

**Chapter 7 TECHNICAL SUPPORT ORGANIZATION FOR
METALWORKING INDUSTRY**

Chapter 7 TECHNICAL ASSISTANCE ORGANIZATION FOR METALWORKING INDUSTRY

The metalworking industry requires a wide range of technical support for development, as compared to other industries, for the industry uses a number of processes to shape a raw material into a finished product, and each of the processes requires reliable and high technological levels to assure quality of final products. Moreover, the quality of each process is often determined by skills of workers. Furthermore, the metalworking industry is characterized by high degree of division of labour, i.e., one factory seldom handles an entire production process, so that unified industrial standards need to be established and enforced to ensure smooth flow of work between processes.

Given these characteristics, to develop metalworking industry requires an organization to provide technical support at a national level. Such technical support organizations should be vested with the following functions:

- To conduct vocational training service to produce competent workers for the industry
- To promote development of industrial standards and to support quality control activities
- To carry out research, inspection, and testing upon request from industries.

In Colombia, there is no organization designed to provide technical support specifically for the metalworking industry, but there are some organizations which partly serve such purpose. These organizations are outlined as follows.

7.1 National Training Service (Servicio Nacional de Aprendizaje: SENA)

The National Training Service (SENA) is the only one and largest national vocational training institute. SENA has been playing an important role in industrial development of the country, and is expected to further expand its roles and upgrade services.

7.1.1 Background and Objective of Establishment

SENA was established in 1957 under Decree No.118 as a government-operated public corporation supervised by the Ministry of Labour and Social Security. A primary purpose of SENA is to implement the government's social policies by means of human resource development and vocational training. In particular, SENA is responsible for the following:

- (1) To develop Colombians, through vocational training, to competent and responsible professional workers possessing moral and cultural values in addition to technical skills and knowledge to become a leader of the country's development.
- (2) To assure sustainable industrialization and socioeconomic development process as a national organization to provide vocational training.
- (3) To apply technical, technological, educational methodological systems. These systems are to meet the requirement of Colombian industry and are useful for improving living standards of poor people.

7.1.2 Subject of SENA's Vocational Training

- (1) All economic sectors, including agriculture, livestock farming, manufacturing, commerce, and service, as well as the informal sector which accommodates most of unemployed workers and part-time employees

- (2) Youths and adults who join labour force for the first time
- (3) Workers who are willing to improve or perfect their skills and knowledge
- (4) Business owners who need advice and assistance for successful growth

7.1.3 Operating Funds

SENA receives most of operating funds from companies, both public and private, in an amount equivalent to 2% of wages and salaries paid to employees, and from the government in an amount equivalent to 0.5% of salaries. This system to base financial resource on contributions from business enterprises, instead of depending on government budget, has primarily enabled SENA to continue activities regardless of government finance situation.

In addition, SENA has financial resources from 1) compensation for services rendered to private industries, 2) revenues from sales of products manufactured in the course of training, 3) revenues from vocational training projects contracted with public organizations and private companies, and 4) penalties imposed on violation of labour laws and regulations.

7.1.4 Organization

SENA consists of the board of directors, which serves as a supervisory body, and headquarters and local branches which are responsible for day-to-day operation and management. The board of directors acts as the supreme organ and establishes general policies, and programs and plans, consisting of the following members:

- 1) Minister of Labour and Social Security
- 2) Minister of Education
- 3) Director General of National Planning Department

- 4) Representative of Ministry of Agriculture
- 5) Representative of Pontifical Council
- 6) Representative of National Industrial Association (ANDI)
- 7) Representative of National Federation of Merchants (FENALCO)
- 8) Representative of Colombian Association of Medium and Small Enterprises (ACOPI)
- 9) Representative of Colombian Farmers' Society (SAC)
- 10) Representative of workers
- 11) Representative of farmers

The headquarters and local branches are responsible for implementation of policies, plans and programs adopted by the board of directors. The headquarters is in charge of direction, supervision, coordination, management, and evaluation of policies, programs and plans, while the local branches perform various activities related to vocational training.

SENA has 20 local branches nationwide, which generally coincide with administrative districts. A new branch may be established once revenues in an area exceed 1% of the total. Each local branch is supervised by the board of directors for the branch and a branch manager.

