up to show production activities identified according to alternative technology-capacity combinations.

3.5 BASIC INPUT FOR DATA COMPILATION AND ANALYSIS

3.5.1 The following entries in a computer programme, computed from all the plant survey forms, in a plant, are the basic input for all further work of tabulation and analysis.

(i) Plant name and location
(ii) Capacity
(iii) Anticipated date of commissioning
(iv) 15-digit code for each item of capital goods
(v) Nomenclature of each item of capital goods
(vi) Quantity of each item of capital goods

3.5.2 Based on an assessment of the time lag (1-2 years in most cases) between manufacture of capital goods and their installation and commissioning, the time period in which the capital goods demand is expected to materialise is determined. The input data also

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indicates year-wise requirements in two series, one by weight in tonnes and the other in value in terms of 1000 US dollars.

3.6 OUTPUTS-PLANT WISE

3.6.1 PLANT SUMMARY

This gives a summary of capital goods requirements for the plant in question in terms of 5-digit SITC code.

3.7 OUTPUTS-INDUSTRY WISE

3.7.1 INDUSTRY SUMMARY

This gives the total demand of all the future plants of the industry in the time horizon under consideration according to 5-digit SITC code to provide the basis for a quick appraisal of the type of demand by weight and value. An example is at **ANNEXURES IX and X.**

3.7.2 INDUSTRY DEMAND OF STEEL FABRICATED EQUIPMENT-PERMUTATION OF MANUFACTURING CHARACTERISTICS.

The three principal characteristics which determine the kind of capacity that may be required to manufactur steel fabricated equipment are

- weight of equipment (for material handling facilities);
- type of steel;
- maximum thickness of plate.

These are codified under digits 12, 13 and 14 of the 15-digit code, evolved by the author. This output gives the demand for various permutations and combinations of these three parameters of the industry in terms of weight and value under each SITC 5-digit code.

3.7.3 MACHINERY DEMAND FOR INDUSTRY

A mental picture of the type of facilities required for manufacture of machinery (other than steel fabricated items) requires data on major

specifications and quantities. This requires a summation of demand for each item, according to its 15-digit code which as indicated earlier, codifies the nomenclature, major specifications, besides the most important manufacturing characteristics, namely the weight of equipment, the main material used for it and maximum weight of the components, to be processed. An example is at **ANNEXURES XI & XII.**

3.8 NATIONAL DEMAND TOTALS

3.8.1 After details of the inputs are available for all the industries, they are programmed to obtain the following outputs to indicate the national demand which is the final figure for planning the capacity. Of course, an allowance has to be made for demand for replacements and spares before a final demand-capacity balance can be struck.

3.8.2 DEMAND SUMMARY-NATIONAL

This indicates the demand projections for the country as a whole according to 5-digit SITC code by value and weight. An example is at **ANNEXURES XIII & XIV.**

3.8.3 NATIONAL DEMAND FOR STEEL FABRICATED EQUIPMENT-PERMUTATION OF MANUFACTURING CHARACTERISTICS

This output provides the summation of demand for each permutation and combination of the manufacturing characteristics mentioned in para 2.5.1 from all the industries covered by the survey under each 5-digit SITC code.

3.8.4 A manufacturing plant for steel fabricated equipment, in the ultimate analysis is principally concerned with optimum utilisation of its installed capacity irrespective of the equipment that it is used to process and produce. For planning capacity, therefore, it is necessary to obtain

national totals of demand for each permutation and combination of the three manufacturing characteristics. This is the basis of planning the kind of manufacturing facilities that will be necessary if the entire demand has to be met locally. An example is at **ANNEXURES XV** and **XVI** for weight and value.

3.8.5 NATIONAL TOTALS OF DEMAND FOR MACHINERY.

This provides the national demand for each item of capital goods, according to its 15-digit code. An example is given at **ANNEXURE-XVII** for weight and **ANNEXURE-XVIII** for value. This is the basis for final demand-capacity balance calculation.

CHAPTER -4

PLANNING METHODOLOGY AS A TOOL FOR INVESTMENT DECISIONS

4.1 BACKGROUND.

4.1.1 Immediately after its emergence as a national-state in 1923, Turkey under its great leader Kemal Ataturk, embarked on a bold policy of industrialisation. State economic enterprises in some critical manufacturing industries including machine building were formed as early as 1930. Since '60, planning has been used as the main instrument of economic policy, the State Planning Organisation having been created in 1961 for drawing up five-year development plans and to provide coordination between different sectors of economy. Four plans have been completed between 1963 and 1982 and the Fifth Plan is due to commence in 1985.

4.1. The initial years of industrialisation even upto early '70s were marked by an emphasis on import substitution. This, however, led to a lack of growth of the capital goods industry, most manufacturers resorting to imported machinery to set up and expand process industries or produce consumer durables. There were, however, notable exceptions including rolling stock for Turkish Railways, textile machinery, sugar machinery and cement plants.

4.1.3 Turkish economy during '60s and a better part of the '70s performed well with GDP having increased at the average annual rate of 6.4% during the second (1968-72) and 7.2% during the third (1973-77) plans. The first three plans laid great stress on import substitution of consumer durables with the result that their

imports were negligible by 1977-78. Even though their exports was not given a high priority, their national demand by itself resulted in a surge in consequent demand of capital goods, for production of intermediate goods as well as for their processing into consumer durables. Simultaneously, efforts were mounted to increase production of basic raw materials like coal, ferrous and non-ferrous ores and promote process industries like cement, chemicals, petrochemicals, fertilizers and food and beverages. Industrial growth in these sectors combined with general improvement in standards of living also increased pressure on services like electric power. These factors further caused a tremendous growth in demand and consequently an urgent need for development of a viable national capital goods industry. The need for scientific planning of this sector was enhanced by its peculiar nature which required relatively high capital, long gestation periods, rapid obsolescence in the international market, unfavourable investment-output ratios and low profits.

4.1.4 With the country having adopted the principles of a mixed economy for its rapid industrial growth, the public sector had a share of 50-55% in the total fixed investment during the first three plans in the period 1963-77, the increase in the manufacturing sector being from 21% in 1963 to 49% in 1977. The private sector kept pace with an annual growth in investment of approximately 11.3% in real terms during 1967-77 even though it was about 5% during 1962-67.

4.1.5 While upto 1973, the Turkish economy was progressing very rapidly, the oil price increases in 1974 and its impact on world economy, in general,

had its adverse effect on Turkey's industrial growth also, as indeed, it did on that of all other developing countries dependent on imports of crude oil or its products. From the 4th development plan onward, it was increasingly recognised that industrial and technological growth were closely linked to the development of the capital goods sector and large scale investments were made in the Fourth Plan. Some of the major units in both public and private sectors have already reached advanced stages of completion.

4.1.6 Manufacture of sophisticated equipment requires heavy capital outlays-initially mostly in foreign exchange for machinery and plant to produce this equipment. The relatively large gestation periods and resultant unfavourable investment/output ratio in initial years of a machine building project makes the situation increasingly complicated as sophistication of designs and production processses of capital goods go up. These peculiar aspects of acquisition of technology for design and manufacture of capital goods make it mandatory for specific policy measures to be decided and effectively followed up.

4.1.7 The fourth plan was directed towards optimal utilisation of existing assets and laid emphasis on speedy development of capital goods in cases where it was economically viable. New projects were evaluated afresh to ensure that they are based on full utilisation of existing facilities and take into account a new thrust on exports of goods and services. Heavy industries like equipment for power generation, distribution and transmission and sophisticated products like machine tools, diesel engines, requiring high initial capital cost and imported costly

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technology were provided for, mostly in the public sector. A careful review, however, to work out demand patterns of capital goods and determine priorities in the context of available resources, was conducted by the UNDP/SPO Capital Goods Project which started towards the end of 1979.

4.1.8 Growth rates of GNP directly influence demand of general purpose machinery like machine tools. While the original growth rate target was 8.2% per year during 1979-83, severe foreign exchange constraints besides other factors seriously hit capacity utilisation during 1979-80. The growth rate (at constant prices) during 1979 was 0.7% and during 1980 around 0.8%. During 1981, however, with certain basic changes in economic policy, a growth of 3% was achieved which went to nearly 4% in 1982.

4.1.9 The UNIDO/SPO Capital Goods Development Project in Turkey was taken up with this background and was intended specifically to evolve a dependable methodology for planning of this sector, one which would make it possible for the Government to take quick decisions on new investments as well as modifying product-mix of existing enterprises and of those in the pipeline, lead to optimal utilisation of national resources and at the same time, be flexible enough to meet the needs of rapidly changing technological needs of user industries. Need for a new methodology was further heightened by the Government drive to promote exports of consumer goods, consumer durables, construction contracts for all of which up-to-date, high-quality, machinery and plant is a pre-requisite.

4.2 RESULTS ACHIEVED.

4.2.1 CAPITAL GOODS FOR PROCESS INDUSTRIES.

4.2.1.1 The process industries covered by the Project were Power(generation, distribution and transmission), Mining (Ferrous, Non-ferrous, Coal and Chemicals), Fertilizers, Petro-chemicals, Food & Beverages and Paper. This methodology made it possible to arrive at summation of demands from all of them for each item of machinery & plant, in terms of 15-digit codes evolved by the Project. These national totals were subjected to an analysis from the points of view of available capacity and economics of indigenous manufacture. As a result, it was agreed that, for power plants,

(i) capacity for hydraulic turbines and generators upto 200 MW capacity should be set up on priority.

(ii) the proposal to manufacture steam turbines should be dropped;

(iii) only one plant for manufacture of utility boilers may be put up (three were under different stages of consideration). This plant should have a capacity of around 30,000 Tpa and should manufacture other vessels and tanks besides boilers.

(iv) capacity for transformers and circuit breakers should be set up urgently;

(v) manufacture of certain types of motors should be taken up in the generator plant;

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4.2.1.2 As a result of the project outputs,

(i) plans for a State Enterprise which was being set up to manufacture steel structurals for buildings were modified so that it would instead manufacture pressure vessels as well as other steel fabricated equipment for chemical, iron and steel and other industries;

(ii) product-mix for a new heavy engineering plant to manufacture earth-moving equipment was revised;

(iii) plans and product-mix of new plants to manufacture diesel engines and tractors were modified.

(iv) proposals for expansion and modernisation of all existing capital goods manufacturing plants were reconsidered and revised on the basis of demand data prepared by the project;

(v) product-mix of a plant, under installation, for manufacture of machine tools was revised, some items being dropped, output of some, revised downwards and some new ones added. Steps were initiated for use of spare capacity in this costly venture;

(vi) existing plants manufacturing sugar plant machinery were asked to take up Pulp & Paper machines also;

(vii) a proposal to set up a new factory for manufacture of pumps in the public sector was dropped. Instead they could be taken up by existing

manufacturers of pumps in the private sector with modernisation and expansion.

(vii) recommendations were made for changes in plans for expansion of existing Railway Workshops and setting up of new ones.

4.2.2 The most important feature of the recommendations made by the Project and decisions taken by the Government was that **PROJECTIONS SHOWED ALL MAJOR SPECIFICATIONS OF EQUIPMENT AS WELL AS THEIR MANUFACTURING CHARACTERISTICS. SIMULTANEOUSLY THE BASIS OF PROJECTIONS WAS CLEARLY SPELT OUT** so that ambiguity was eliminated and decisions were fast and clearcut, saving considerable time and money where new plants or expansion of existing ones was under consideration. In addition, in the case of steel fabricated equipment, the national demands of capacity in terms of various permutations and combinations of the three principal parameters namely, weight, type of material and plate thickness was made available. These should enable both public and private sectors, to plan their expansion and modernisation plans including the type of manufacturing technology to be developed in the next 10-15 years. The fact that the recommendations were made on the basis of readily available, scientifically-compiled data, fecilitated their acceptance by the enterprises concerned as well as senior echelons of the Government.

CHAPTER - 5

POTENTIAL FOR APPLICATION OF PLANNING METHODOLOGY IN OTHER COUNTRIES

5.1 What the Planning methodology explained in this paper was able to achieve in Turkey has been briefly outlined in Chapter-4. There is no doubt that all developing countries are looking for ways to secure economic independence and as agreed to in the First Consultation on Capital Goods (Brussels - 1980), one of the important steps in this direction is EFFECTIVE planning of Capital Goods Industries. They may be following a free, planned or mixed economy but conceptualisation of future demands of capital goods by each industry and then the country, year by year, is essential for this sector to intelligently plan its growth, irrespective of whether individual enterprises are run by the State, by private entrepreneurs or jointly by the two. At the same time, these projections in order to be meaningful for this purpose must indicate broad specifications of equipment as well as provide clues to the type of manufacturing facilities required for them. It is only with this kind of data that it will be possible to arrive at the national arithmetic totals of demand from different industries, of types and categories of machinery & plant and to organise their manufacture in such a way that each set of manufacturing facilities can be used to produce a large variety of capital goods, serving different industries but requiring similar manufacturing processes and methods.

5.2 The planning methodology evolved, tested and applied in Turkey provided this kind of data, which has the same significance for other countries. In fact, the application of this methodology is as relevant to developing as to developed countries - the data needed by both for charting out the growth of their capital goods industries is similar.

5.3 The planning methodology is based on sets of codes which are expansion of international codes already in use, for national, regional and international statistics. Used for regional projections, it could lead to well-defined proposals for regional cooperation for production sharing so that manufacturing units can usefully practice economies of scale. Use of this methodology could be a major factor in tracing the path of technological development so that starting from simple steel fabrications to complicated equipment say for a power plant, one could visualise, from the codified national demands, year by year, which items could be gradually produced indigenously in economic lots. This will lead to collective self-reliance when individual countries' demands for outputs of each type of manufacturing facillity, are too small for economic production.

5.4 A clear perception of the demands of capital goods by specifications, directly and dynamically linked to commodity projections and updated whenever there are changes in plans and priorities will also enable the existing units to develop linkages with all sectors which can use their manufacturing facililties and optimise utilisation of their installed capacities. This will also enable them to take a view on future technological growth and take timely steps to modernise, expand, or upgrade their design and production facilities.

5.5 Optimum utilisation of installed capacities is directly related to net demand of their products after taking into account the total demand and imports which may have to be resorted to for a variety of reasons. This planning methodology makes it possible to rationalise future projections of imports of capital goods, not only by categories and types but by individual items of capital goods. This will make available to manufacturers crucial data for taking timely action on manpower planning, provision, if necessary, of infrastructural facilities and take up marketing drives for products within their manufacturing potential.

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5.6 Based on this methodology, Governments should be able to also take unequivocal decisions, on specific items for which capacity should be created in the public, private or joint sectors. It will also enable each enterprise to identify its product-mix which can be based on full exploitation of its facillities to produce all capital goods capable of being manufactured within the available capacity of its production processes. Many developing countries have had their heavy engineering units based on anticipated growth patterns of a single user sector so that when for lack of resources or other reasons, investments in the latter fall short of original anticipations, the result is gross under-utilisation of capacity of the capital goods unit linked to it. This brings in its wake high costs of production and sets in a vicious cycle of low production, high costs and customer-resistance.

5.7 An extremely important aspect of introduction of this methodology is that it provides a permanent base for future planning of capital goods industries. Its flexibility enables all changes and modifications, in plans, technologies, plant sizes, addition of new plants, deletion from plans of proposed units, being readily introduced in the system and resulting in immediate availability of revised projections. In a couple of decades the computer output of projections may be entirely different from the one that is made today but this will have been made possible by introduction of all plan changes into the initial data, compiled and stored in computer facilities. In L.D.C's and other countries where the demand is relatively small, the work can be easily done by the head-and-hand method.

5.8 To ensure that capacity utililsation can be effectively planned, the methodology takes into account the time-lag between manufacture and erection/commissioning of individual items of equipment.

5.9 The present practice in many developing countries is to import process plants on a turnkey basis. Many times, of course, it cannot be helped - particularly if conditions attached to loan or grant by another country make it imperative. There are, however, strong possibililties of utillisation of available capacities in the country if the capital goods required for a proposed plant can be expressed in terms of codes used in this planning methodology and a cross reference made with codified data on installed/available capacity.

5.10 Frequently, it is argued that equipment cannot be manufactured because designs are not available. This may be so in some cases but certainly not in all. If manufacturing capacity is available it is possible in many cases to buy designs either on a one-shot basis or with a regular collaboration agreement.

5.11 The data made available by this methodology has a number of other applications for developing countries. To cite a few, these are planning for:

(i) foreign exchange for import of capital goods;

(ii) R&D programmes in capital goods design and production and their linkage to R&D programmes in process industries;

(iii) research institutes in machine building;

(iv) ancillary industries;

(v) technical education in related areas.

5.12 The potential of this methodology in all developing countries is clear. In the context of Lima Declaration, the need is immediate.

CHAPTER - 6

PLANNING & TECHNOLOGICAL COMPLEXITY OF CAPITAL GOODS

6.1 Industrial planning, generally speaking,is primarily concerned with, development of large and medium industries including mineral industries and resources. Its functions, at central government level, broadly are:

(i) Formulation of plans and programmes of development for individual industries, sectors and subsectors including fixing targets for capacity creation and production.

(ii) Forecasting demand estimates, evaluation of studies regarding technological and economic aspects of industrial units.

(iii) Carrying out studies on capital formation in organised industrial sectors, source of supply of funds, problems of allocation of institutional finances.

(iv) Coordination of industrial development programmes with related sectors like power and transport.

(v) Study of factors inhibiting or accelerating growth in different sectors.

(vi) A continuous appraisal of industrial policy in relation to its economic and social aspects, problems of implementation and assessment of progress of industrial development in the public and the private sectors.

(vii) Policy for science and technology including application of international scientific and technical advances.

(viii) Policy for import substitution.

(ix) Policy for export promotion.

(x) Policy for regional development.

6.2 The relevance of any theory or methodology for planning of capital goods industries must be viewed in the context of one or more of these functions bearing in mind that

one is dealing in the first instance, with the subject at a policy planning level - distinctly separate from the steps to be taken at other levels. The objectives of the exercise of planning of capital goods industries is to identify the products which should receive priority treatment for investment and for it to provide a direction for organisation of technical manpower and infrastructural inputs in a suitable time-frame.

6.3 For both these, it must provide for macro-level planning and over-all view of the sector and its requirements, albeit approximate, yet incorporating essentially correct degree of relevant techno-economic details.

6.4 Broadly this exercise can be visualised at three levels namely the

Policy level which is relevant to PRESELECTION of projects
Feasibility study level,
and Project engineering level.

6.5 From a study of the data so far available there does not seem to be any methodology other than the one described in this paper for arriving at the data for the Policy level. The objective at this level is to provide to the policy makers a techno-economic description of demand projections yearwise, according to quantities and value, to a degree of detail that makes it possible for a policy decision to be taken to go ahead with further work to second and third levels with minimum cost and maximum speed. This would be applicable to initial decisions at the ministerial/planning organisation levels of governmental management. The demand picture is adequately accurate but its analysis relies entirely on application of industrial engineering and managerial judgement in the context of overall economic planning by qualified, experienced managers with a background of disciplines of industrial/production engineering.

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6.6 Once the policy decision has been taken it should be possible to use the basic data for the second level - the feasibility level. It is at this stage that the complexity analysis of capital goods(possibly carried out by UNIDO experts) can be linked up with the basic data of policy level for

(a) defining the route and time-frame of development of capacity and capabilities of the sector from the point of view of the rate of increase of complexity level of local manufacture that can be reasonably expected,

(b) modifying the time horizon of individual, preselected projects on the basis of (a) above, if necessary,

(c) providing a direction to ancillary industries for the TYPE AND SCALE OF supplier activities that are likely, and

(d) working out guide lines for development of manpower(engineers, supervisors and workers) including job specifications as the objective of different schemes of education and training in technical schools, universities and institutes.

6.7 Based on the results of the second level of planning, the final stage of planning i.e. Project engineering stage should be taken up for those units that are found to be economically feasible and final details of construction, erection and commissioning targetted.

6.8 ANNEXURE-XIV shows the 80 factors conceived in the ATC theory, related to the classification method for planning of capital goods, A2 items 1-7 are production processes whose scope and nature will be determined by permutations and combinations of 12th, 13th and 14th digit of relevant codes for steel fabricated equipment used in the classification method and which can be conceptualised after these latter details on a national basis are available. Like-wise other means of production can be considered only in the context of quantities and major specifications

as well as manufacturing characteristics like total weight of equipment and max weight of a processed component.

6.9 Similarly most items listed under B2, Technical services from third parties depending of course on the scale of demand and hence anticipated utilisation of manufacturing machinery and plant, will have to be provided within the main production unit. This is specially true of items where transport can be a major item of cost or where the services listed are closely linked with a number of other operations and disruptions of supply from other services may be relatively costly.

6.10 From the nature of the details of these 80 factors, it is felt that their optimum use (and that of ATC) will be at the second level of planning i.e. the feasibility stage and as logical extension of the demand projected by the classification method - which incidentally will still remain the basic data for this as well as the third level of planning ie. the project engineering level.

6.11 In the case of technical infrastructure - semifinished products (castings and forgings) the complexity and type have been classified by an extension of relevant SITC codes and can be easily linked up with the levels of complexity visualised by ATC.

6.12 ATC provides a very important tool for defining strategies for development of capital goods but these strategies can be only in the context of a projection of the demand pattern of each country. It is felt that the classification methodology provides the essential link between the desire to promote the capital goods industry and national strategies as well as fiscal and promotional measures to be taken for eventful emergence of viable machine building units.

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6.13 In order to put these two tools into the hands of developing countries for effective use, it is necessary to link up the two. This can be done by working out ATC for representative capital goods NOT by name but classified according to the 15 digit codes which indicate the broad specifications also. The ATC of a small mild steel tank with no special range of temperature to handle using upto 20mm thick plates will be entirely different from that of a large tank(say $4000m^3$) to with-stand a temperature of over 500^0C or -150^oC, spherical in shape and made principally of thick, high-alloy steel plates. The demand according to the classification method is crucial for all these levels of the planning exercise. ATC, if linked up with 15 digit codes of capital goods, will be more useful for working out strategies than it is now.

CHAPTER-7

PLANNING METHODOLOGY & OPTIMISATION OF UTILISATION OF INSTALLED CAPACITY

7.1 It is important to collect the capacity data for the enterprises manufacturing capital goods according to the parameters used for defining the demand, to arrive at demand-capacity balance in terms of data which provides the basic essential technological details for a rational analysis. In case of iron castings, for example, the data will be in terms of material, maximum piece weight cast and complexity, the emphasis being on LIMITING FACTORS of capacity e.g. maximum weight handled. In the case of steel fabrication, the data will be in terms of three parameters codified, namely weight of equipment, principal plate material and maximum plate thickness while in the case of machinery like turbines, bulldozers, machine tools, data will be in terms of numbers according to major specifications which have been codified. These data when fed into the computer with demand data, provide the net demand for the items or range under consideration. Its evaluation using normal principals of analysis of economic feasibility, will lead to decisions on which items should continue to be imported and which locally produced through modernisation/ expansion of existing units or setting up new ones. Another look at the results can be taken from the point of view of national policy which may require some capacity to be set up on strategic rather than economic considerations.

7.2 Once the technological parameters of the future demand are available, it is essential to have a close look at the potential of existing installed capacity IN TERMS OF THESE PARAMETERS. In view of its obvious impact on availability of capacity, a brief mention of the steps that are necessary to improve productivity of machine-building plants is relevant.

7.2.1 Modern Productivity Techniques: Modern productivity techniques have become an important tool for better utilisation of investment and increasing outputs. Introduction of these techniques inclulding scientifically-designed production incentives schemes will lead to marked increase in output in existing workshops.

7.2.2 Impact of short supply of infra-structure, particularly transport and power, should be quantified based on a proper management information system.

7.2.3 STANDARDISATION

In capital building industry, standardisation of design has an extremely important role to play, affecting as it obviously does, the level of productivity which can be achieved with a given set of resources. There is often a danger when there is emphasis on imported technology, some times in the interest of saving time, that for each item a number of different design concepts are simultaneouosly introduced in the national production programme. It is recommended that a long term view be taken and such precautionary measures introduced as will ensure that standardisation of designs and equipment is taken up as a national policy and implemented effectively, care being taken to ensure that it does not hamper innovation and technological growth.

7.2.4 PRODUCT MIX AND ORDER BOOK

7.2.4.1 The facilities in large capital goods manufacturing plants are by their very nature capital intensive and their best utilization lies in the manufacture of relatively high-technology

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items. Lower technological categories such as storage tanks, simple conveyors and elevators, normal types of cranes etc., are best left for manufacture by small fabricators.

7.2.4.2 In any diversification programme, the variety of products should be kept limited, keeping in view the existing facilities in other manufacturing units since local demand is generally limited. Duplication of manufacture in state enterprises for similar items should be avoided.

7.2.4.3 Every effort should be made to avoid import of equipment which can be manufactured in the country. This will not only reduce dependence on foreign resources but will also help to increase the work-load on existing plants which is vitally necessary to speed up the build-up of technical know-how and personnel skills, to say nothing of build-up of managerial capacities in large manufacturing units.

7.2.4.4 Rationalisation of product-mix and coordination of production between existing units and cooperation between them for a horizontal transfer of technology must be controlled and encouraged.

7.2.4.5 To effect a balanced order book, policy decisions are frequently necessary to direct at least state enterprises to get their machinery and plant from indigenous suppliers capable of supplying them in preference to imports.

7.2.5 QUALITY CONTROL

7.2.5.1 Lack of stage quality control, particularly in heavy engineering equipment seriously affects plant productivity because, besides extra time frequently taken in initial manufacture of individual components, time is taken to repair them. Even more important, poor quality of equipment can have serious effect on commissioning schedules and later, on production and performance of process plants. Formal procedures for control of quality at operation and finishing stages should be promoted.

7.2.6 OPERATIONAL RESEARCH

This should be introduced as a tool for better planning of activities of manufacturing units.

7.2.7 MAINTENANCE

7.2.7.1 Realisation of production plans depends to a fair extent on the effectiveness of the procedures and methods for maintenance of machinery and plant. There should be an emphasis on preventive maintenance.

7.2.8 Number of shifts operated should be increased to minimum 2 and in bottleneck areas,, to 3, and the level of efficiency in each should be assessed by the Industrial Engineering departments as a matter of routine.

7.3 POLICY CONSIDERATIONS

7.3.1 TECHNOLOGICAL PARAMETERS OF THE CAPITAL GOODS INDUSTRY

In this industry, there is a wide diversity of products and degrees of technological sophistication. In the matter of producing capital goods, as a general rule, the industry in developing

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countries should be planned in the following stages:

During the first stage and on a short-term basis, the manufacture should be limited to relatively low levels of complexity, care being taken to avoid fresh capital expenditure on developing products which are already obsolete or obsolescent in the industrialized countries. This stage should enable the industry to gain experience in design and manufacturing techniques as well as creating a basic infrastructure, which has to respond to demanding requirements of quality. A large number of steel fabricated items can be covered in this stage.

During the second stage and on a long-term basis, depending upon the demand, manufacture of more sophisticated machinery including those with numerical control could be taken up. NC machine tools, for example, though expensive initially, are economical and flexible for manufacture of parts.

7.3.2 SPECIALIZATION

When demand is relatively low, specialization by different units in different types of capital goods is recommended. This would result in the following benefits:

(i) Increase in technological level of machines manufactured,

(ii) Improvement of quality of machines manufactured,

(iii) Lower production costs,

(iv) Improvement in utilisation of installed capacities,

(v) Lower capital requirements,
(vi) Increase in labour productivity,
(vii) Improvement in export potential by making the machine tool industry competitive in the world market.

7.3.3 DESIGN AND DEVELOPMENT

While in initial stages it is necessary and even desirable to obtain complete designs from foreign collaborators, the stage has already reached for machine tool builders in many developing countries to develop design organisations which will not only adapt foreign designs to suit local conditions (such as availability of raw material and components) but also take up designs of new models and types. It will be necessary for designers to get assistance from foreign collaborators which should include training in their design offices and later vetting and checking the designs and calculations made by local experts. The objective of local expertise being developed to the point of complete designing of machine tools in a period of 5-8 years should be spelt out by the Government and facilities made available to the manufacturers to achieve it.

Incidentally design personnel are generally in short supply and their terms and conditions of service may need to be adjusted to ensure their continued availability to the enterprises.

7.3.4 PROTECTION OF LOCAL INDUSTRY

It is normal for indigenous manufacturers to seek Government protection by restriction of imports of products similar to their own for a certain period of time to allow them to achieve a level of healthy growth to a point that they can compete with foreign suppliers by way of cost and quality. While this is

certainly desirable, protection must not be a cover for inefficiency and hence denial to users of urgently-needed machinery in the name of protection. The manufacturers must be able to submit to users and publicise their plans of production which if accepted by the Government as reasonable, may be used as the basis of import restrictions.

7.3.5 TOOL, JIGS, DIES AND FIXTURES

The efficiency of utilisation of machine tools depends to a large extent on the design and quality of cutting tools, jigs, dies and fixtures. It is desirable for capital goods manufacturers either to set apart specific capacity for both design and manufacture of these items to suit their products or plan their procurement from recognised suppliers.

7.3.6 ANCILLARY INDUSTRIES

Many developing countries already possess well developed ancillary industries but it is extremely important for machine building units to build up a sound information system on performance of individual units and also to organise a dependable quality control programme for their bought-out items.

7.3.7 AFTER SALES SERVICE

After sales service covers a wide range of activities but perhaps the most important is immediate professional attention to complaints on quality and performance. A careful record needs to be kept of all complaints and action taken on them. This record could well be the basis of design changes.

7.3.8 MECHANISATION

A very important aspect of the development of the capital goods industry is that of proper tooling which is to necessarily take into account other available skills. There is at times an undesirable emphasis on mechanisation of operations and this, quite apart from being in many cases inappropriate for the economy of the country, also presents serious problems in the maintenance of such equipment for which heavy costs may have to be incurred in employing foreign technicians. With the rapid development of technology, in the developed world and the speed of obsolescence, this aspect has special relevance in developing countries. It would be useful for them to enlist UNIDO's help in obtaining experience in methods, procedures, tooling and other aspects of manufacture of capital goods from other developing countries with mixed economies.

7.3.9 ROLE OF STATE SECTOR

7.3.9.1 The capital goods industry as a general rule, is characterized by heavy initial investment, long gestation periods, instability in demand that implies great risks, and low rates of profit. In most developing countries, these conditions offer opportunities for investment which would interest the private sector only for either relatively simple steel fabrications or a limited range of general purposes machines. For developing this industry, a conscious and deliberate policy on the role of State Enterprises therefore becomes necessary.

7.3.9.2 Coordination between public sector units

It is felt that a very close coordination between different public sector units in the matter of plans of manufacture of capital goods is essential so that the Government's objective of maximum utilisation of installed capacity is achieved as far as this sub-sector in the state enterprises is concerned. Their product-mix may also be rationaled so that in keeping with the Government's policy, similar items are not produced by many units. It is felt that this coordination should include inter-change of experienced engineers and skilled artisans on mutually acceptable terms. They could be loaned for specific periods or transferred on a permanent basis, as agreed to by the parties concerned.

7.3.10 COORDINATION BETWEEN STATE UNITS AND PRIVATE SECTOR

With the number of recognised capital goods manufacturers in most developing countries being limited, and considering the size of the domestic demand, it is desirable that all the different units should adopt a common pollicy of standardisation of parts, quality control standards, research and development and acquisition and storage of documentation. These could be done under the umbrella of National Institutes.

7.3.11 NEED FOR NATIONAL INSTITUTES

In countries where a basic capital goods manufacturing industry is already available, it is desirable to consider setting up coordinating organisations for different sub-sectors (e.g. machine tools) which will serve as a data bank, organise testing of machinery, be a focal point for

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introduction of standards on a national basis and assist the small and medium scale manufacturers in designing their products. By the very nature of its work, it should be an independent organisation under the Ministry of Industry. Specifically, it could:

(i) serve as an information link among various firms in order to be able to make up, and to bring up-to-date, more precise market studies,

(ii) analyse the complexities of manufacture and give advice on measures to create capacity for its different levels and consequently on types of capital goods to be manufactured,

(iii) assist individual companies in achieving the highest possible degree of specialisation,

(iv) advise the ancillary industry in meeting technological requirements of products,

(v) be an instrument for exchange of technical information among firms in this sector in regard to quality, technological development, etc.,

(vi) keep updated information on international prices for benefit of users and manufacturers,

(vii) create a system of national standards for raw materials as well as finished products,

(viii) prepare basic data and programmes for training of personnel,

(ix) offer services to user industries which employ in their production processes, the relevant capital goods,

(x) study the infrastructure of the country in the area of application of capital goods,

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(xi) offer services to the investors in the sector in preparation of feasibility studies and project engineering,

(xii) offer assistance for the acquisition of technology in the sector,

(xiii) offer advice in acquisition of capital goods from other countries, and

(xiv) contribute to national technological progress through its own research and development programmes.

CHAPTER - 8

MANPOWER PLANNING FOR CAPITAL GOODS INDUSTRIES

8.1 OBJECTIVE

8.1.1 The principal objective of manpower planning is to assess the gaps between anticipated demand and supply of various categories of skills and relating their analysis to facilities, present and future, for education and training. In the context of capital goods, it applies to all technological disciplines involved in manufacture, of all types of capital goods and their infrastructure such as electronics, castings and forgings. There will be an overlap with operation and maintenance of these facilities. In view of the need for technical manpower, in the present and next decade, likely to arise ahead of availability of suitably-trained local personnel, from within national institutions or otherwise, manpower planning would have to be specifically considered under short-term and long-term measures.

8.2 INPUTS TO MANPOWER PLANNING

8.2.1 Manpower planning for any country, in general, has to take into account socio-economic and political setting in it. Planning for an industrial sector has additionally to consider the impact of technologies. In both cases, it implies a systematic analysis of available manpower according to skills involved, shortages or surpluses in each at present, additional demand and availability and anticipated gaps between demand and supply. The forward and backward linkages of demand projections will connect them to capacity for commodities, services and infrastructural facilities on the one hand and capabilities of training and educational institutions on the other.

The starting point, of course, is a rational analysis of scientifically-derived demand and supply balance for capital goods industries.

8.2.2 Effectiveness of any manpower plan will depend on the data on which it is based - both for future demand as well as present availability. Initial estimates are often made on the basis of relationship between output targets and manpower requirements in other countries. Quite apart from the fact that available data in this area is woefully inadequate, there seems to be hardly any work having been done to relate the crucial factor of productivity and influence on it, of mechanisation, automation, quality control and supervisory and management skills.

8.2.3 In the capital goods industry as indeed in most other engineering industries, it is essential to develop relationship between manpower demands at individual project level to those at the national level. Each project in developing countries, almost invariably does (and if not, easily can) make an estimate of quantity and quallity of skills required for operation of its facilities. To these, have to be added an estimate of upgrading the manpower capabilities in existing plants and an estimate of manpower requirements by skills, likely to be caused by input of gradually higher levels of technology in the unorganised capital goods sector - namely, small scale, for manufacture and maintenance, in rural and urban areas.

8.2.4 In thix context the inputs for manpower are, inter alia,

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(i) Future requirements, present availability and gaps in terms of man hours required and available for different types and grades of skills, and

(ii) Basic education, technical education, vocational training and experience required and available for each type and grade of skill.

8.2.5 The main disciplines which could, for example, be considered for engineers and managers will be Industrial, Mechanical, Electrical, Electronic, Finance. These could be conceived as specialising in operational branches such as production, design, research, plant management, maintenance, EDP, marketting, materials management, plant engineering, quality control and operations research.

8.2.6 In the case of artisans, highly skilled, skilled or semi-skilled, demand and availabililty will have to be assessed in terms of processes of manufacture and trades involved e.g. fitters, machinists, forge and foundrymen, carpenters, welders, etc. Demand for unskilled artisans will be derived from it.

8.2.7 It is important that manpower planning is conceived as a part of an integrated system and dependable, accurate linkages developed to suit different conditions.