SENA collects its revenues through the local branches and uses them for vocational training for each branch. General flow of operating funds is summarized as follows. Each branch uses 80% of its revenues for own purposes and sends remaining 20% to the headquarters. The headquarters uses a part of them for general administration and grants or loans the remaining amount to local branches which do not collect sufficient revenues to meet vocational training requirements. Thus, this system enables each local branch to provide services suitable for local needs, thereby ensuring balanced development of each branch.

Location of the existing local branches:

- 1) Bogota-Cundinamarca
- 2) Antioquia-Choco

- 3) Valle
- 4) Atlantico
- 5) Santander
- 6) Bolivar-Sucre
- 7) Caldas
- 8) Tolima
- 9) Magdalena
- 10) Norte de Santander
- 11) Boyaca
- 12) Risaralda
- 13) Cordoba
- 14) Huila
- 15) Narino
- 16) Cauca
- 17) Quindio
- 18) Cesar
- 19) Guajira
- 20) Villavicencio

SENA employed approximately 8,200 persons in 1987, a half of which were instructors.

Changes in the work force by job type are summarized as follows:

	1983	1985	1987	1988
Management	577	593	593	-
Specialists	595	630	630	-
General administration	1,154	1,209	1,209	-
Technical experts	556	561	561	-
Assistants	904	933	933	-
Instructors	4,105	4,278	4,278	4,384
Total	7,891	8,204	8,204	

In 1988, there were 4,384 instructors, which were classified by duties and major fields as follows:

	Full-time instructors	Part-time instructors	Supervisors	Advisors	Total
Agriculture/ livestock farming	944	110	77	-	-
Industry	1,167	385	84	-	-
Commerce	695	382	61	-	-
Service	187	57	17	-	-
Total	3,043	934	239	168	4,384

As of 1987, each local branch had training centers as permanent facilities, which are classified as follows. Note that the total number of training centers increased to 95 in 1989:

1) Agriculture/Livestock farming	: 16
2) Industry	: 24
3) Commerce/service	: 19
4) Multi-disciplinary	: 30
<hr/>	
5) Total	: 89

7.1.5 Major Activities

Endowed with stable financial resource (56.1 billion pesos in 1988), large work force (8,204 employees in 1987), a nationwide branch network (20 in 1990) and training facilities (95 in 1989), SENA has been conducting a wide range of activities.

The number of persons who received SENA's vocational training amounted to 840,000 nationwide in 1988. Compared to 360,000 in 1983, the figure grew at an annual average rate of 18.5%.

SENA offers five training courses, which are described as follows. As shown in Table 7.1, the "complementation" course has the largest enrollment.

(1) Apprenticeship

The course is designed to provide newly employed young workers, 15 or older, with training for skills required by industries. Duration is 1 year or 3 years. It consists of simulated training at SENA and on-the-job training at each company.

(2) Promotion

The course is designed to develop the supervisor class positioned between skilled workers and managers by teaching advanced skills. It lasts 2 or 2 years and 6 months.

(3) Complementation

The course aims at developing skills by providing lectures and practical training that cannot be learned at companies. Duration varies according to particular needs.

(4) Specialization

The course is designed to develop advanced skills in a specific field and is conducted as the short-term or the medium-term course.

(5) Habilitation

The course is designed for newly employed adult workers to develop skills at intermediate levels. Many of trainees come from informal sectors.

Training is conducted in the following manners. As shown in Table 7.1, general training in rural areas and training in the centers account for a dominant share. Training in the centers mainly covers commerce and manufacturing areas.

(1) Training in the centers

Training centers are classified into agriculture and livestock farming, industry, commerce, service, and multi-disciplinary.

(2) Training in the firms

SENA's instructors visit companies and provide technical assistance and advice.

(3) General training

This is designed for underprivileged people to develop skills and knowledge to improve living and working condition. It is classified into training for rural areas (PPPR) and that for urban areas (PPPU).

(4) Correspondence course

The correspondence course covers a wide range of people, including newly employed and experienced workers, self-employed workers, and unemployed people, by using course materials sent by mail.

(5) Technology dissemination

This service is designed to provide scientific and engineering information for people, companies and organization related to production activities. It was started in 1987.