8.3 FORMULATING A PLAN.

8.3.1 The success or otherwise of a plan will depend on the accuracy of the data used, involvement of relevant agencies including plant designers, national planners for industrial sector and manpower, their experience and knowledge of skills required for manufacture of capital

goods and their infrastructure and concerned educational and training institutions. A possible framework is to obtain future demands from the industry in terms of 15 digit codes developed for capital goods, from existing as well as new units, analyse them and add to them the likely demands of the small scale sectors (in some countries, valuable data may be available from Federations of Small Scale Industries and Government agencies for development of small scale industries), feed the information to relevant national bodies for education and training and obtain from them their plans for timely action to cover the gap. It will be necessary to keep the exercise as dynamic, to enable it to take into account changes in plans, priorities, technologies and plant sizes. It will also be necessary to involve agencies connected with analysis and promotion of productivity so that impact of anticipated levels or productivity in the context of gradually-increasing level of complexity of manufacturing technologies on demands for skills can be taken into account. Future demands will also be related to wage systems and working hours and, therefore, will need to be coordinated with national workers' bodies.

8.3.2 TRAINING PROFILES need to be developed for different disciplines as recommended in First Consultation on Capital Goods in Brussels in September, 1981.

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8.4 USE OF PLANNING METHODOLOGY FOR MANPOWER PLANNING - NATIONAL, REGIONAL AND GLOBAL.

8.4.1 The planning methodology presented in this paper provides to the planner all the basic data required for manpower planning. It readily provides the demands, year-wise, of all types of capital goods including their major specifications and manufacturing characteristics.

8.4.2 The codes evolved and used in the planning process can be easilly linked to quantitative and qualitative requirements of engineers and workers - and the fact that the methodology can provide arithmetic totals in terms of weights, values and numbers, enables it to be dynamically used either for national planning or regional cooperation in terms of education and training or global projections of manpower demands for this sector. It quickly provides the basis of continuous updating and avoids the need (universal in most developing countries) for periodic, fresh demand studies, saving considerable money and manpower.

8.4.3 It is felt that UNIDO can play a very important role in assisting the developing countries in manpower planning by collecting, analysing and disseminating relevant data on relationship between outputs and managerial, engineering and artisan skills, under different socio-economic and environmental conditions in organised and small scale sectors. These could conceivably be done using the 15 digit codes for capital goods and 8 digit codes for castings and forgings - by adding to them additional digits for codes to represent indices of complexity and

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country characteristics (e.g. population, level of technological development in C.G. industry, plant sizes and characteristics of manufacturing technology e.g. levels of mechanisation and automation).

8.5 UNIDO's ROLE.

8.5.1 UNIDO could assist in -

(i) developing linkages between requirements for different skills and codified production parameters of capital goods as a guide, and

(ii) providing training facilities on a regional or sub-regional basis in disciplines such as production planning and control, industrial engineering and MIS.

CHAPTER - 9

FUTURE COURSE OF ACTION

9.1 The future course of action should be to synthesize the new methodology evolved, tested and successfully applied by UNIDO's Capital Goods Development Project in Turkey and later adapted for use in other similar projects, with the extensive background and experience in UNIDO Headquarters and other developing countries. The project in Turkey dealt with the capital goods for the following process and service industries:-

Power (generation, distribution and transmission),
Mining (Coal, Ferrous and Non-Ferrous ores and chemicals),
Pulp and Paper,
Cement,
Foods and Beverages,
Petrochemicals,
Fertilizers,
Railways,

In the area of general purpose machines, it covered metal cutting and metal forming machine tools and diesel engines while in the infrastructural area, it dealt with castings and forgings. Other areas were subsequently covered with the same methodology, in a Project in Venezuela. During execution of these projects, UNIDO has identified well-defined, coordinated steps in a scientific approach using international coding systems with a relatively simple mathematical model for macro-level planning of investment opportunities.

9.2 Two international codes were used in the Turkey project. The "International Standard Industries Classification (ISIC) of all Economic Activities" has been used for classifying and codifying parameters of industries and the "Standard International Trade Classification Rev. 2(SITC)" for classifying and codifying the capital goods.

9.3 UNIDO has also developed a comprehensive system for complexity analysis of capital goods which can be put to a variety of uses for macro and micro-level planning including manpower planning. A combination of conceptual framework of these two approaches can now be evolved.

9.4 **ANNEXURE-I** gives a list of major division, divisions and major groups of industries covered by the ISIC code. Considering constraints of time and resources, a selective approach has generally to be adopted to identify high priority sectors. Simultaneously, urgent consideration has to be given to the infrastructure required for the growth of the capital goods industry. It is hoped that UNIDO will assist the developing countries in establishing national priorities of selected user industries, identified machine building industries and infrastructure as a first step.

9.5 Using the data already available with UNIDO, from the documentation of the Turkey project, further classification and codification of selected user industries in the following basic steps could be prepared for the guidance of developing countries:

(i) Preparation of "MODULAR PRODUCTION CHARTS" to show relationship of products, intermediate products, by-products and waste products, identifying stages of manufacture.

(ii) Codification of other industries on the basis of a cumulative 9 digit coding system consisting of industry sector (4), products (1), production stages (2), technology (1), capacity (1) already developed by the project in Turkey. For international usage, the code may be expanded to 10 digits with 2 digits for products, if necessary.

(iii) Modular process flow diagram and plant survey forms to record relevant details of all equipment for each TECHNOLOGY-CAPACITY COMBINATION.

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9.6 For classification and codification of capital goods, a 15-digit system starting with the 5-digit SITC code has already been developed, first 14 digits being for machine definition including nomenclature, major specifications and manufacturing characteristics, and the last digit for information on whether it is imported or indigenously manufactured. Similar codes will need to be evolved for equipment not yet covered by the Turkey Project but required by other countries.

9.7 Once a study of the existing codes for industries and and capital goods has been completed by national teams, modification, if necessary, of these as well as evolution of additional codes for items not available have to be coordinated to evolve internationally applicable codes - a crucial activity prior to arithmetic totals of codified capital goods. Coefficients have been built up to indicate the relationship between each code of the industry activity and codified capital goods required for them in the case of industries covered by the Turkey Project. These coefficients quantify the physical and financial values of capital goods required for specified STANDARD plant capacities with such technologies as can be foreseen for future plants. For other industries and other technology-capacity combinations, data will need to be built up.

9.8 Projection of domestic demand for commodities has to be coordinated by national agencies and it will help if an exercise could be undertaken to assist national experts to make the necessary projections, particularly spelling out various assumptions that are necessary. Projections for 15-20 years are required with the background of experience in developing countries that from the time of their conceptualisation, heavy machine building units take 7-12 years years before they reach optimum capacity utilisation.

9.9 Simultaneously, with the demand analysis, capacity of existing capital goods industry needs to be surveyed.

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This takes into account the equipment available, technological capabilities, quality control and present as well as future capacity for production of capital goods as CODIFIED. It will be desirable to evolve a standard questionnaire for this purpose.

9.10 As a part of the exercise a data bank for capacity available for manufacture of components in the ancillary industry is essential. Methods and formats for data collection and analysis can be standardised. The data can then be used at the time of feasibility studies and micro-level planning.

9.11 Considerable further work is necessary on proposals to achieve actual, tangible progress in the following areas related to capital goods development:-

(i) R and D in industry and its relationship with the machinery-producing units,

(ii) Standardisation,

(iii) Quality control,

(iv) Manpower requirements and their training profiles.

9.12 These factors should normally lead to steps for optimal utilisation of existing assets and emphasis on speedy development of capital goods in cases where they are economically viable. Projects already conceived may have to be evaluated afresh to ensure that they are based on full utilisation of existing facilities and take into account a new thrust on exports of goods and services. Heavy industries like equipment for power generation, distribution and transmission and sophisticated products like machine tools, diesel and petrol engines, requiring high initial capital cost and imported, costly technology, have to be subjected to a careful review to determine priorities in the context of available resources as also the possibilities of regional cooperation.

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9.13 Considering their high capital-output and capital-labour ratios as well as long gestation periods, some heavy and/or high complexity machine-building industries may have to be developed in the public sector. Simultaneously, policy measures may have to be planned and implemented for the private sector to enable it to become a dependable and dynamic source for a wide range of capital goods and/or parts and components for units in the public sector, particularly for items of process equipment based on steel fabrication, as well as machine tools. UNIDO projects to assist the developing countries in deciding on incentives to improve their productivity including procedural, technological and management aspects and taking into account the current constraints of high mobility and consequent shortages of trained, qualified engineers and technicians in many developing countries, will also help.

9.14 From a study of data of capital goods industry in some developing countries, it appears that not only its development but its capacity utilisation occasionally suffer on account of a number of factors - the principal amongst them being:

(i) Non-availability of imported inputs such as machinery and plant, raw materials, imported parts, components and sub-assemblies on account of scarcity of foreign exchange,

(ii) Scarcity of local currency,

(iii) Inadequate development of infrastructure in the form of quality castings and forgings,

(iv) Shortage of qualified engineers and technicians for production management as well as other disciplines such as industrial engineering, production planning and control, quality control and design.

A UNIDO project to study the impact of these constraints on future planning of industries in depth in developing countries will be useful.

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9.15 INVESTMENT POSSIBILITIES

After totals of demand for capital goods as codified are available, they have to be examined for the purpose of aggregating them to evolve product mixes for investment possibilities for either expansion of existing units or setting up new ones with due regard to proposals in the pipeline including these in different stages of implementation. Most developing countries need assistance to assess the demand-capacity gaps based on optimisation of resources, take manufacture-or-import decisions and prepare a portfolio of projects for domestic financing and foreign investment as well as to carry out feasibility studies.

9.16 POLICY INSTRUMENTS

Import policy, licensing of industrial capacity, allocation of resources, distribution between public and private sector, direct and indirect incentives for manufacture are some of the issues which have a critical bearing on the development of the capital goods sector. Most developing countries also need help to analyse the present policites and consider suitable modifications in the light of experience gained in other countries.

9.17 In order to enable all developing countries to take advantage of the methodology for industrial planning with particular reference to capital goods, evolved tested and proved in UNIDO assisted projects, workshops should be held at intervals.

9.18 The course of action suggested above should enable developing countries to build up a flexible national data system on demand and capacity capable of being routinely updated and eliminating the need for time-to-time costly investigations for specific products for different periods.

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9.19 SUMMARY

9.19.1 UNIDO should, through a combination of training workshops and consultancy, assist developing countries to -

(i) apply a flexible methodology, already tested and proved for industrial planning in general and their capital goods industries in particular, and capable of easy incorporation of changes in plans and priorities,

(ii) introduce a system of industrial planning capable of providing continuous, reliable data for investment decisions,

(iii) formulate detailed projections of domestic demand and anticipated imports of capital goods,

(iv) identify production and technological gaps,

(v) prepare pre-feasibility and feasibility reports for specific projects on the basis of a scientific analysis of essential technological parameters of demand and capacity for specific goods from ALL user sectors,

(vi) arrive at policy and other measures necessary to promote growth of capital goods in particular and other industries in general,

(vii) make definitive plans for exports of capital goods or parts and components on a regional basis or otherwise.

9.19.2 UNIDO should evolve for future reference exhaustive data on -

(a) classification of industries including, in particular, alternative technology-capacity combinations for process industries and production stages for each,

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(b) codifications of all capital goods including parameters of nomenclature, major specifications and manufacturing characteristics,

(c) coefficients between capacity of user industries and their capital goods,

(d) sub-regional, regional and global demands of different categories and types of capital goods,

(e) manpower requirements for different types of capital goods related to levels of technological growth, technologies and plant sizes.

9.20 PROPOSED TIME-FRAME.

(i) Intensive training workshops for application of of this methodology on a regional basis for Africa, South East Asia, Middle East and Latin America - 1985 and 1986.

(ii) Consultancy services to developing countries ready and keen to apply this methodology - from 1985 onwards.

(iii) Reference data as suggested in Para 9.19.2 to be compiled by UNIDO - 1985-86.

(iv) Synthesis between this planning methodology and ATC to be completed - 1985-86.

(v) Reference data on manpower requirements during 1985-87.

(vi) Training workshops on a sub-regional or regional basis for specific disciplines such as Production Planning & Control and Industrial Engineering - 1985 onwards.

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APPENDIX-I

METHODOLOGY FOR MACHINE TOOLS, RAILWAY ROLLING STOCK, CASTINGS AND FORGINGS.

1. MACHINE TOOLS.

1.1 Considering the state of development of this industry in Turkey, the most important indicators that could be used for making the machine tool demand forecast were the previous years' total demand and GNP. These two factors are closely related to each other and both of them have shown similar trends in recent years.

1.2 In the "Machine Tool Industry" Publication of United Nations, economic structure and machine tool consumption of more than 80 countries has been studied and related to several economic indicators. Even though the correlation coefficient is higher for capital accumulation per capita, it was decided not to use this because of difficulties in obtaining relevant data. With high correlation coefficient between GNP/capita and Machine tool/capita, GNP was accepted as a logical indicator.

1.3 With the background of planning for full utilisation of installed capacity, two sets of projections were made for the "Turkish Model" used in this study-one with normally expected growth rate of GNP and the second with lower figures for calculating the absolute minimum demand. It was felt that where high levels of investment are involved, it would be better to have the initial capacity installed on the basis of the minimum demand and expand it as market conditions warrant.

1.4 The values calculated for Turkish conditions were very interestingly, similar to the value for "Developing-Developed Countries" as shown in UNIDO's publication

"Machine Tool Industry".

1.5 CLASSIFICATION AND CODIFICATIONS OF MACHINE TOOLS

15 digits code for all machine tools were developed using the same criteria as for other machines.

1.6 All the previous studies had been carried out on the basis of projections for broad groups of machines, each group containing not only different specifications of each category of machine tools but also machines of different types and categories. It was felt that it would be desirable to conduct a study on the basis of SITC codes expanded to cover not only the individual categories of machine tools but also their specificatins and broad manufacturing characteristics indicated in 15 digit codes developed for them.

1.7 For the purpose of the initial study however, only the first 9 digits were used- i.e. SITC code, basic machine, major specification (capacity) and one more specification. These adequately represented the depth to which it was necessary to pursue this research at that point. The balance will be used at the time of feasibility studies when more details are necessary to be recorded and analysed.

1.8 DEMAND FORECASTS

All machine tools which could substitute machines under consideration were taken into account for calculating their share in consumption figures. For each individual group, unit prices and average values were calculated and used in detailing the total machine tools demand forecast figures. These were shown in "Machine Identification Table" which indicates major specifications which best identify the machine, and the relevant 15 digit code.

By using the import values of 1976-1980, unit price, average value and group coefficients were calculated

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and shown. The total machine tool demand forecast 1980 based was multiplied by the group coefficient to get the forecast value for that specific group and then divided by the unit price to get the anticipated demand.

1.9 EVALUATION OF THE RESULTS

It was felt that it will be useful to consider the following points while analysing the values of demand forecast of machine tools upto the year 2000.

(i) In the forecasts, the domestic demand is considered as the sum of imports and the domestic production of machine tools. But the actual demand may be higher since imports were conditioned by restrictions for different types of machine tools.

(ii) The study only determines the domestic demand. But while making production plans, it will be necessary to take into consideration the increasing importance given to exports by most developing countries.

(iii) It is obvious that in order to be successful, it is necessary to produce goods which meet international standards of quality and can be offered at competitive price. In this context, production of high quality goods in the ancillary industries for machine tool manufacture will increase the demand for automatic lathes and grinding machines in them.

(iv) It will be crucial to create and develop an aggressive marketting organisation which can continuously monitor the demands in other countries and besides feeding the government with the requisite data for bilateral discussions mount, an offensive for selling machine tools in potential markets.

1.10 UTILISATION OF INSTALLED CAPACITY

After determining the production programme, an analysis of capacity available was carried out and new proposals developed for optimum utilisation of installed capacity for each production plant. Capacity calculations were done on the basis of standard working time in hours obtained from licensors.

2. ROLLING STOCK FOR RAILWAYS

2.1 INTRODUCTION

2.1.1 Most developing countries place heavy emphasis on the development of the transport sector as an essential element of economic progress. It is desirable, however, to carry out detailed studies, and draw up a master transport plan for a 10-15 year period. Railways, in most countrties, occupy a significant position in the scheme of development of the transport sector.

2.1.2 Demand and capacity for rolling stock cannot be considered in isolation from other parts and components forming the Railway system. The demand is dependent to a very large extent on operating conditions, operating efficiency, track conditions, signals and telecommunication facilities, commercial organisation and workshop facilities in addition to others.

2.1.3 Any demand projections of rolling stock will use parameters regarding usage of locomotives, passenger cars and freight cars as well as average percentages of rolling stock under repairs. It is, however, necessary to work out targets for these basic parameters on the basis of actual results on comparable, efficient Railway systems and demand figures for additional stock worked out on the basis of targetted parameters.

2.1.4 A technological review of the present capacity of Railway workshops and also of the proposed expansions and new workshops for manufacture and repair of locomotives, passenger and freight cars is inherent in planning of capacity for rolling stock. This should result in modifications in these plants, considered advisable for improving the utilisation of present and proposed installed capacities and also to make the Railways less dependent on imports.

2.2 MASTER PLAN FOR RAILWAYS

The Railways plan was based on a Master Transport Plan for the country, one which identified the traffic load for passengers and freight on different subsystems including Railways.

The basic parameters of planning for Railways is originating freight traffic in terms of tonnes and passenger traffic in terms of passenger-KMS. They are then translated into the principal index of work-load in Railways namely, Net Tonnes Kms (NT KMs). NTKms are converted intc Gross Tonne Kms (GTKMs) for the purpose of assessing locomotive requirements.

The division between rail and road was done after an evaluation of both for each transport corridor.

2.3 RAILWAY PLANNING - SOME IMPORTANT BASIC CONSIDERATIONS

2.3.1 While the main objective of any Railway Plan has to be to carry the projected quantum of passenger and goods traffic, its achievements, at different times have to be viewed in the context of priorities of many related factors such as:

- rehabilitation/replacement of overaged assets;
- preparing the Railways to handle traffic for new plants requiring large volumes of transport of raw materials and finished goods (e.g. steel plants).
- modernisation of traction through dieselisation and electrification coupled with improvements in signalling and track;
- an improvement in the efficiency of the network through cost reduction and better utilisation of assets.