7.1.6 Training Facilities for Manufacturing and Metalworking Industries

Of 95 vocational training centers operated by SENA (as of 1989), 24 are specialized in industry fields, as shown in Table 7.2. In metalworking fields, metalworking centers are located in Bogota and Antioquia, and casting centers in Bogota and Santander. In addition, the industrial center divisions in regional branches have metalworking sections.

Training areas related to metalworking are machine tools, automobiles, diesel engines, welding, plate working, electricity, electronics, casting, piping, refrigeration, industrial testing, heat treatment, quality control, and robots.

Although SENA has training facilities and equipment to generally cover these areas, those related to latest technology are in short supply. Table 7.3 lists metalworking-related training equipment in short supply which were published by SENA in 1988.

7.1.7 Problems and Possible Improvement Measures

SENA is primarily involved in vocational training service to reflect vested objectives of establishment. However, it owns a variety of testing equipment to be capable of conducting testing and research for industries and organizations, and some of its branches or sections provide such services. As such function also meets objectives to foster industrial development in the country, it appears to be appropriate for SENA to provide technical services including testing and research, by improving facilities and equipment if necessary.

At the same time, it is recommended to expand the scope of training, which currently focuses on conventional skills by using equipment and machinery that have been long used in the country. For instance, some companies want training related to advanced production lines, including opera-

tion of automated machinery and equipment.

SENA is under control of the Ministry of Labor and Social Security and is restricted by a law to provide services other than vocational training. However, it is reasonable to expect that SENA's resources - sound financial resource and nationwide networks of facilities and staffs - should be directed to promote Colombia's industrialization in more diverse and active manners. And for this purpose, it is recommended to conduct a comprehensive study to identify ways to make most use of SENA, including possibility of service expansion through flexible operation of the law, and the upgrading of SENA's abilities in terms of hardware and software.

At the same time, the following moves are seen in SENA itself to reform the present system by taking into consideration its future roles in industrial development:

- 1) Under the recognition that the present service emphasizing vocational training is not sufficient for effective promotion of industrial development, SENA plans to render services directly contributing to production activities, such as research and development, testing, and inspection, although some opposition is heard because of legal restriction.
- 2) Modernization and improvement of production technology and facilities
- 3) Support to MEs (mostly informal) which have not been eligible for SENA's service as they have not paid contribution.

The National Planning Department intends to provide support for MEs and commissioned SENA to prepare a report which contains the following proposals:

- a) To establish an organization "National Service of Technological Orientation for Microenterprises" (Servicio Nacional de Orientacion Tecnologica para las Microempresas).

This service is designed to inform MEs of SENA's service through mass media (newspapers, radio and television) and to provide technical support upon request.

- b) To establish "Specialized Centers of Integrated Training and Technological Development for Micro-enterprises" (Centros Especializados de Formacion Integral y Desarrollo Tecnologico para la Microem-presa)

The centers specialized in any of confection, woodworking, shoemaking, tapestries, leather confection, machining, metalworking, bakery, plastics, rubber, glass, textile, and electronics will be established in 9 major cities, as selected according to local conditions (for Bogota, all of them), and will provide comprehensive services including market research, product planning and development, training, technical advice, technical assistance, and information service. SENA proposes to establish 35 centers, of which 13 are related to the metalworking industry, including machining, metalworking, electronics, and plastics.

4) Regional Development

SENA has recently opened its newest branch in Villavicencio, Meta, and has 20 branches in total.

Table 7.1 NUMBER OF TRAINEES IN SENA

	1983	1985	1987	1988
A. BY COURSE OF TRAINING				
1. Apprenticeship	18,656	18,356	19,389	16,423
2. Promotion	3,836	3,533	5,180	4,368
3. Complementation	270,474	327,539	468,516	687,277
4. Specialization	4,388	3,310	3,298	4,860
5. Habilitation	62,500	69,818	83,730	127,681
Total	359,854	422,556	580,113	840,609
B. BY METHOD OF TRAINING				
1. Training in the Centers	150,911	101,295	249,037	282,406
2. (Agriculture & Stock Raising)	(11,226)	(6,715)	(23,058)	(31,678)
3. (Industry)	(44,785)	(29,375)	(64,318)	(92,868)
4. (Commerce)	(56,470)	(46,168)	(96,290)	(101,793)
5. (Service)	(16,112)	(9,748)	(26,496)	(38,855)
6. (Multiple)	(22,318)	(9,289)	(38,875)	(17,412)
7. Training in the Firms	49,360	108,067	31,984	38,106
8. General Training (Rural)	90,673	111,317	191,964	355,817
9. General Training (Urban)	48,276	53,036	70,002	136,796
10. Correspondence Course	20,634	48,841	37,126	27,484
Total	359,854	422,556	580,113	840,609

Table 7.2 SENA'S CENTERS FOR INDUSTRY

Region	Industrial Centers
BOGOTA	1) Metalworking Center (CENTRO METALMECANICO) 2) Electricity and Electronic National Center (CENTRO NACIONAL DE ELECTRICIDAD Y ELECTRONICA) 3) Casting National Center (CENTRO NACIONAL DE FUNDICION) 4) Construction National Center (CENTRO NACIONAL DE LA CONSTRUCCION) 5) Graphic Arts National Center (CENTRO NACIONAL DE ARTEE GRAFICAS) 6) Industrial Technician National Center (CENTRO NACIONAL DE TECNICOS DE INDUSTRIA)
ANTIOQUIA	7) Metalworking Center (CENTRO METALMECANICO) 8) Construction Center (CENTRO DE LA CONSTRUCCION) 9) Textile National Center (CENTRO NACIONAL TEXTIL) 10) Wood and Furniture National Center (CENTRO NACIONAL MADERA Y MUEBLE) 11) Confection Center (CENTRO DE CONFECCIONES)
VALLE	12) Salomia Industrial Center (CENTRO INDUSTRIAL DE SALOMIA) 13) Construction Center (CENTRO DE LA CONSTRUCCION) 14) Industrial Technical Assistance Center ASTIN (CENTRO DE ASISTENCIA TECNICA INDUSTRIAL ASTIN)
ATLANTICO	15) Barranquilla Metalworking Center (CENTRO METALMECANICO DE BARRANQUILLA) 16) Aviation Mecanicos Center (CENTRO MECANICOS DE AVIACION) 17) Colombo German Center (CENTRO COLOMBO ALEMAN)
BOLIVAR-SUCRE	18) Cartagena Industrial Center (CENTRO INDUSTRIAL DE CARTAGENA)
CALDAS	19) Manizales Industrial Center (CENTRO INDUSTRIAL DE MANIZALES)
SANTANDER	20) Giron Casting Industrial Center (CENTRO INDUSTRIAL FUNDICION DE GIRON) 21) Barrancabermeja Petro-Chemical Center (CENTRO PETRO-QUIMICO DE BARRANCABERMEJA)
BOYACA	22) Sogamoso Mining National Center (CENTRO NACIONAL MINERO DE SOGAMOSO)
NORTE DE SANTANDER	23) Electronics and Cucuta Network Industrial Center (CENTRO INDUSTRIAL DE ELECTRONICA Y REDES DE CUCUTA)
GUAJIRA	24) Riohacha Industrial Center (CENTRO INDUSTRIAL DE RIOHACHA)

Table 7.3 EQUIPMENT REQUIRED FOR TECHNOLOGICAL MODERNIZATION AND UPDATING IN SENA (METALWORKING ONLY)

Particular	Existing Equipment	Equipment Required	Regional Centers
Machine Tools	Minimum	— NC and CNC type Machinery — Machinery for automated or robotized productive processes	All regional centers
Automobile	Minimum	— Vehicles as tutorial units	All regional centers except Guajira and Cesar
Welding	Minimum	— Equipment for special weldings — Equipment for plasma welding	All regional centers
Electronics	Incomplete	— Complement to the existing equipment about new techniques of electronics, power control, digital logic, robotics.	All regional centers
Plate Work	Minimum	— Electric bending machine, punching machine, etc.	All regional centers
Heat Treatment	Deficient	— Furnaces, measurement laboratories	All regional centers
Quality Control	None	— Destructive and non destructive testing machines, scientific laboratory, metrology	BOGOTA, ANTIOQUIA, VALLE, CALDAS, SANTANDER, BOYACA
Casting	Adequate	— Soft metal injection machine	SANTANDER, BOGOTA

Source: EL SENA EN CIFRAS 83-87 PROGRAMACION 1988

7.2 Vocational Training Institutes and Research and Testing Organization

7.2.1 Vocational Training Institutes

The following organizations are leading vocational training institutes:

- SENA
- Don Bosco Technical School (Centro Don Bosco)

SENA is described in 7.1, and another school, Centro Don Bosco, is described below.