2.3.2 Passenger traffic is planned separately for suburban and non-suburban categories. With competition from an efficient system of roadways, the growth of passenger traffic on Railways will depend on cost, comfort and punctuality.

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2.3.3 Demand is considerably influenced by the number of fast and slow freight trains considering the NTKms per loco on fast trains may be 5 to 6 times that on slow trains - depending on various operational factors.

2.4 RATIONALE FOR A TOTAL NETWORK PLAN

2.4.1 Most Railways are going in progressively for more and more electrification and dieselisation. It is recommended that a total cost-benefit analysis of the alternatives of traction for different sections taking into account the density of traffic and other factors be done, particularly in the context of a total energy plan.

2.4.2 With growing emphasis on exports and transport traffic(through Turkey) containerisation of railways transport may be given special consideration.

2.4.3 Any plan of Railways for rolling stock must take into account the steps necessary to maximise the utilisation of existing capacity. The factors which should be taken into account are:-

(i) Power availability affecting output in workshops motive/power depots;
(ii) Constraints of performance amongst principal users of Railway system e.g. steel plants, mines;
(iii) Maintenance of permanent way;
(iv) Modernisation of rolling stock;
(v) Productivity in workshops;
(vi) Introduction of storage-cum-road distribution facilities;
(vii) Modernization of workshops;
(viii) Optimal design of wagons for different types of traffic;
(ix) Communication facilities in yards;
(x) Facilities for point to point rakes e.g. for steel plant traffic;
(xi) Modernisation of signals and telecommunication system.

APPENDIX-I

3. CASTINGS AND FORGINGS

3.1 The demand for castings and forgings in general can be directly related to parameters such as total consumptions of steel, GNP but any logical attempt to plan these crucial infrastructural facilities for industries in general, and capital goods in particular, pre-supposes availability of demand and capacity data according to parameters which determine the type of facilities and plant sizes. These parameters are material, weight and type/complexity and it is essential to codify them for data collection and analysis. SITC code 67930 covers steel forgings and **ANNEXURE- XX** shows the classification of criteria relevant to them. SITC codes 67941 and 67942 are for iron castings and steel castings and **ANNEXURES-XXI & XXII** indicate classification of criteria relevant to them.

3.2 A very large part of demand for iron castings are simple grey iron castings of light weight and require low capital. Capacity for these in most developing countries is set up by small scale units and market forces take care of adequate availabililty. In cases, however, of iron castings of over 100 Kg. and those involving high degree of complexity even if they are of smaller weights, capacity needs to be specifically planned.

3.3 This in turn implies that accurate demand data for them should be available necessitating a demand survey for them covering each user industry sector or subsector eg. engines for automobile sector, heavy castings for steel industry. The demand collected in terms of quantities of individual castings has to be converted into weights of rough castings and then entered into computer files as basic input which contains -

user plant name,
user plant location,
8 digit code for each casting nomenclature,
quantity required yearwise in numbers,
weight of each casting,
value of each casting in US $.

From this basic input, the following outputs can be easily obtained through the computer for EACH 8 digit classification of castings,

(i) yearwise demand by weight, industry wise,
(ii) yearwise demand by value, industry wise,
(iii) yearwise demand by weight, national totals,
(iv) yearwise demand by value, national totals.

Demand data for steel castings and forgings is required to be collected and collated on the same basis.

ANNEXURE-I
(Ref. Para 2.13

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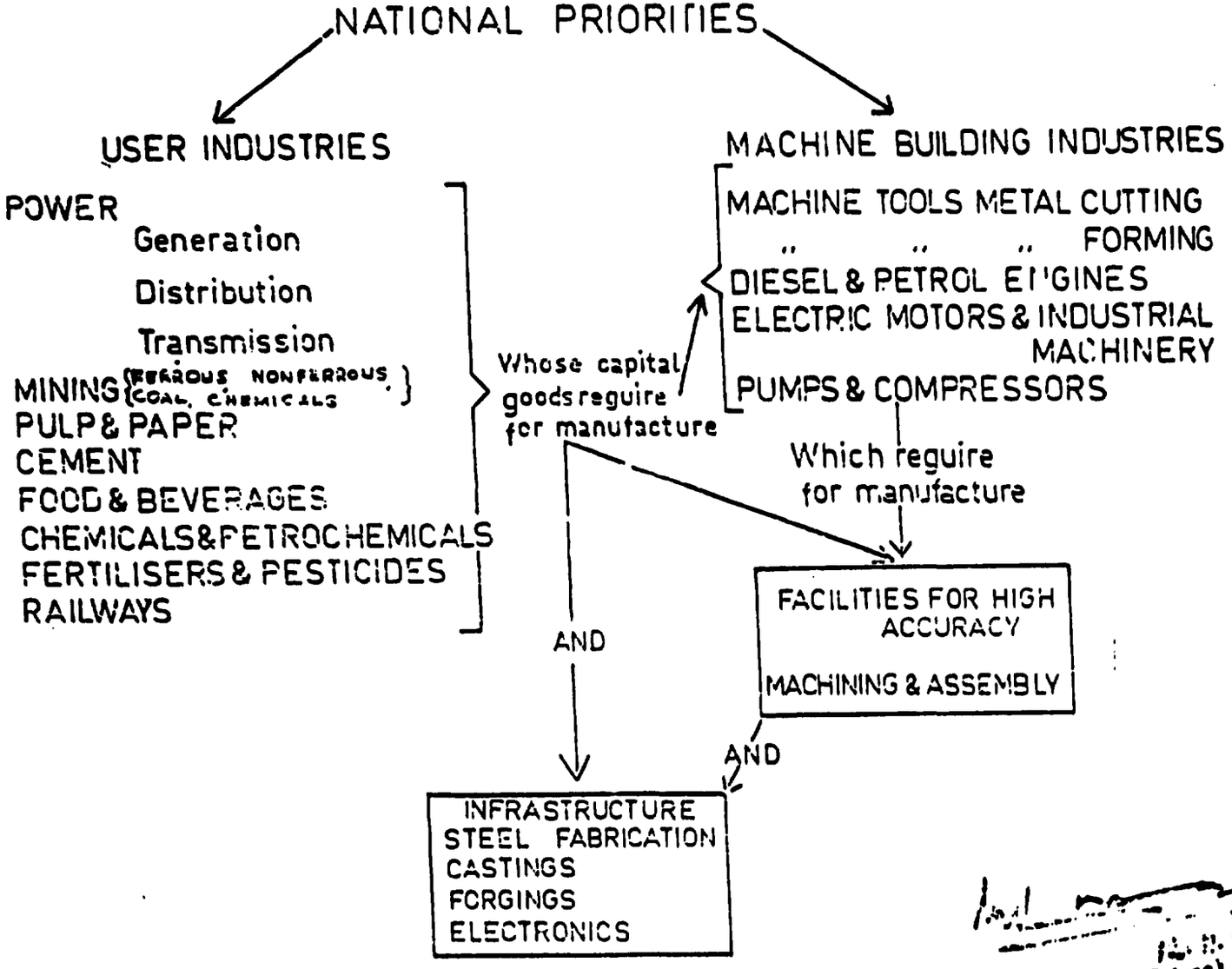
LIST OF MAJOR DIVISIONS, DIVISIONS AND MAJOR GROUPS.

Division	Major group	Title of category
		Major Division 1. Agriculture, Hunting, Forestry and Fishing
11		Agriculture and Hunting
	111	Agricultural and livestock production
	112	Agricultural services
	113	Hunting, trapping and game propagation
12		Forestry and Logging
	121	Forestry
	122	Logging
13	130	Fishing
		Major Division 2. Mining and Quarrying
21	210	Coal Mining
22	220	Crude Petroleum and Natural Gas Production
23	230	Metal Ore Mining
29	290	Other Mining
		Major Division 3. Manufacturing
31		Manufacture of Food, Beverages and Tobacco
	311-312	Food manufacturing
	313	Beverage industries
	314	Tobacco manufactures
32		Textile, Wearing Apparel and Leather Industries
	321	Manufacture of textiles
	322	Manufacture of wearing apparel, except footwear
	323	Manufacture of leather and products of leather, leather substitutes and fur, except footwear and wearing apparel
	324	Manufacture of footwear, except vulcanized or moulded rubber or plastic footwear
33		Manufacture of Wood and Wood Products, Including Furniture
	331	Manufacture of wood and wood and cork products, except furniture
	332	Manufacture of furniture and fixtures, except primarily of metal
34		Manufacture of Paper and Paper Products, Printing and Publishing
	341	Manufacture of paper and paper products
	342	Printing, publishing and allied industries
35		Manufacture of Chemicals and Chemical, Petroleum, Coal, Rubber and Plastic Products
	351	Manufacture of industrial chemicals
	352	Manufacture of other chemical products
	353	Petroleum refineries
	354	Manufacture of miscellaneous products of petroleum and coal
	355	Manufacture of rubber products
	356	Manufacture of plastic products not elsewhere classified
36		Manufacture of Non-Metallic Mineral Products, except Products of Petroleum and Coal
	361	Manufacture of pottery, china and earthenware
	362	Manufacture of glass and glass products
	369	Manufacture of other non-metallic mineral products
37		Basic Metal Industries
	371	Iron and steel basic industries
	372	Non-ferrous metal basic industries
38		Manufacture of Fabricated Metal Products, Machinery and Equipment
	381	Manufacture of fabricated metal products, except machinery and equipment
	382	Manufacture of machinery except electrical
	383	Manufacture of electrical machinery apparatus, appliances and supplies
	384	Manufacture of transport equipment
	385	Manufacture of professional and scientific and measuring and controlling equipment not elsewhere classified, and of photographic and optical goods
39	390	Other Manufacturing Industries
		Major Division 4. Electricity, Gas and Water
41	410	Electricity, Gas and Steam
42	420	Water Works and Supply
		Major Division 5. Construction
50	500	Construction
		Major Division 6. Wholesale and Retail Trade and Restaurants and Hotels
61	610	Wholesale Trade
62	620	Retail Trade
63		Restaurants and Hotels
	631	Restaurants, cafés and other eating and drinking places
	632	Hotels, rooming houses, camps and other lodging places
		Major Division 7. Transport, Storage and Communication
71		Transport and Storage
	711	Land transport
	712	Water transport
	713	Air transport
	719	Services allied to transport
72	720	Communication
		Major Division 8. Financing, Insurance, Real Estate and Business Services
81	810	Financial Institutions
82	820	Insurance
83		Real Estate and Business Services
	831	Real estate
	832	Business services except machinery and equipment rental and leasing
	833	Machinery and equipment rental and leasing
		Major Division 9. Community, Social and Personal Services
91	910	Public Administration and Defence
92	920	Sanitary and Similar Services
93		Social and Related Community Services
	931	Education services
	932	Research and scientific institutes
	933	Medical, dental, other health and veterinary services
	934	Welfare institutions
	935	Business, professional and labour associations
	939	Other social and related community services
94		Recreational and Cultural Services
	941	Motion picture and other entertainment services
	942	Libraries, museums, botanical and zoological gardens, and other cultural services not elsewhere classified
	949	Amusement and recreational services not elsewhere classified
95		Personal and Household Services
	951	Repair services not elsewhere classified
	952	Laundries, laundry services, and cleaning and dyeing plants
	953	Domestic services
	959	Miscellaneous personal services
96	960	International and Other Extra-Territorial Bodies
		Major Division 0. Activities not Adequately Defined
0	000	Activities not adequately defined.

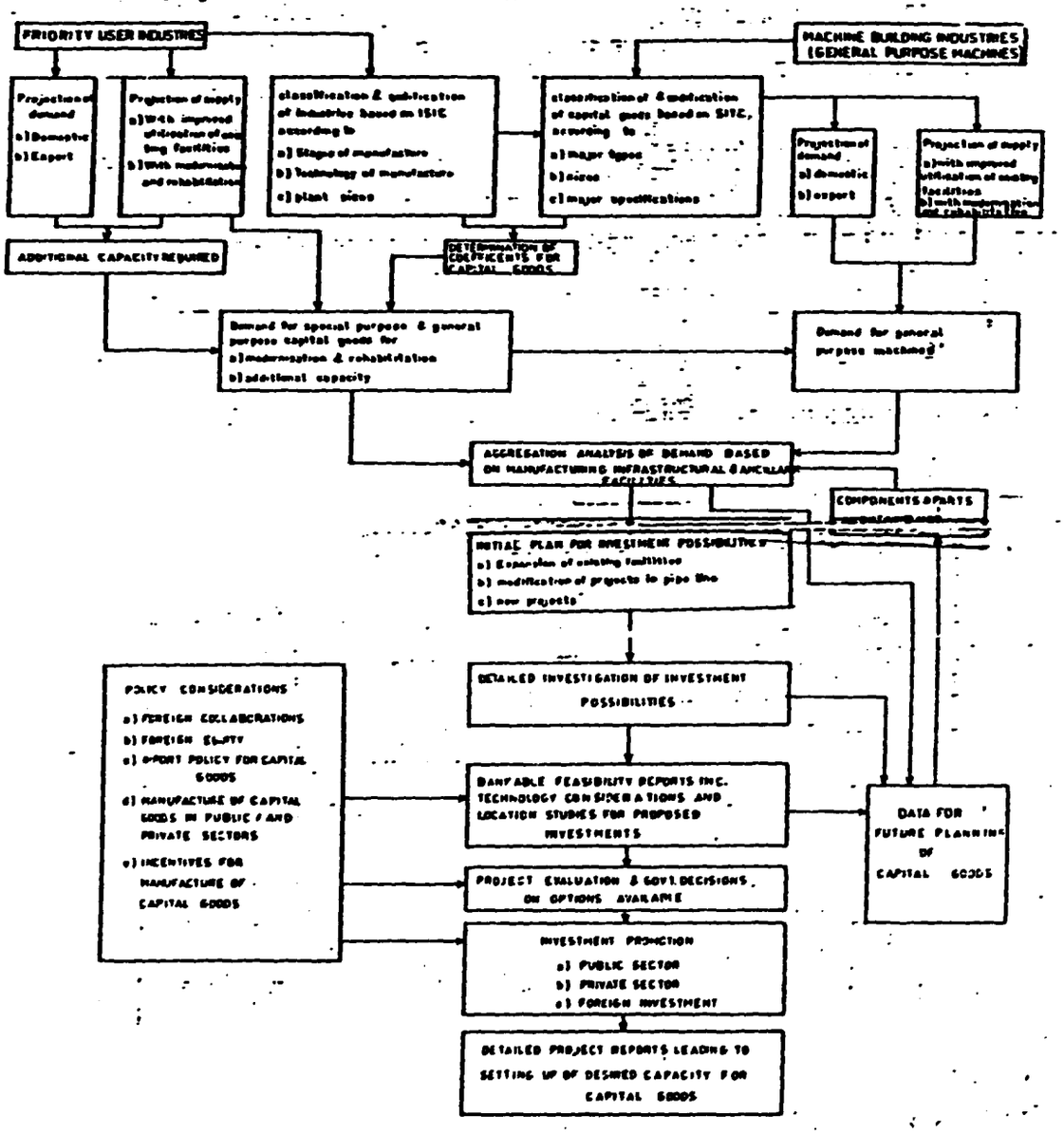
CAPITAL GOODS DEVELOPMENT PROJECT IN TURKEY



ANNEXURE-II
(Ref. Para 2.13)

ANNEXURE-III
(Ref. Para 2.13)

CAPITAL GOODS DEVELOPMENT PROJECT IN TURKEY
STRATEGY



Fabricated equipments

SITC Code 711.11 - Steam and other vapour generating boilers
- STEAM BOILERS FOR POWER PLANTS AND USER INDUSTRIES