Centro Don Bosco, established in 1957 as a missionary school, is a private technical school located in Bogota. Its primary purpose is to provide 6-year vocational training for young people between 16 and 20 years old, who have completed its 5-year primary education program. The school offers training programs in the following areas. At present, approximately 1,600 students are enrolled and around 250 are graduated annually to join work force.

- 1) Metalworking and assembly
- 2) Plating
- 3) Welding
- 4) Casting and pattern making
- 5) Electricity
- 6) Printing and bookbinding
- 7) Furniture and woodworking
- 8) Technical arts and ornamentation

In addition, it provides the following paid services:

- 1) Nighttime vocational training for general public
- 2) Processing and operations requested by private companies
- 3) Testing and inspection (e.g., plating, welding) requested by private companies
- 4) Technical assistance requested by private companies

The nighttime vocational training program offers 33-day courses for company workers who wish to improve skills, and around 600 people are currently enrolled. Some of companies in Bogota the Study Team visited highly evaluated the school to have new equipment and teach latest technology compared to SENA.

Centro Don Bosco also manufactures and sells a wide range of products including bench drilling machines, vices, furniture, and cast products. Revenues from these sales and various services are used as operating funds. (All instructors at the school are sent by the Ministry of Education, which pays their salaries.)

7.2.2 Organizations to Promote Standardization and Quality Control Activities

The following organizations are classified in this category:

- Colombian Standards Institution (Instituto Colombiano de Normas Tecnicas: ICONTEC)
- Quality Control and Metrology Center (Centro de Control de Calidad y Metrologia: CCCM)

(1) ICONTEC

ICONTEC was originally established in 1963 as a non-profit private organization. In 1984, it was authorized as a national organization to promote standardization under Decree No.2746. Today, ICONTEC is involved in activities related to standardization and quality control.

1) Standardization

ICONTEC coordinates development of draft industrial standards under participation of the government and industries. Industrial standards are approved and issued by the National Council on Standards and

Qualities (Consejo Nacional de Normas y Calidades: CNNC) under the Ministry of Economic Development, organized by representatives of ministries.

Colombia's industrial standards are principally based on ISO*, but reportedly use other standards such as SAE, JASO, JIS, DIN, IEC, and BS* as reference.

Note * :

ISO: International Organization for Standardization

SAE: Society of Automotive Engineers

JASO: Japan Automobile Standard Organization

JIS: Japanese Industrial Standards

DIN: Deutscher Normenausschuss

IEC: International Electrotechnical Commission

BS : British Standards Institution

According to the 1988 catalog (Catalogo de Normas Tecnicas Colombianas), around 2,500 standards have been completed to this date. Industrial areas encouraged for establishment of standards are agriculture and livestock farming, metalworking, electrical products, civil engineering and architecture, safety and hygiene, and chemical industry.

2) Quality control

In quality control areas, ICONTEC is engaged in activities to promote use of industrial standards and to improve quality levels of Colombian products.

ICONTEC issues certificates to companies which

products comply with applicable standards. The companies are authorized to affix "ICONTEC" stamp to products upon shipment. ICONTEC conducts field inspection on companies which manufacture the certified products and evaluates whether appropriate quality control is practiced.

ICONTEC also provides assistance and advice to companies which intend to obtain the certificate. Furthermore, ICONTEC publishes monthly reports (Boletin Informativo) and periodical magazines (Normas y Calidad) to make information on standards and technologies avail to public.

ICONTEC employs approximately 120 persons, including 30 engineers. The number of members totals to approximately 1,500 organizations, which are mainly large companies, universities and colleges, and associations, but not many SMEs and MEs.

ICONTEC's major financial sources include membership fees, revenues from sales of publications including standards, and revenues from seminar and technical services for industries.

ICONTEC has only one office in Bogota at present, however, it is applying for increasing branches in Medellin, Cali and Barranquilla. Also, it does not own any testing laboratory and uses the following four organizations for testing on product certification:

- Universidad Nacional de Colombia - Instituto de Ensayos e Investigaciones (IEI)
- Instituto de Investigaciones Tecnologicas (IIT)
- Universidad Nacional de Colombia - Seccional Medellin
- Universidad Industrial de Santander (UIS)

(2) Quality Control and Metrology Center (CCCM)

CCCM was established in 1977 under the technical assistance from West Germany and is supervised by the Superintendence of Commerce and Industry of the Ministry of Economic Development. CCCM provides legal services related to regulation of metrology to protect consumers, and technical services for manufacturers. It has various prototypes for metrology, and conducts testing and calibration with charge, for requests from private companies.

This center has the following equipment:

- Length : meter prototypes, block gage, screw gage, three-coordinate measuring device, levels, angle measuring equipment, etc.
- Mass : balances, prototypes of weight, tension and compression, gravimeters, pressure gage, etc.
- Volume : cylinders, pipets, bulettes, etc.
- Temperature : mercury thermometers, thermocouples, etc.
- Electricity : oscilloscopes, ampere-meters, voltmeters, resistance meters, etc.

7.2.3 Organizations Providing Services to Private Companies in Areas of Research, Inspection, and Testing

Colleges and research institutes listed in Table 7.4 conduct tests requested by private companies and issue certificates.

Of these colleges and research institutes, the questionnaire was sent to 12 national and public organizations, 4 private organizations, totaling 16 organizations via the DNP of which 9 organizations responded to the question-

naire. These organizations are mainly located in Bogota, Medellin, and Cali areas. Then the Study Team visited nine of the organizations which gave consent to the interview.

Three of the nine organizations visited conduct testing and inspection in fields of metalworking, and they are described as follows:

- (1) National University of Colombia - Testing and Research Institute (Universidad Nacional de Colombia - Instituto de Ensayos e Investigaciones: IEI)

This institute was established 26 years ago (1964) as an affiliated organization of the Colombia University, and consists of 9 laboratories and 5 units (Unidad).

1) Laboratories

- Material testing laboratory (Laboratorio de Ensayo de Materiales)
- Metalworking laboratory (Laboratorio de Metalurgia)
- Mechanical engineering laboratory (Laboratorio de Ingenieria Mecanica)
- Electrical engineering laboratory (Laboratorio de Ingenieria Electrica)
- Chemical engineering laboratory (Laboratorio de Ingenieria Quimica)
- System engineering laboratory (Laboratorio de Ingenieria de Sistemas)
- Hydraulics laboratory (Laboratorio de Hidraulica)
- Agriculture laboratory (Laboratorio de Agricola)
- Environment laboratory (Laboratorio de Ambiental)

2) Units

- Industrial Testing (Unidad de Ensayos a la Industria)
- Investigation and Contracts (Unidad de Investigacion y Contratos)
- Maintenance (Unidad de Mantenimiento)
- Education (Unidad de Educacion Continuada)
- Technical Innovation and Development (Unidad de Innovacion y Desarrollo Tecnologico)

Testing equipment related to the metalworking industry owned by IEI is listed in Table 7.5, and many of which are of old type.

IEI provides the following paid services for outside companies and institutions:

- a) To conduct tests and to issue test reports.
- b) To hold seminars.
- c) To conduct large-scale study and research

IEI has 54 engineers with college degrees or higher educational background.

The operating fund of this research laboratory comes mainly from the government, and covers salaries. In addition, revenues from outside services are used for purchase of new equipment.

(2) Technological research institute (Instituto de Investigaciones Tecnológicas: IIT)

This institute was established in 1958, and is presently a non-profit organization under supervision of the Ministry of Economic Development. Each year, IIT makes application for funding of proposed research projects to DNP. Then, approved projects are funded by the Ministry of Economic Development, while operation costs are borne by such sponsors as the Coffee Unions and the Central Bank.

IIT has the following three laboratories and 7 units (Unidad) as its technical section:

1) Laboratories

- Metalworking and quality control laboratory (Laboratorio de Metalurgia y Control de Calidad)
- Electrochemistry and corrosion control laboratory (laboratorio de Electroquímica y Control de Corrosion)
- Electrochemistry pilot plant (Planta Piloto Electroquímica)

2) Units (Unidades de Trabajo)

- Quality control (Control de Calidad)
- Pre-investment study (Estudios de Preinversion)
- Service engineering (Ingeniería de Servicios)
- Food development (Desarrollo de Productos Alimenticios)
- Coal development (Desarrollo del Carbon)
- Biotechnology (Biotecnología)

- Chemical products development (Desarrollo de Productos Quimicos)

Table 7.5 lists testing equipment related to the metalworking industry owned by IIT. There are no material strength testing facilities.