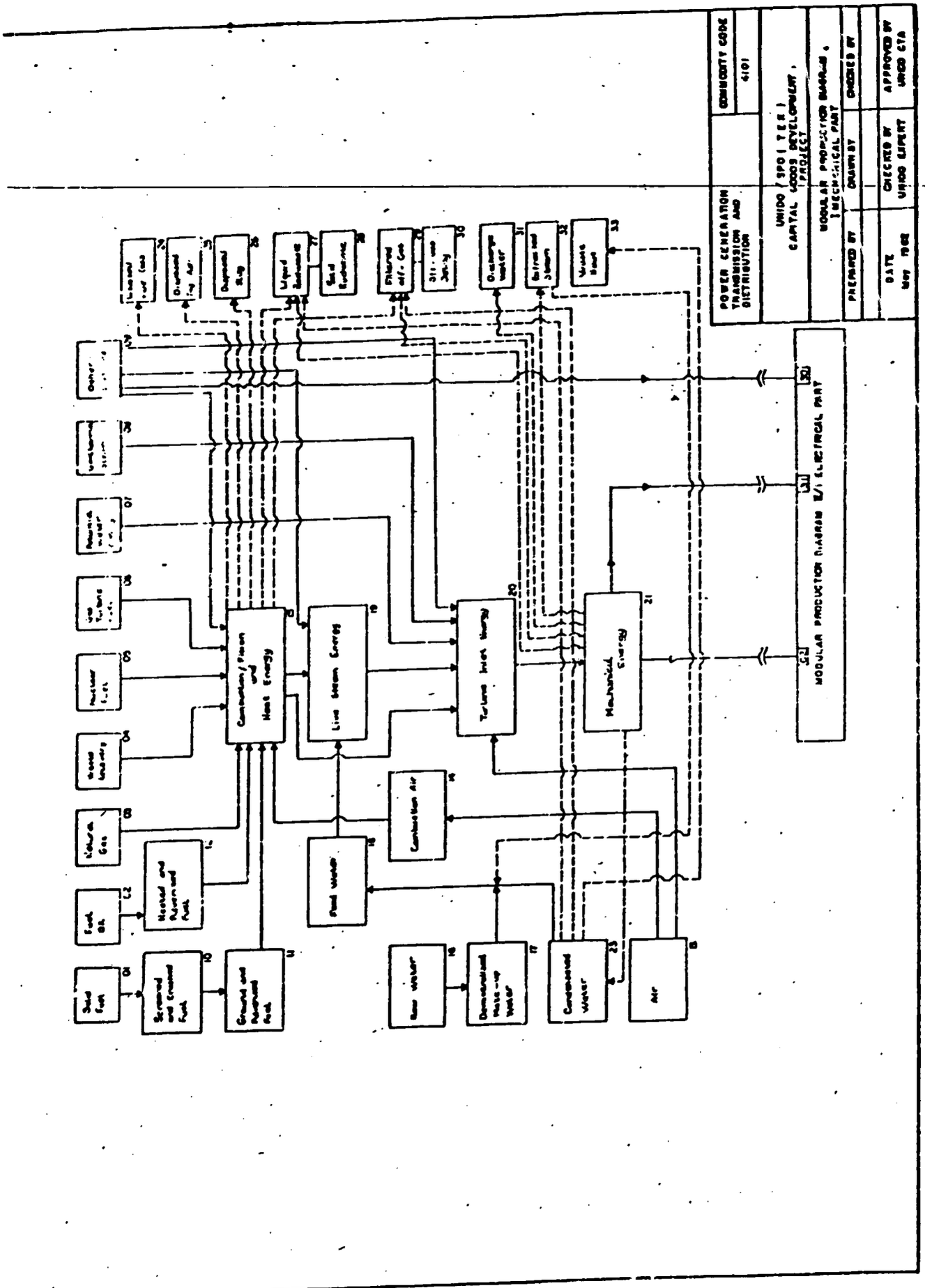
6-7		8		9		10		11		12		13		14		15	
Basic Machine Nomenclature		Major Specification (Capacity)		Major Spec.-1 Optional		Major Spec.-2 Optional		Type		Manufacturing characteristic -1		Manufacturing characteristic -2		Manufacturing characteristic -3		Origin	
Code	Name	Code	Output t/h	Code	Pressure (kg/cm²)	Code	Temperature (°C)	Code	Description	Code	Weight(tons)	Code	Main body materials	Code	Plate thickness mm.	Code	
11	Natural circulation boilers	1	Upto 25	1	Upto 50	1	Upto 200	1	Bituminous coal fired	1	Upto 5	1	Mild steel upto 0.20 carbon (untested quality)	1	Upto 20	1	Turkey
10	Once-through boilers	2	25-50	2	50-100	2	200-300	2	Brown coal fired	2	5-10	2	Carbon steel above 0.20 C tested quality	2	20-40	2	Imports
11	Subcritical boilers	3	50-100	3	100-150	3	300-400	3	Lignite fired	3	10-25	3	Boiler steel	3	40-50		
12	Supercritical boilers	4	100-200	4	150-200	4	400-450	4	Fuel oil fired	4	25-50	4	Alloy steel	4	Over 50		
20	Controlled circulation boilers	5	200-300	5	200-250	5	450-500	5	Natural gas fired	5	50-100	5	High alloy steel				
30	Mono-tube boilers	6	300-500	6	250-300	6	500-550	6	Sulphite liquor fired	6	100-200	6	Stainless steel				
99	Others	7	500-1000	7	Over 300	7	Over 550	7	Combined fired	7	200-300	7	Non-ferrous materials				
		8	1000-2000					8	Waste fired	8	300-500						
		9	Over 2000					9	Others	9	Over 500	9	Others				

ANNEXURE-IV
(Ref. Para 2.14.3)

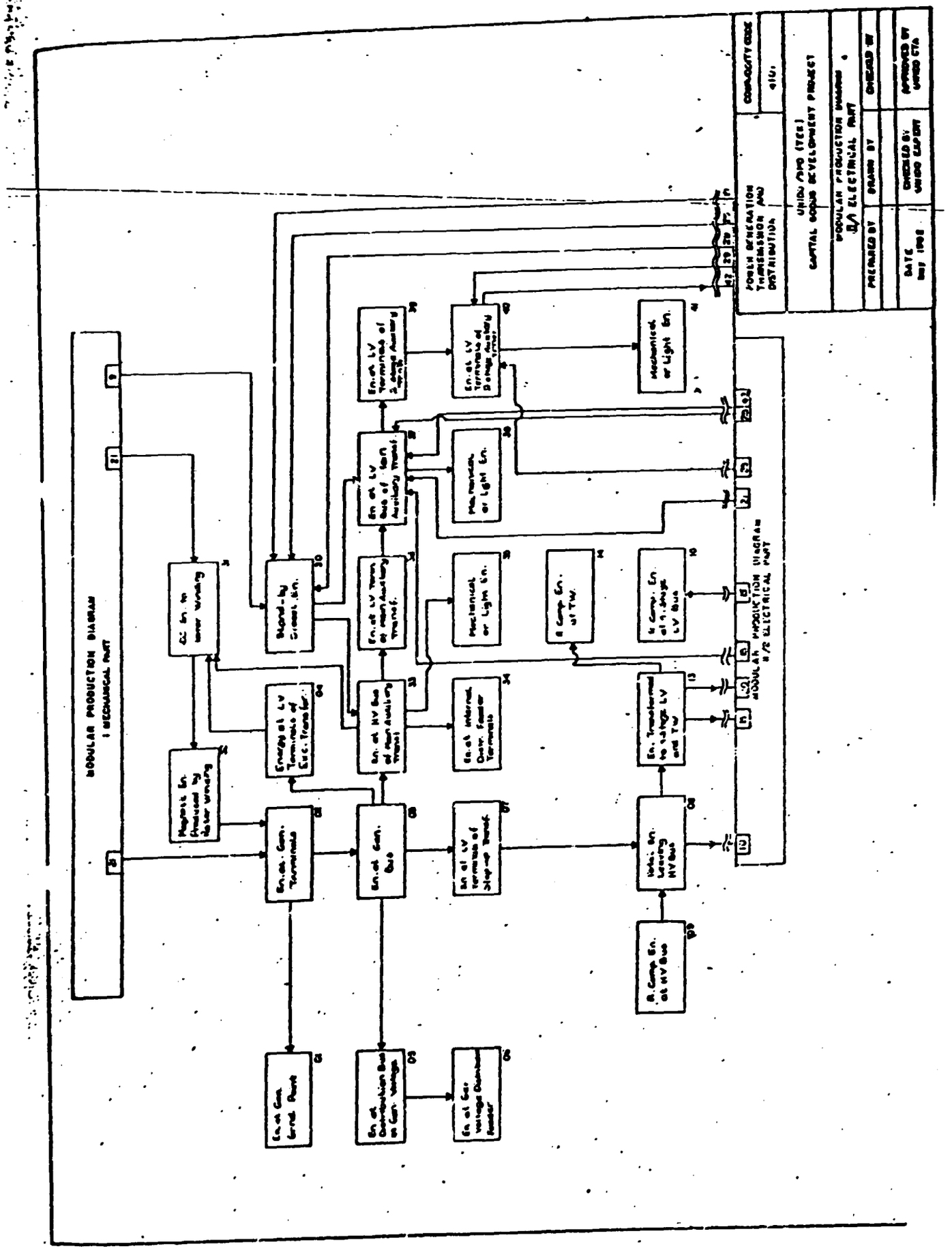
SITC Code 712.61 - Steam and other vapour units, not incorporating boilers
- STEAM TURBINE FOR POWER GENERATION AND PROCESS INDUSTRIES

6-7		8		9		10		11		12		13		14		15	
Basic Machine Nomenclature		Major Specification (Capacity)		Major Spec.-1 Optional		Major Spec.-2 Optional		Type		Manufacturing characteristic -1		Manufacturing characteristic -2		Manufacturing characteristic -3		Origin	
Code	Name	Code	Output (MW)	Code	Speed (RPM)	Code	Steam inlet pressure (kg/cm^2)	Code	Description	Code	Weight(tons)	Code	Main body material	Code	Max. Component Weight(tons)	Code	
00	Single-cylinder steam turbines	1	Upto 5	1	Upto 166.7	1	Upto 20	1	Impulse	1	Upto 5	1	Chilled iron casting	1	Upto 1	1	Turkey
01	Condensing turbines	2	5-20	2	166.7-300	2	20-50	2	Reaction	2	5-10	2	Grey iron casting	2	1-2	2	Imported
02	Back pressure turbines	3	20-50	3	300-375	3	50-100	3	Combined	3	10-25			3	2-5		
03	Extraction turbines	4	50-100	4	375-500	4	100-150			4	25-50	3	Alloy iron casting	4	5-10		
04	Turbines with automatic steam extraction and back pressure	5	100-150	5	500-750	5	150-200			5	50-100	4	Malleable iron casting	5	10-15		
		6	150-200	6	750-1000	6	200-250			6	100-200	5	Spheroidal iron casting	6	15-25		
		7	200-300	7	1000-1500	7	250-300			7	200-300	6	Carbon steel casting	7	25-50		
10	Multi-cylinder steam turbines	8	300-600	8	1500-3000	8	Over 300			8	300-500	7	Alloy steel casting	8	50-100		
11	Condensing turbines	9	Over 600	9	Over 3000			9	Others	9	Over 500	8	Non-ferrous casting	9	Over 100		
12	Back pressure turbines											9	Steel fabrication				
13	Extraction turbines																
14	Turbines with automatic steam extraction and back pressure																
99	Others																

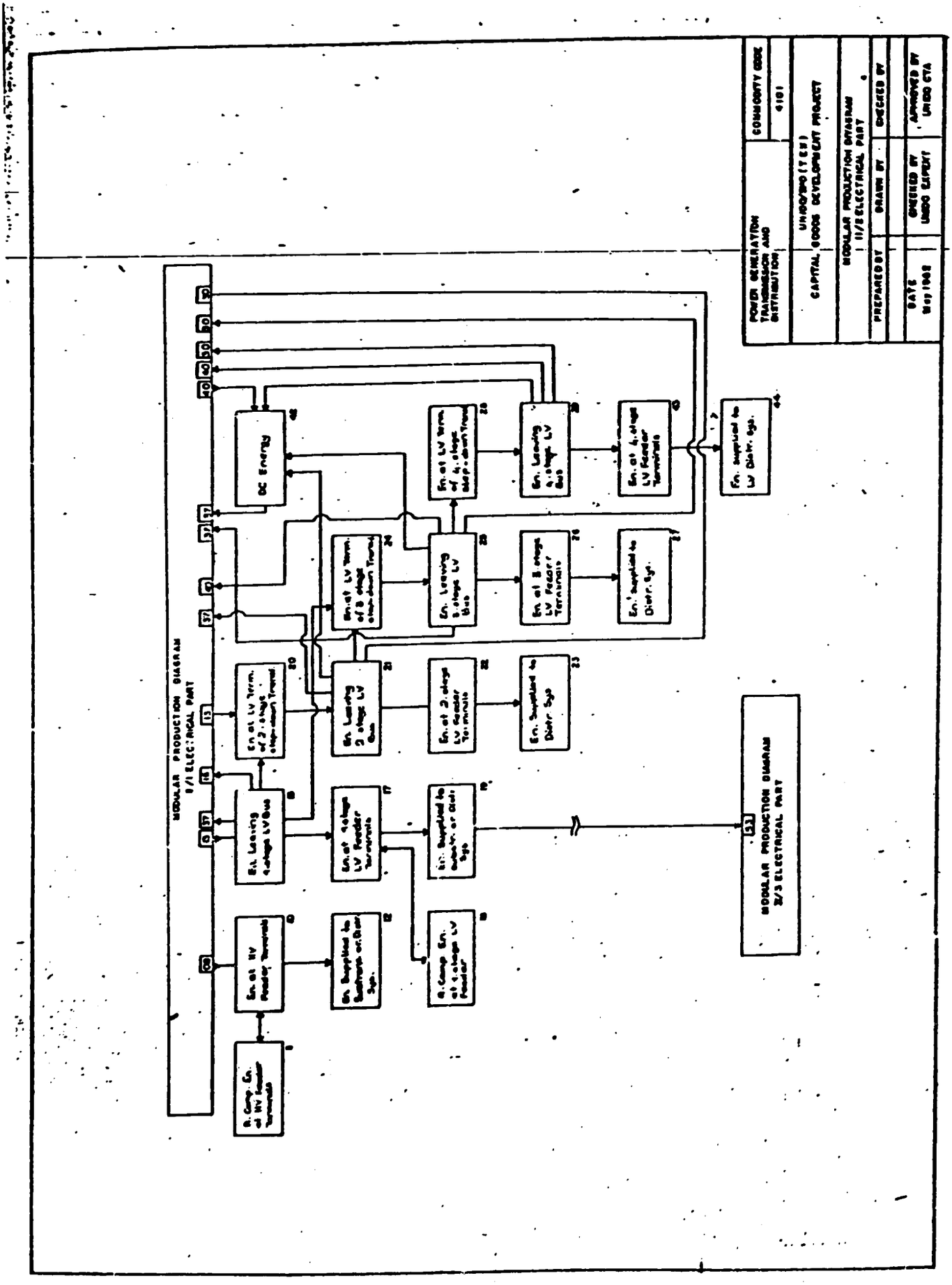
ANNEXURE-VI
(Ref. Para 3:4.5/I



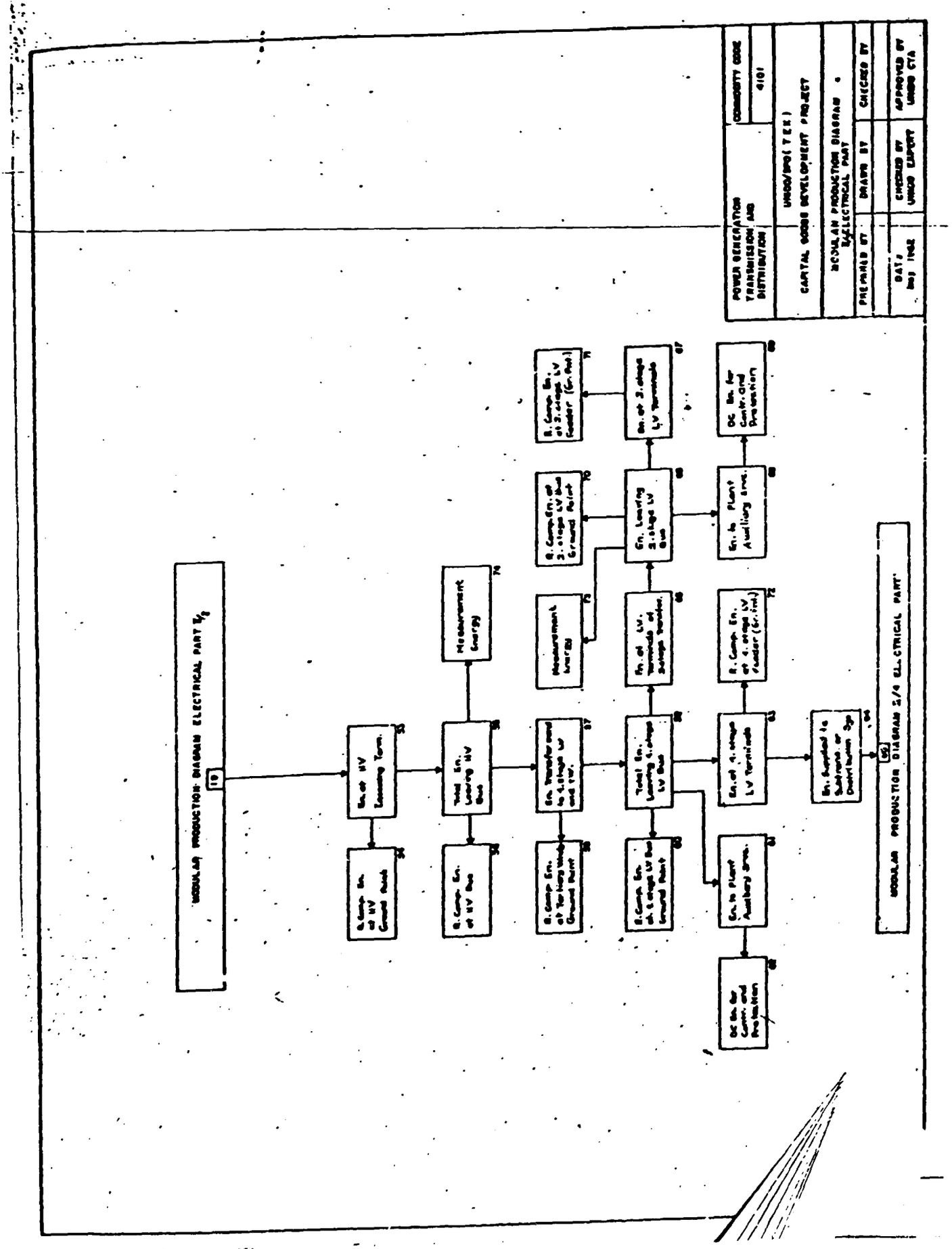
ANNEXURE-VII/1
(Ref.Para 3.4.5.1(II



ANNEXURE-VII/2
(Ref. Para 3.4.5.1(II



ANNEXURE-VII/3
(Ref. Para 3.4.5.1(II)



ANNEXURE-VII/4
(Ref. Para 3.4.5.1(II)

UNIDO/SPO (TEK)
CAPITAL GOODS DEVELOPMENT PROJECT IN TURKEY.