IIT provides the following paid services to outside companies and institutions:

- a) To conduct tests and to issue test reports
- b) To provide consultation and technical assistance
- c) To conduct consultation and technical assistance

Most of the activities are related to food, biotechnology, and chemical products, and the metalworking area accounts for a small portion. Nevertheless, IIT conducts chemical analysis, metallographic inspection, hardness tests, corrosion tests, and technical assistance for casting and plating plants. recommendation by a local chamber of commerce.

IIT employs 80 staffs, including 30 researchers, 11 technicians, and 39 assistants.

(3) Universidad Nacional de Colombia - Seccional Medellin

The Department of Mechanical Engineering (Departamento de Ingenieria Mecanica) of the university has 5 laboratories, 1 workshop, and 4 units (Unidad), as listed below, of which laboratories of metallic materials and foundry render metalworking-related services for private enterprises:

- 1) Laboratories and Workshop
 - Laboratory of Material Structure (Laboratorio de Conformacion de Materiales)
 - Laboratory of Machinery Diagnosis (Laboratorio de Diagnostico de Maquinaria)

- Laboratory of Metallic Materials (Laboratorio de Materiales Metalicos)
- Laboratory of Thermal Science (Laboratorio de Ciencias Termicas)
- Laboratory of Foundry (Laboratorio de Fundicion)
- Workshop of Machine Tools (Taller de Maquinas Herramientas)

2) Unit (Unidad)

- Academic Unit of Material Structure (Unidad Academica de Conformacion de Materiales)
- Academic Unit of Machine Design (Unidad Academica de Diseno de Maquinas)
- Academic Unit of Metallic Materials (Unidad Academica de Materiales Metalicos)
- Academic Unit of Thermal Design (Unidad Academica de Diseno Termico)

Table 7.5 shows testing and inspection facilities and equipment owned by the laboratories of metallic materials and foundry. Facilities and equipment in the laboratory of metallic materials were mostly introduced at the time of its establishment 21 years ago. On the other hand, the laboratory of foundry is of small size designed for aluminum casting and has few equipment.

These laboratories provide the following services for private enterprises:

- a) To conduct tests requested and issue test reports;
- b) To conduct seminars; and
- c) To manufacture and sell aluminum casting products, on a custom-made basis.

The department has 4 professors, 24 professional engineers, and 9 assistants.

7.2.4 Problems in and Recommendations on Technical Support Organizations

As mentioned above, Colombia has various organizations to provide technical support for the industries. Through the study, the following problems were identified.

- (1) There is no organization whose objective is to provide overall technical assistance close to local industries, including Sml-Es and MEs.

For example, in Japan, there are industrial laboratories (or industrial technical centers) in each prefecture, and they provide a wide range of services conducive to promotion of local industries including the SMEs and MEs, ranging from testing, issuance of test reports, technical consultation and advice, and supply of technical and market information.

- (2) In Colombia, colleges and research institutes conduct tests requested by private companies and issue test reports. However, it is efficient that colleges and research institutes are engaged exclusively in research and development as well as dissemination of latest technology, testing to required advanced technology and equipment, and promotion of large-scale projects.

In practice, however, due to lack of reliable testing organizations, which are equipped with adequate testing equipment and easily accessible to local industries, they have to depend to colleges and research institutes for relatively simple testing on products and materials.

- (3) Only LEs and some of Med-Es use the technical support organizations, while the MEs and Sml-Es enjoy few benefits.
- (4) Most of testing equipment owned by the universities and research institutes are very old.

(5) Most of Med-Es, and Sml-Es and MEs do not have equipment to test products and materials.

(6) While quality control requires prompt feedback of information on products and materials, present testing organizations take too much time.

To promote modernization of the metalworking industry in Colombia, improvement of technical levels - product quality in particular - should be given of the highest priority. To this end, promotion of quality control practice plays an essential role, in addition to modernization of production facilities and equipment.

From this point of view, to ensure sustainable development of metalworking industries on a local basis, it is proposed to consider the establishment of ;metalworking industry promotion center(s) and the like to provide technical services for companies of all sizes.