COMMODITY CODE : 4101
COMMODITY NAME : POWER GENERATION TRANSMISSION AND DISTRIBUTION PART I+II

PREPARED BY	CHECKED BY UNIDO EXPERT	APPROVED BY UNIDO CTA

PRODUCTION ACTIVITIES CHART
I- MECHANICAL PART

PRODUCTION STAGE		TECHNOLOGY		CRITICAL EQUIPMENT		DESIGN LINE CAPACITY	
Code	Name	Code	Name	Name	Capacity Range	Code	Capacity
021	Mechanical energy	1	Thermal power plant -solid fuel	Condensing turbine	165 MW	6	165 MW
021	"	1	"	"	210 MW	7	210 MW
021	"	1	"	Extrection turbine	840 MW	8	300 MW
021	"	1	Hydradic power plant potentiel water energy	Water turbine	5 MW	1	5 MW
021	"	7	"	"	15 MW	2	15 MW
021	"	7	"	"	46 MW	3	46 MW
021	"	7	"	"	62 MW	4	62 MW
021	"	7	"	"	135 MW	5	135 MW
021	"	7	"	"	181 MW	6	181 MW
021	"	7	"	"	306 MW	8	300 MW

UNIDO/SPO (TEK)
CAPITAL GOODS DEVELOPMENT PROJLCT IN TURKEY

COMMODITY CODE : 4101
COMMODITY NAME: POWER GENERATION TRANSMISSION AND DISTRIBUTION PART I+II

PREPARED BY	CHECKED BY UNIDO EXPERT	APPROVED BY UNIDO CTA

PRODUCTION ACTIVITIES CHART
II- ELECTRICAL PART

PRODUCTION STAGE		TECHNOLOGY		CRITICAL EQUIPMENT		DESIGN LINE CAPACITY	
Code	Name	Code	Name	Name	Capacity Range	Code	Capacity
401	Energy at generator ground point	1	Thermal Power Plant - Solid	Current transformer	300VA, 15 kV	6	165 MW
401	"	1	"	Voltage "	90 VA, 15 kV	7	210 MW
501	"	1	"	Current "	90 VA, 10.000 A	8	300 MW
201	"	7	Hydroelectric Power Plant (Water energy)	Load break switch	630 A, 6.3 kV	1	5 MW
301	"	7	"	Disconnecting switch	630 A, 6.3 kV	2	15 MW
401	"	7	"	"	2500 A, 13.8 kV	3	46 MW
401	"	7	"	Voltage transformer	100 VA, 13.8 kV	4	62 MW
401	"	7	"	Disconnecting switch	2000 A, 14.4 kV	5	135 MW
401	"	7	"	" "	2000 A, 14.4 kV	6	181 MW
401	"	7	"	Current transformer	90 VA, 15 kV	8	300 MW

UNIDO/SPO (TEK) COMMODITY CODE: 4101/0-9

CAPITAL GOODS DEVELOPMENT PROJECT IN TURKEY

EQUIPMENT REQUIREMENTS FOR TEK

Total Weight in Tons/~~Value in US $ (1000)~~

SITC Code	Basic Machine Name	YEARS										TOTAL 1991-2000
		1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	
59211	Reservoirs,tanks,etc	3090.0	884.0	1768.0								5742.0
71111	Steam boiler	11000.0	7000.0	14000.0								32000.0
71121	Heater	100.0	120.0	240.0								460.0
71122	Soot removers											
71261	Steam Turbines	760.0	495.0	990.0								2245.0
71262	Condensers	1320.0	250.0	500.0								2070.0
71622	Generators AC	20688.5	17948.3	9613.8	19011.4	9570.3	14970.3	13265.2	3313.9			109587.1
71623	Generators DC	200.8	116.1	51.4	158.8	126.2	137.9	101.1	66.9			963.2
71881	Water turbines	14099.0	9768.0	4078.0	15973.0	7927.0	11061.0	9074.0	3011.0			74991.0
72831	Screens	40.0	33.0	56.0								129.0
72832	Crushers	618.0	768.0	1536.0								2922.0
72833	Mixers		10.0	20.0								30.0
74121	Burner	132	144.0	288.0								564.0
74161	Heat exchangers	72	487.0	731.0								1290.0
74220	Centrifugal pumps	87.0	143.0	217.0								447.0
74230	Rotary pumps	14.0	12.0	24.0								50.0
74240	Jet pumps	8.0	5.0	5.0								18.0
74312	Vacuum pumps		18.0	36.0								54.0
74313	Compressors											
74341	Fans	110.0	152.0	304.0								566.0
74342	Blower											
74361	Elec.precipitator	800.0	700.0	1400.0								2900.0

ANNEXURE-IX
(Ref. Para 3.7.1)

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UNIDO/SPO (TEK -)

COMMODITY CODE: 4101/0-9

CAPITAL GOODS DEVELOPMENT PROJECT IN TURKEY

EQUIPMENT REQUIREMENTS FOR TEK

Total Weight in Tons/ ~~Value in US $ (1000)~~

SITC Code	Basic Machine Name	YEARS										TOTAL 1991-2000
		1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	
74362	Filter		120.0	240.0								360.0
74423	Pneumatic Conveyor		25	50								75
74426	Conveyors,mech.	1508.0	1458	1588								4554.0
74428	Stackers	392.0	490.0	980.0								1862.0
77111	Elec.power transfor	16842.7	15213.0	12391.8	18726.5	14792.5	15798.6	14087.2	11362.8	10246.0	8988	138451.1
77112	Current transformer	963.1	930.1	805.6	1014.8	1003.8	1087.6	955.6	876.7	867.5	760.8	9265.6
77113	Voltage "	496.9	421.9	385.8	531.5	489.9	459.9	424.3	368.5	360.2	325.8	4264.7
77118	Other "	1859.9	1887.7	779.4	2958.4	1068.2	1266.6	594.5	424.5	257.5	229.5	11326.2
77122	Power reactors	293.7	561.7	561.7	293.7	35.0	25.7	25.7	25.7	25.7	25.7	1874.3
77211	Circuit breakers	2836.0	2677.6	2329.8	3063.5	2741.8	2999.3	2676.7	5016.3	2256.4	2058.7	22244.3
77212	Switches	2336.6	2076.1	1916.5	2354.9	2438.0	2412.8	2317.2	2118.6	2089.9	1857.4	21918.0
77213	Arrester	324.5	388.3	107.5	660.9	269.1	298.8	113.7	113.7	116.4	107.1	2500.0
	GRAND TOTAL	81070.6	65374.5	58032.4	65638.5	40504.3	50524.3	43579.6	24578.1	16221.6	14353.0	459927.5
	Plate Fabricated	16382.0	9561.6	18879.0	-	-	-	-	-	-	-	44822.6
	Machines	64688.6	55812.9	39153.4	65638.5	40504.3	50824.3	43579.6	24578.1	16221.6	14353.0	415104.9

UNIDO/SPO (TEK -)

COMMODITY CODE: 4101/0-9

CAPITAL GOODS DEVELOPMENT PROJECT IN TURKEY

EQUIPMENT REQUIREMENTS FOR TEK

~~Total Weight in Tons~~/ Value in US $ (1000)

SITC Code	Basic Machine Name	YEARS										TOTAL 1991-2000
		1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	
69211	Reservoirs,tanks,etc.	3770.0	1169.0	2338.0								7277
71111	Steam boiler	31000	17500	35000								83500
71121	Heater	240	140.1	480								860.1
71122	Soot removers											
71261	Steam Turbines	24000	8600	17200								49800
71262	Condensers	4400	750	1500								6650
71622	Generators AC	110086.3	103319.3	16194.8	139965.1	52677.3	6493.8	5235.3	1863.2			489055.1
71623	Generators DC	4220.7	4071.1	1469.0	6570.6	3099.6	114824.5	83105.7	38730.9			256092.1
71881	Water turbines	324921.6	199389.8	129868.8	238182.3	214030.3	106550.9	102229.7	33035.6			1348209.3
72831	Screens	40	300	500								840
72832	Crushers	1180	2010	4020								7210
72833	Mixers		36	72								108
74121	Burner	264	690	1380								2334
74161	Heat exchangers	194	914	1373.5								2481.5
74220	Centrifugal pumps	286	875	1198								2359
74230	Rotary pumps	40	60	120								220
74240	Jet pumps	24	22	22								68
74312	Vacuum pumps		90	180								270
74313	Compressors											
74341	Fans	925	1130	2360								4465
74342	Blower											
74361	Elec.precipitator	1040	1000	2000								4040

ANNEXURE-X
(Ref. Para 3.7.1)

UNIDO/SPO (TEK ·)

COMMODITY CODE: 4101/0-9

CAPITAL GOODS DEVELOPMENT PROJECT IN TURKEY

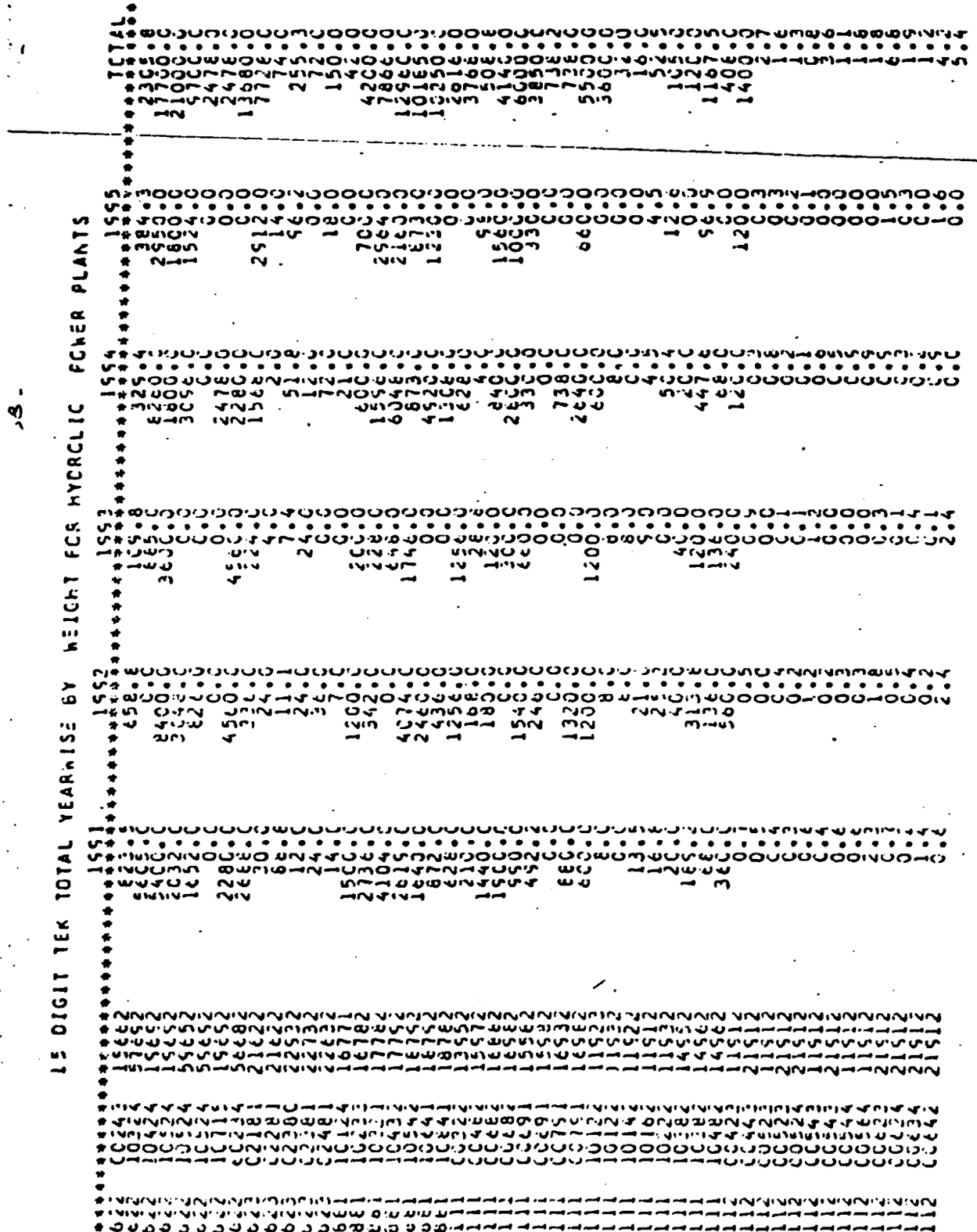
EQUIPMENT REQUIREMENTS FOR TEK

~~Total Weight in Tons~~/ Value in US $ (1000)

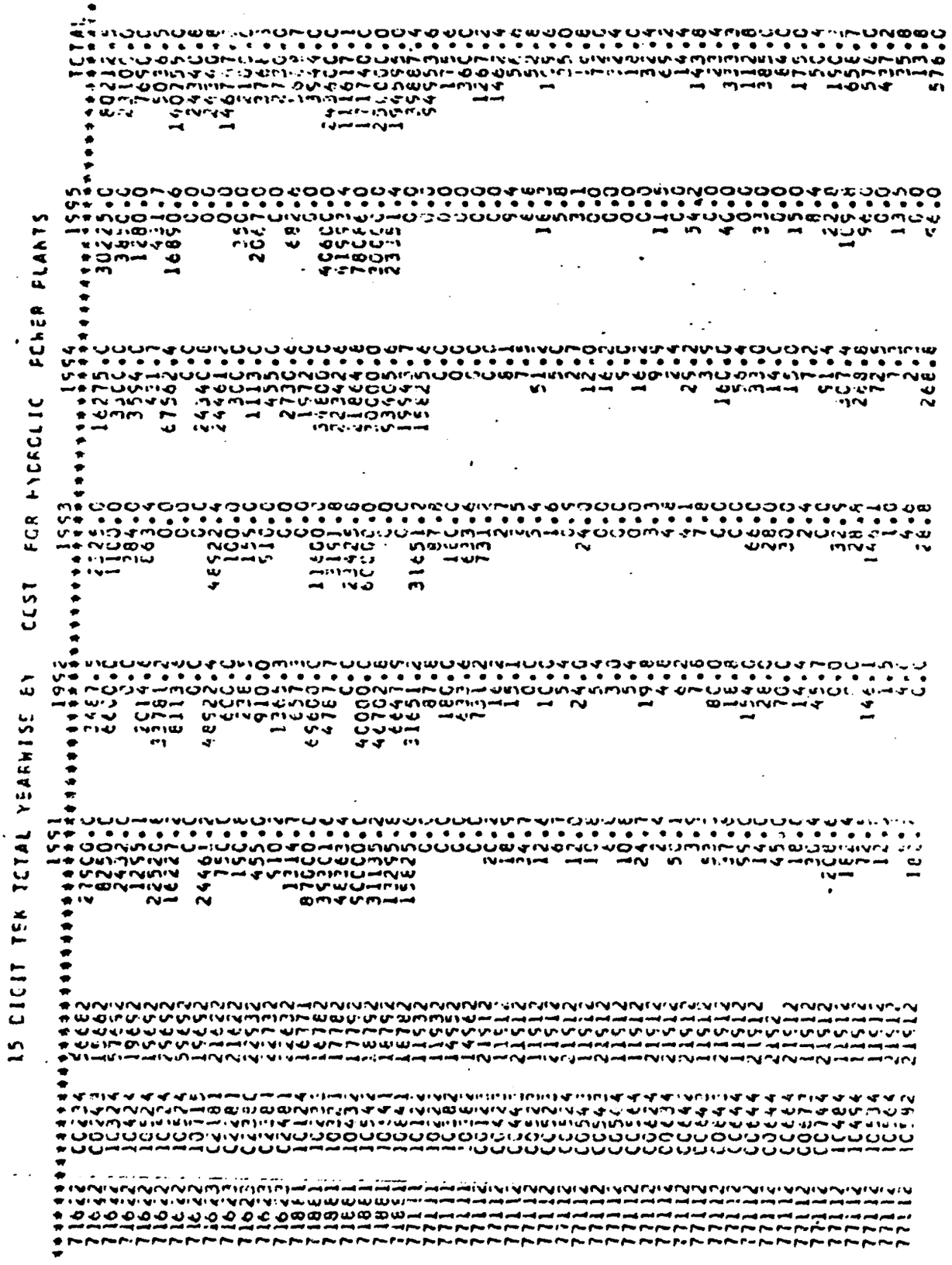
SITC Code	Basc Machine Name	YEARS										TOTAL 1991-2000
		1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	
74362	Filter		155	310								465
74423	Pneumatic Conveyor		76	152								228
74426	Conveyors,mech.	4146	3204	3547								10897
74428	Stackers	780	1205	2410								4395
77111	Elec.power transfor mers	43169.9	42419.4	42323.1	42513.7	46328.2	44043.2	42470.3	42470.3	43870.3	38970.3	428570.8
77112	Current transformer	6504.3	5397.3	3937	7954.7	4927	4392.6	4112.6	3005.4	2032.7	2022.8	44806.4
77113	Voltage "	3503.4	3135.8	2159.2	4194.3	2929.3	2875	2723.5	1965.5	1439	1357	26333
77118	Other "	999.9	1000.8	997.1	1041.5	1019.3	1041.5	1026.9	1005.3	1038.0	996.3	10222.9
77122	Power reactors	8802.0	8530.3	3279	7822.0	1482.7	3093.2	254	254	254	254	28333
77211	Circuit breakers	28364.3	25051.9	19947.8	33050.5	28216	24437.0	22315.8	19662.5	18198.3	16295.7	233891.1
77212	Switches	8138.9	7619.3	4991.7	11439.1	10173.7	2748.8	5038.1	4775.9	3281.4	3912.7	62859.9
77213	Arrester	1618.6	1351.4	939.9	1779.9	1264.4	120541.1	52999.1	13801.1	516.5	487.9	195250.1
	GRAND TOTAL	651242.7	508704.6	380155.7	562884.3	384667.7	466436.1	344615.5	165564.9	70911.7	63396.7	3608581.4
	Plate Fabricated	42544.0	21628.1	43001.5	-	-	-	-	-	-	-	105273.6
	Machines	620598.7	487076.5	337154.2	562884.8	384667.7	466436.9	344615.5	165564.9	70911.7	63396.7	3503307.8

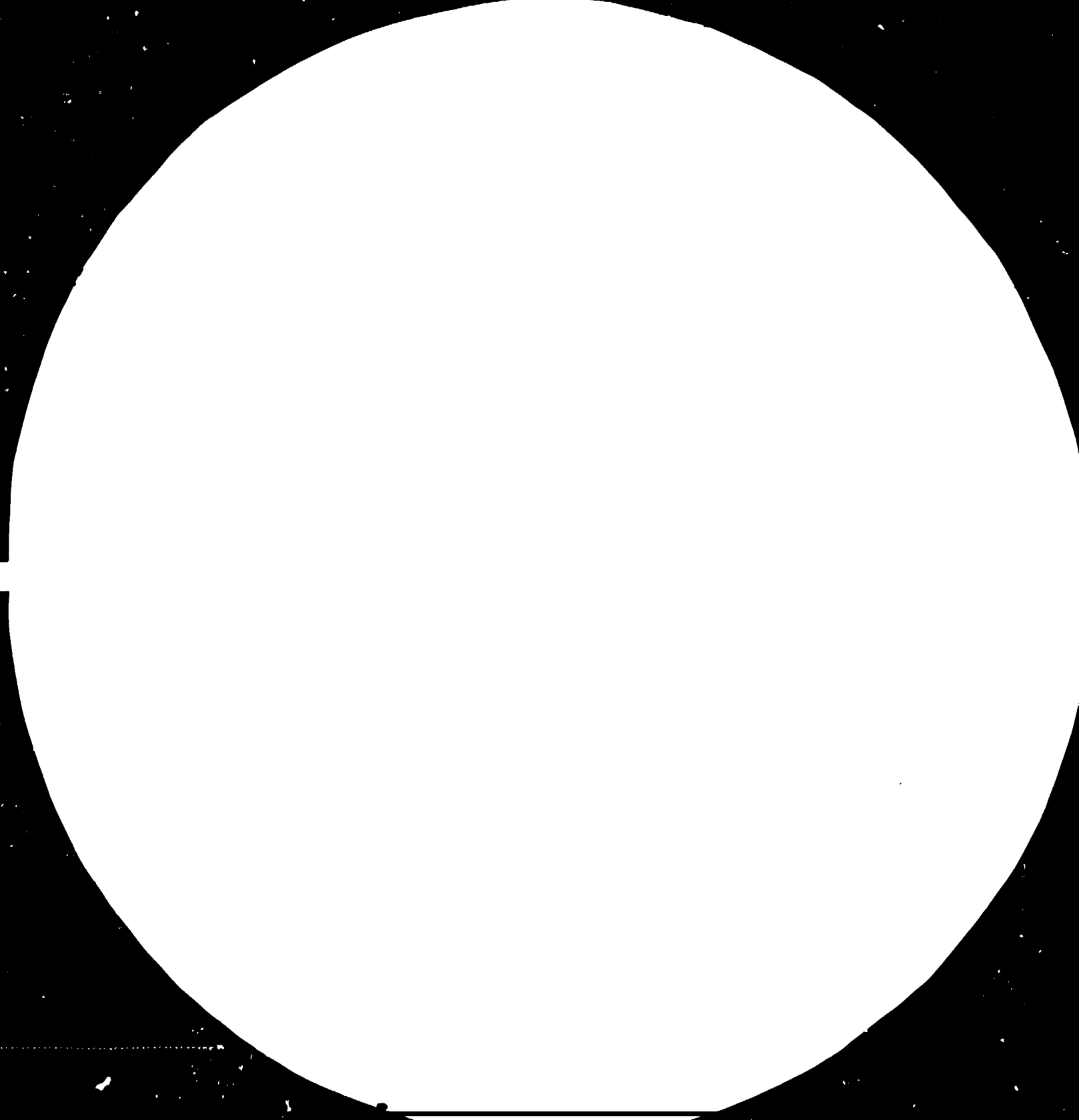
ANNEXURE-XI
(Ref. Para 3.7.3)

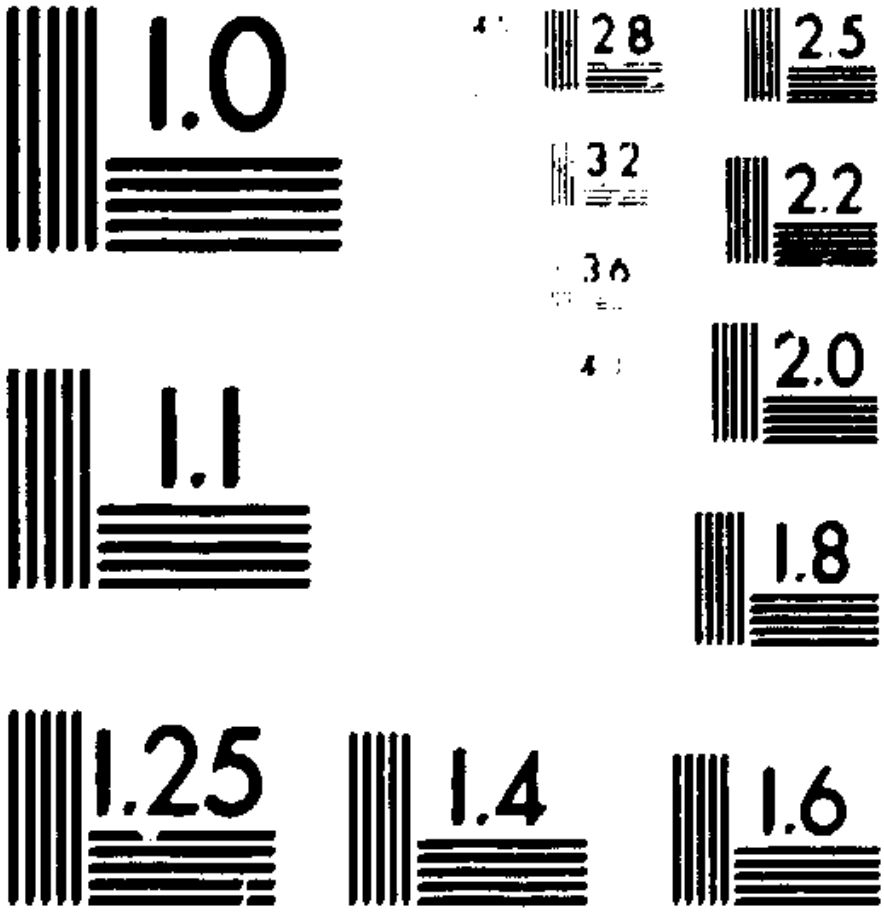
15 DIGIT TEK TOTAL YEARWISE BY WEIGHT FOR HYDROELECTRIC POWER PLANTS



ANNEXURE-XII
(Ref. Para 3.7.3)







ANNEXURE-XIII
(Ref. Para 3.8.2)

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CAPITAL GOODS TELEDEPENDENT PROJECT IN TURKEY

SITC CODE	BASIC PACKAGE NAME	NATIONAL DEMAND FOR MACHINERY				DETENT FACTORS
		1991	1992	1993	1994	1995
71122	SEED RECEIVERS	.0	.0	10.0	10.0	10.0
71201	STEAM TURBINES	1000.0	.0	1340.0	1340.0	1442.0
71622	GENERATORS ALTERNATING CURRENT	5225.0	7760.0	24034.4	12390.4	12352.3
71623	GENERATING SETS(DIES.COMB.P.EN.	43.4	52.4	294.6	142.3	142.9
71681	WATER TURBINES	3188.0	4280.0	14597.0	9757.0	9681.0
72341	BULLDOZERS,ANGLEDOZERS,LEVEL.	.0	75.0	278.0	.0	.0
72342	MECHANICAL SHOVELS AND EXCAVAT	.0	38.0	133.0	48.0	.0
72343	ELASTWELL DRILLS,DRILL.MACH.	32.0	16.0	40.0	.0	.0
72726	SUGAR MANUFACTURING MACH.	4.4	143.0	.0	.0	.0
72831	SCREENS,WET CLASS.,SEPARATORS	92.0	.0	497.0	497.0	495.3
72832	CRUSHERS,GRINDING MILLS	1596.0	.0	2941.0	2941.0	3657.0
72871	PIPES	20.0	.0	.0	.0	4.0
72894	ASSEMBLERS	.0	.0	.0	.0	7.0
72942	EXPLODER	.0	.0	.0	.0	70.0
74311	BOILER BLOWERS	8288.0	.0	234.0	234.0	234.0
74210	RECIPROCATING PUMPS	.0	.0	.0	3.2	47.0
74220	CENTRIFUGAL PUMPS	430.3	.0	535.0	528.0	581.0
74230	ROTARY PUMPS	25.2	.0	1.5	1.5	1.5
74240	JET AND ELECTRIC HYDRAULIC PUMPS	10.0	.0	1.0	.0	1.7
74312	VACUUM PUMPS AND EJECTORS	47.0	.0	110.4	.0	.0
74313	AIR OR GAS COMPRESSORS	.0	.0	24.0	304.0	183.4
74351	FANS	310.0	.0	211.2	219.0	256.0
74352	BLOWERS	16.5	.0	16.5	16.5	82.3
74411	FORKLIFT,DUMP.TRAILER TRUCKS	.0	200.0	275.0	.0	.0
74423	ELEVATORS CONVEYORS PNEUMATIC	54.0	.0	7.6	7.6	7.6
74424	CONVEYORS,MECHANICAL	3164.2	.0	3588.0	3585.0	4092.0
74428	STACKERS , DUMPERS	1114.0	.0	.0	.0	300.0
74525	WEIGHING MACHINERY	4.0	1.7	.0	.0	.9
77111	ELEC.POWER TRANSFORMERS	12299.0	11729.0	17275.0	15332.5	16294.0
77112	CURRENT TRANSFORMERS	877.8	836.2	1015.1	923.0	1100.7
77113	VOLTAGE TRANSFORMERS	405.0	382.1	472.4	475.1	531.0
77118	OTHER ELECTRICAL TRANSFORMERS	835.8	1116.1	2376.2	1685.1	1973.3
77122	POWER RECTIFIERS	379.2	379.2	297.0	433.0	535.0
77211	CIRCUIT BREAKERS	9516.3	9413.0	3569.4	11276.4	6407142
77212	SWITCHES	2053.0	1954.6	2246.2	2340.4	2572.0
77213	LIGHTNING ARRESTERS	136.9	138.3	210.6	172.1	192.9
	TOTAL	51785.0	38523.4	79369.2	124687.1	120457.8

ANNEXURE-XIV
(Ref. Para 3.8.2)

LABOR-SPE

CAPITAL GOODS DEVELOPMENT PROJECT IN TURKEY

NATIONAL DEPRECIATION MACHINERY — VALUE IN 1000 US$

SITC CODE	BASIC MACHINE NAME	1991	1992	1993	1994	1995
71172	STEAM BOILERS	.0	.0	1439.2	1439.2	1439.2
71741	STEAM TURBINES	17220.0	.0	16525.0	16525.0	16481.0
71622	GENERATORS ALTERNATING CURRENT	49742.9	63195.7	153478.5	64636.5	77734.7
71623	GENERATING SETS(DIES.-COMP.P.EN.	1669.1	3641.7	11396.4	3832.0	3978.7
71881	WATER TURBINES	89265.2	101386.3	180383.5	217628.3	211778.3
72341	PULVERIZERS,AGGLOMERATORS,LEVEL.	.0	5720.0	1680.0	.0	.0
72342	MECHANICAL SHOVELS AND EXCAVAT	.0	260.0	786.0	991.2	.0
72343	BEARINGLE GRILLS,GRILL.MACH.	360.0	90.0	275.0	.0	.0
72726	SUGAR REFACTORING MACH.	13.0	238.0	.0	.0	.0
72831	SCREENS,WET CLASS.,SEPARATORS	789.2	.0	4373.0	4373.0	4481.9
72832	CRUSHERS,GRINDING MILLS	4010.0	.0	18595.0	18595.0	20874.0
72833	MIXERS	720.0	.0	.0	.0	731.0
72834	ACCLEPERATORS	.0	.0	.0	.0	178.3
72852	EXTRUDER	.0	.0	.0	.0	300.0
74121	BOILER CLEANERS	1380.0	.0	1639.1	1027.7	1027.7
74210	RECIPROCATING PUMPS	2.0	.0	.0	3.0	1318.3
74220	CENTRIFUGAL PUMPS	2162.6	.0	7404.5	7404.2	6420.5
74230	ROTARY PUMPS	133.4	.0	35.0	35.0	35.0
74240	JET AND ELECTRIC MAGNETIC PUMPS	46.0	.0	13.0	.0	4.2
74311	VACUUM PUMPS AND EJECTORS	199.4	.0	319.4	.0	.0
74313	AIR OR GAS COMPRESSORS	.0	.0	273.3	436.9	4338.7
74341	FANS	2367.6	.0	7771.0	7386.7	7488.2
74342	BLOWERS	385.4	.0	219.0	219.0	291.2
74617	FORKLIFTS,DUMP,TRAILER TRUCKS	.0	880.0	3210.0	.0	.0
74623	ELEVATORS CONVEYORS PNEUMATIC	104.0	.0	91.6	91.6	93.6
74624	CONVEYERS,MECHANICAL	8193.9	.0	20824.0	20868.0	30458.2
74628	STACKERS , DUMPERS	2519.7	.0	.0	.0	1326.0
74525	WEIGHING MACHINERY	4.0	11.3	.0	.0	.9
77111	ELEC.POWER TRANSFORMERS	45895.1	40530.1	57232.5	50745.4	54564.0
77112	CURRENT TRANSFORMERS	3190.3	4008.7	5644.5	5595.9	6687.7
77113	VOLTAGE TRANSFORMERS	2178.7	2173.5	3299.0	2973.2	3325.8
77118	OTHER ELE' ICAL TRANSFORMERS	18096.2	25706.1	42152.5	23834.2	22555.0
77122	POWER REACTORS	3546.8	3946.8	1588.5	2739.5	3585.9
77211	CIRCUIT BREAKERS	20774.2	21203.9	36152.7	26182.9	25869.4
77212	SWITCHES	5125.0	5588.3	10215.0	8543.5	9151.2
77213	LIGHTNING ARRESTERS	916.5	1014.5	1746.5	1261.9	1405.9
	TOTAL	262370.2	273774.3	582156.1	482277.4	527314.1

ANNEXURE-XV
(Ref. Para 3.8.4)

[illegible]

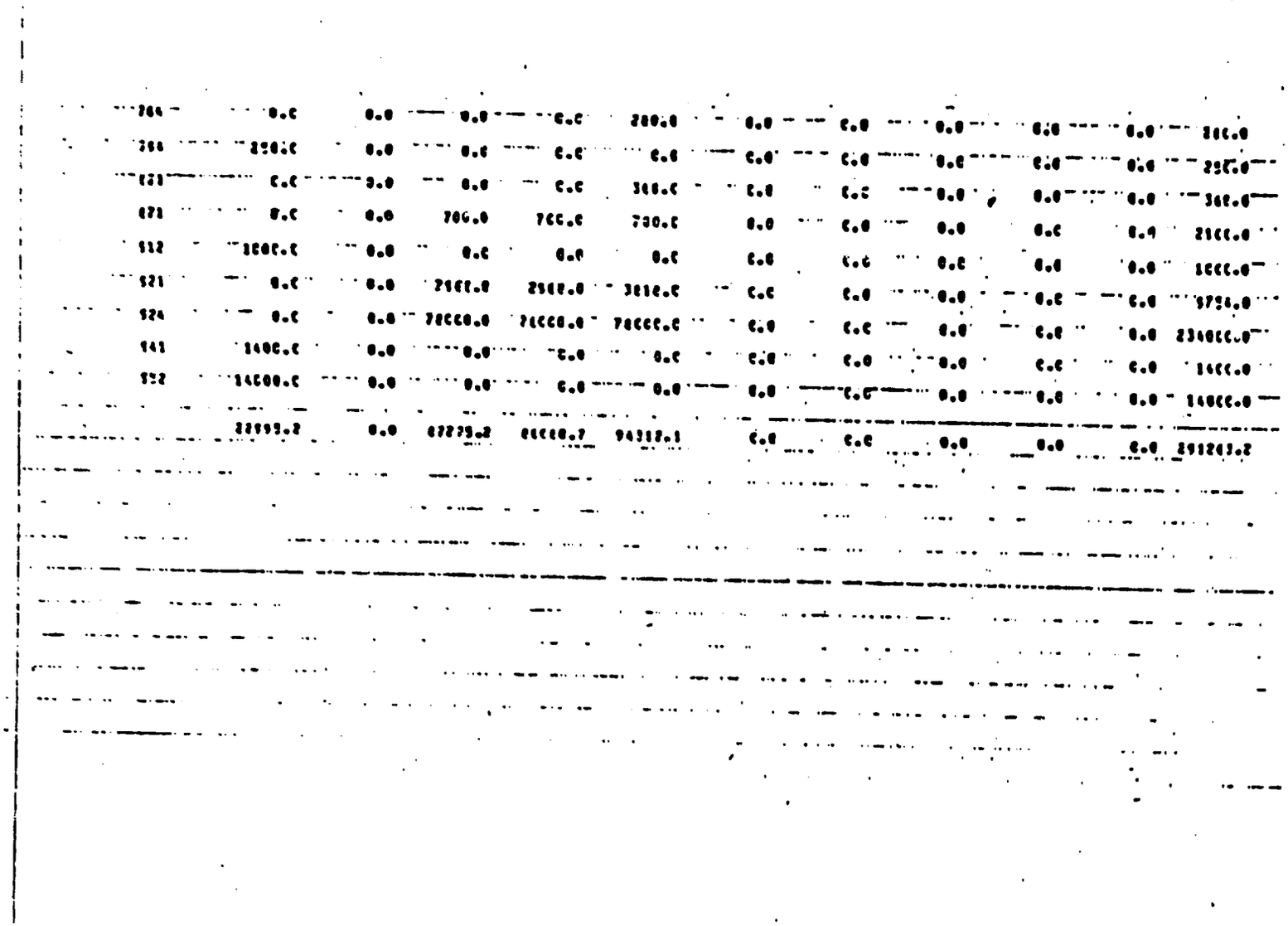
CAPITAL GOODS DEVELOPMENT PROJECT IN TURKEY

[illegible] OF FABRICATED EQUIPMENT FOR NATIONAL [illegible]

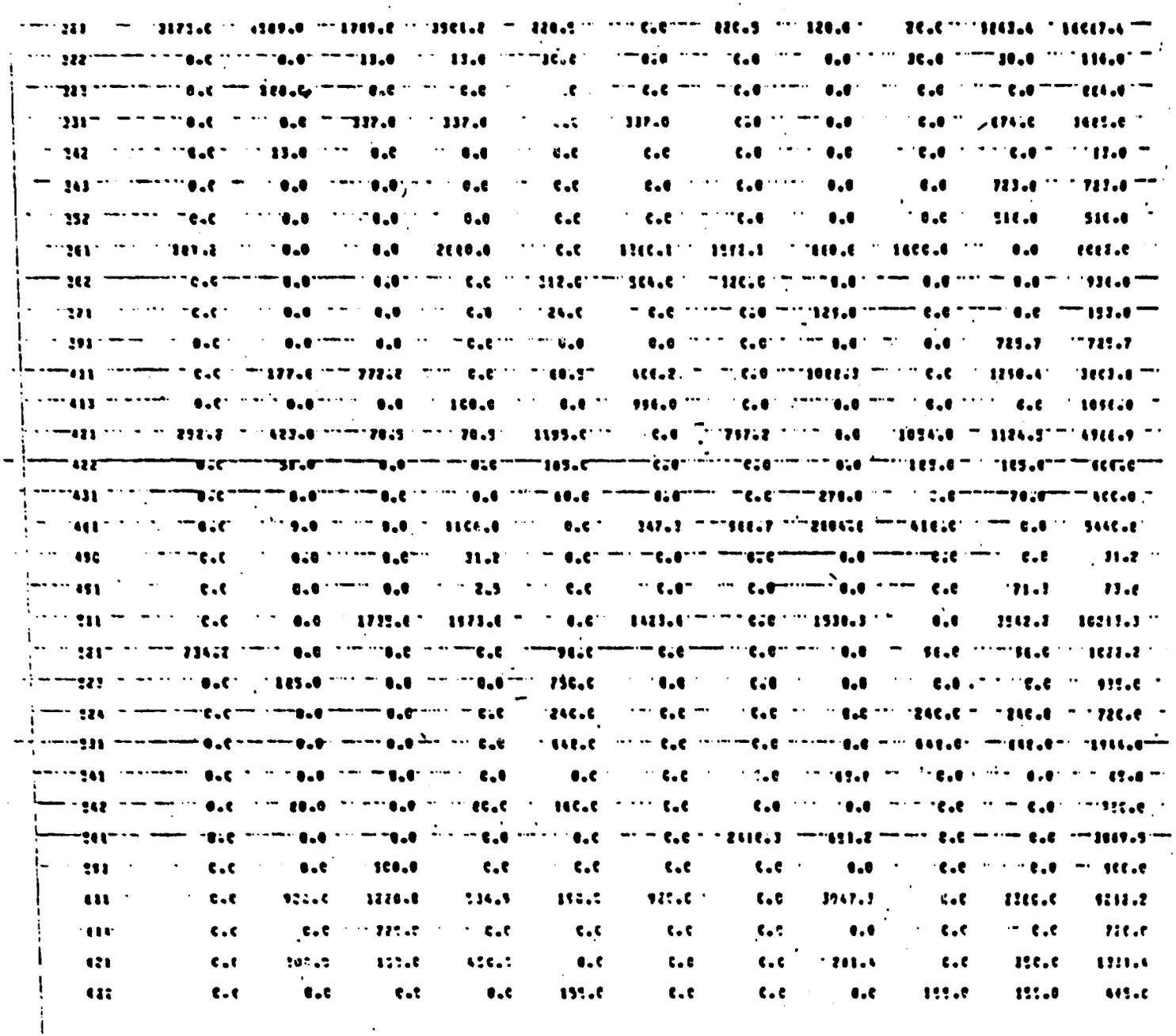
(Effect in Rs)

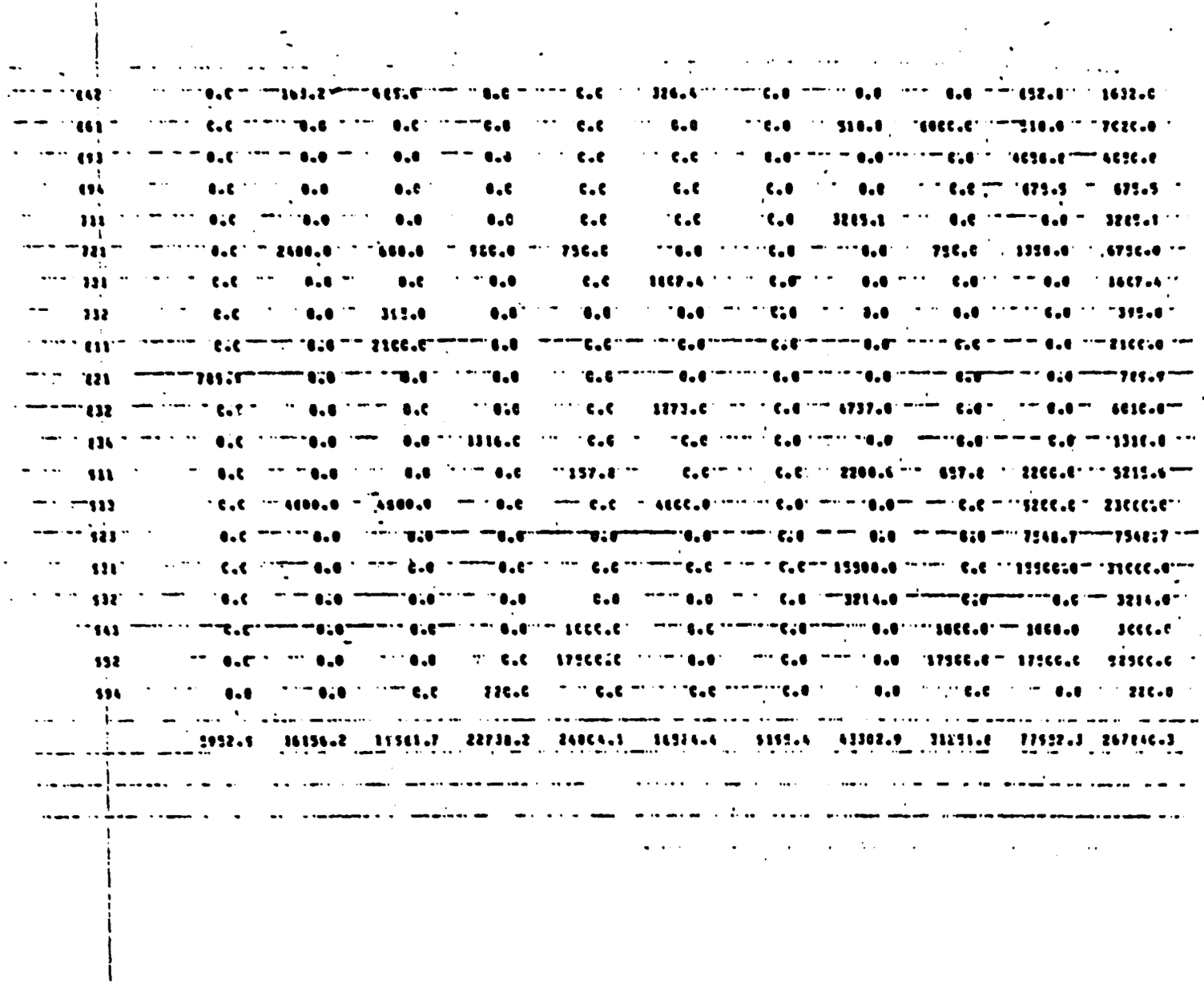
SITC CODE	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	TOTAL
111	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	1.0
121	23.4	0.0	9.0	16.0	8.0	0.0	0.0	0.0	0.0	0.0	57.2
122	174.0	0.0	178.0	163.0	420.0	0.0	0.0	0.0	0.0	0.0	935.0
211	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	2.0
221	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	1.0
231	0.0	0.0	0.0	0.0	4.0	0.0	0.0	0.0	0.0	0.0	4.0
232	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.4
241	0.0	0.0	0.0	2.7	25.6	0.0	0.0	0.0	0.0	0.0	41.2
242	16.0	0.0	37.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	77.0
243	22.1	0.0	1.0	1.0	0.9	0.0	0.0	0.0	0.0	0.0	24.0
244	73.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	73.3
245	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.0
246	136.0	0.0	63.0	63.0	439.3	0.0	0.0	0.0	0.0	0.0	702.3
247	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
248	0.0	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.7
249	0.0	0.0	0.0	0.0	7.4	0.0	0.0	0.0	0.0	0.0	7.4
251	18.0	0.0	0.0	0.0	19.0	0.0	0.0	0.0	0.0	0.0	37.0
252	0.0	0.0	0.0	0.0	36.0	0.0	0.0	0.0	0.0	0.0	36.0
259	12.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.0
261	253.0	0.0	10.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	263.0
321	113.0	0.0	112.0	112.0	789.0	0.0	0.0	0.0	0.0	0.0	1126.0
322	28.0	0.0	0.0	0.0	220.0	0.0	0.0	0.0	0.0	0.0	248.0
323	0.0	0.0	9.0	0.0	10.0	0.0	0.0	0.0	0.0	0.0	19.0
332	0.0	0.0	0.0	0.0	13.0	0.0	0.0	0.0	0.0	0.0	13.0
341	60.0	0.0	0.0	0.0	36.0	0.0	0.0	0.0	0.0	0.0	96.0

342	0.0	0.0	0.0	0.0	22.0	0.0	0.0	0.0	0.0	0.0	22.0
341	52.0	0.0	0.0	0.0	249.0	0.0	0.0	0.0	0.0	0.0	301.0
343	0.0	0.0	0.0	0.0	14.0	0.0	0.0	0.0	0.0	0.0	14.0
341	0.0	0.0	0.0	0.0	13.7	0.0	0.0	0.0	0.0	0.0	13.7
342	0.0	0.0	0.0	0.0	19.0	0.0	0.0	0.0	0.0	0.0	19.0
343	0.0	0.0	0.0	0.0	134.4	0.0	0.0	0.0	0.0	0.0	134.4
411	113.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	113.0
421	1444.0	0.0	300.0	300.0	693.0	0.0	0.0	0.0	0.0	0.0	2837.0
422	274.0	0.0	0.0	0.0	71.2	0.0	0.0	0.0	0.0	0.0	345.2
423	80.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	80.0
424	0.0	0.0	0.0	0.0	34.0	0.0	0.0	0.0	0.0	0.0	34.0
431	0.0	0.0	0.0	0.0	38.9	0.0	0.0	0.0	0.0	0.0	38.9
442	46.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	46.0
451	0.0	0.0	150.0	150.0	150.0	0.0	0.0	0.0	0.0	0.0	474.0
461	0.0	0.0	0.0	0.0	49.9	0.0	0.0	0.0	0.0	0.0	49.9
510	0.0	0.0	0.0	111.0	0.0	0.0	0.0	0.0	0.0	0.0	111.0
511	174.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	174.0
521	300.0	0.0	200.0	200.0	1112.0	0.0	0.0	0.0	0.0	0.0	1872.0
522	0.0	0.0	0.0	0.0	116.9	0.0	0.0	0.0	0.0	0.0	116.9
524	240.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	240.0
531	1040.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1040.0
611	430.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	430.0
612	0.0	0.0	232.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	232.0
621	382.0	0.0	0.0	0.0	449.0	0.0	0.0	0.0	0.0	0.0	831.0
622	0.0	0.0	0.0	0.0	488.0	0.0	0.0	0.0	0.0	0.0	488.0
623	0.0	0.0	0.0	0.0	268.0	0.0	0.0	0.0	0.0	0.0	268.0
632	0.0	0.0	0.0	0.0	369.0	0.0	0.0	0.0	0.0	0.0	369.0
642	0.0	0.0	0.0	0.0	376.0	0.0	0.0	0.0	0.0	0.0	376.0
662	240.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	240.0
711	0.0	0.0	400.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	400.0
721	506.0	0.0	3730.0	3730.0	4214.0	0.0	0.0	0.0	0.0	0.0	12180.0
724	0.0	0.0	0.0	0.0	249.0	0.0	0.0	0.0	0.0	0.0	249.0



ANNEXURE-XVI
(Ref. Para 3.8.4)



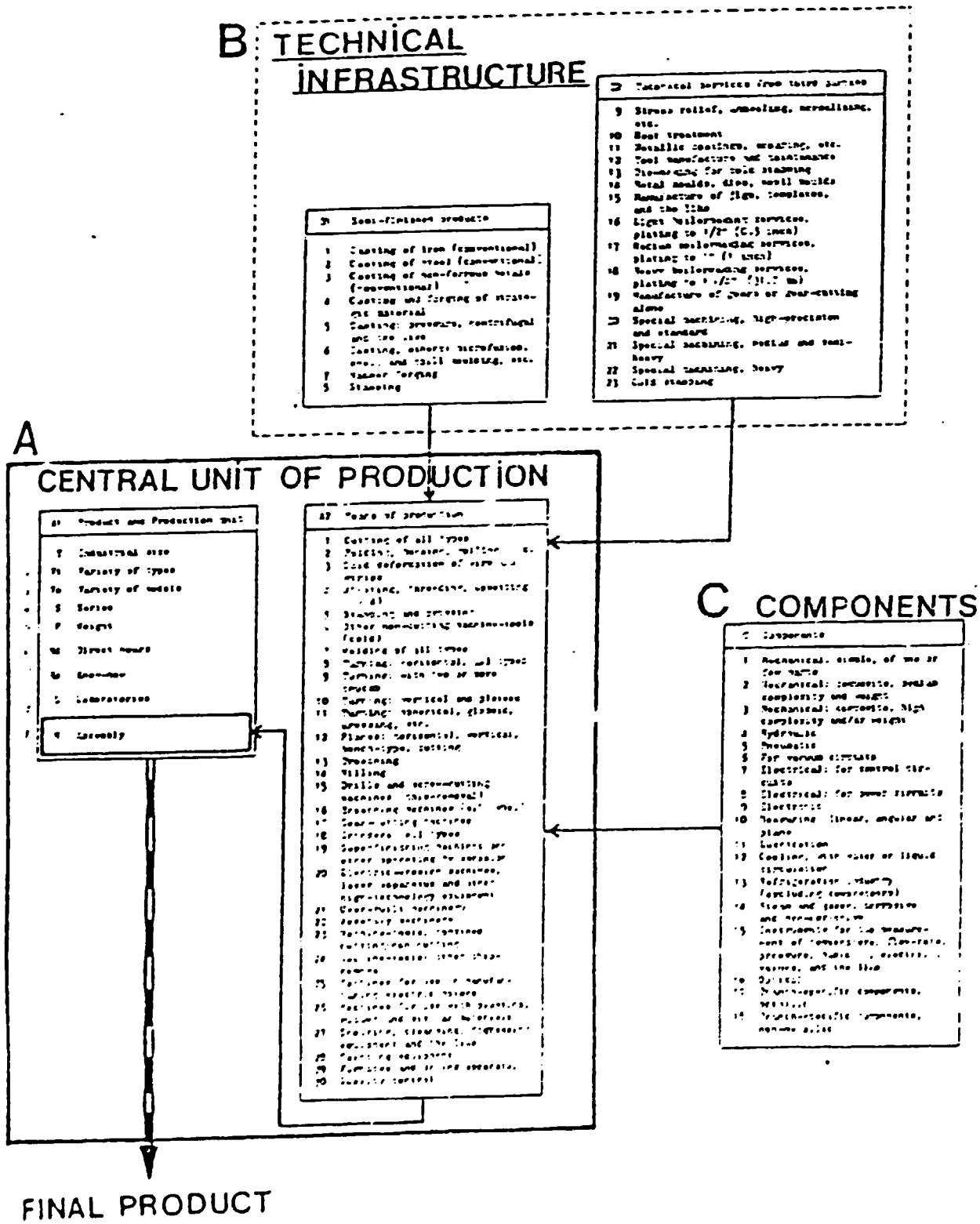


ANNEXURE-XVII
(Ref. Para 3.8.5)

ANNEXURE-XVIII
(Ref. Para 3.8.5)

ANNEXURE-XIX
(Ref. Para 6.8)

ANALYSIS OF TECHNOLOGICAL COMPLEXITY
Assemblies and Sub-Assemblies of the Techno-economic Factors
in the Structure of the Production of Capital Goods



ANNEXURE-XX
(Ref. Para 3.1 of Appendix-I)

CLASSIFICATION OF STEEL FORGINGS

SITC GROUP	MATERIAL	CRITERIA 1 WEIGHT	TYPE
67930	1. Carbon steels 2. Alloy steels 3. High alloy steels	1. Less than 3 kg. 2. 3-10 kg. 3. 10-40 kg. 4. 40-100 kg. 5. 100-500 kg. 6. 500-1000 kg. 7. 1000-5000 kg. 8. 5000-10000 kg. 9. More than 10000 kg.	1. Open forging 2. Die forging

ANNEXURE-XXI
(Ref. Para 3.1 of Appendix-I)

CLASSIFICATION OF IRON CASTINGS

SITC GROUP	MATERIAL	CRITERIA 1 WEIGHT	CRITERIA 2 COMPLEXITY
67941	1. Chilled 2. Grey Iron 3. Alloyed iron 4. Malleable 5. Spheroidal	1. Less than 3 kg. 2. 3-10 kg. 3. 10-40 kg. 4. 40-100 kg. 5. 100-500 kg. 6. 500-1000 kg. 7. 1000-5000 kg. 8. 5000-10000 kg. 9. More than 10000 kg.	1. Shaped, highly complex 2. Shaped, medium and low complexity 3. Centrifugal 4. Others

APPENDIX-XXII
(Ref. Para 3.1 of Appendix-II)

CLASSIFICATION OF STEEL CASTING

SITC GROUP	MATERIAL	CRITERIA 1 WEIGHT	CRITERIA 2 COMPLEXITY
6782	1. Carbon steels 2. Alloy steels 3. High alloy steels	1. Less than 3 kg. 2. 3-10 kg. 3. 10-40 kg. 4. 40-100 kg. 5. 100-500 kg. 6. 500-1000 kg. 7. 1000-5000 kg. 8. 5000-10000 kg. 9. More than 10000 kg.	1. Shaped, highly complex 2. Shaped, medium and low complexity 3. Centrifugal 4. Others