The center(s) should be equipped with essential testing equipment required for quality control, that is not owned by the SMEs and MEs, and perform reliable testing and inspection on products and materials for local industries.

Table 7.4 INSTITUTIONS OF R & D, INSPECTION AND TESTING FOR METALWORKING INDUSTRY

Institutions	Location	Remarks
A. Public		
1) UNIVERSIDAD NACIONAL DE COLOMBIA INSTITUTO DE ENSAYOS E INVESTIGACIONES (IBI)	BOGOTA	⊙□
2) INSTITUTO DE INVESTIGACIONES TECNOLOGICAS (IIT)	BOGOTA	⊙□
3) EMPRESA DE ENERGIA ELECTRICA DE BOGOTA (EEDD)	BOGOTA	⊙□
4) INSTITUTO COLOMBIANO DE HIDROLOGIA, METEOROLOGIA Y ADECUACION DE TIERRAS (HIMAT)	BOGOTA	○□
5) INDUSTRIA MILITAR (INDUMIL)	BOGOTA	○
6) UNIVERSIDAD NACIONAL DE COLOMBIA - SECCIONAL MEDELLIN	MEDELLIN	⊙□
7) UNIVERSIDAD DE ANTIOQUIA	MEDELLIN	○
8) EMPRESAS PUBLICAS DE MEDELLIN (EPP DE MEDELLIN)	MEDELLIN	⊙□
9) SERVICIO NACIONAL DE APRENDIZAJE (SENA)	MEDELLIN	○□
10) UNIVERSIDAD DEL VALLE	CALI	⊙□
11) CENTRO DE DESARROLLO TECNOLÓGICO - REGIONAL VALLE - ASTIN - SENA	CALI	⊙□
12) UNIVERSIDAD INDUSTRIAL DE SANTANDER (UIS)	BUCARAMANGA	○
13) UNIVERSIDAD FRANCISCO DE PAULA SANTANDER	CUCUTA	
14) UNIVERSIDAD PEDAGOGICA Y TECNOLÓGICA DE COLOMBIA	TUNJA	
15) UNIVERSIDAD DE NARIÑO	PASTO	
16) SERVICIO NACIONAL DE APRENDIZAJE (SENA)	BARRANQUILLA	
17) UNIVERSIDAD DE CARTAGENA	CARTAGENA	
B. Private		
18) UNIVERSIDAD DE LOS ANDES	BOGOTA	○
19) ESCUELA DE ADMINISTRACION Y FINANZAS Y TECNOLOGICAS (EAFIT)	MEDELLIN	⊙
20) SIDERURGICA DE MEDELLIN S. A. (SINESA)	MEDELLIN	⊙
21) UNIVERSIDAD POSTIFERICA BOLIVARIANA (UPB)	MEDELLIN	○

Notes : ⊙ Institutions which answered the questionnaire.
○ Institutions which were enquired but do not answer the questionnaire so far.
□ Institutions visited by the JICA Team.

Source: DIRECTORIO NACIONAL DE LABORATORIOS Y CENTROS DE INVESTIGACION, SECTOR ELECTRICO COLOMBIANO.

Table 7.5 EXISTING MAIN FACILITIES FOR MATERIAL / PRODUCT TESTING, MEASURING AND INSPECTION

(1/3)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1. Testing Machine for Mechanical Properties										
1) Universal Testing Machine	○				○	○	○	○		○
2) Impact Testing Machine	○				○		○		○	○
3) Hardness Tester										
a) Brinell Hardness Tester	○		○		○	○	○	○	○	○
b) Rockwell Hardness Tester	○	○	○		○	○	○	○	○	○
c) Vickers Hardness Tester			○		○	○	○	○		○
d) Shore Hardness Tester						○				
e) Micro Vickers Hardness Tester	○	○			○					○
4) Fatigue Testing Machine	○						○			○
5) Abrasion Testing Machine	○						○			○
6) Torsion Testing Machine	○				○					
2. Equipment for Metallographical Inspection										
1) Metallurgical Microscope with Photomicrographic Attachment	○	○			○	○	○	○	○	○
2) Scanning Electronic Microscope		○								

Notes: (1) IEI (2) IIT (3) EEBB (4) HIMAT (5) UNIVERSIDAD NACIONAL DE COLOMBIA - SECCIONAL MEDELLIN (6) EPPP de Medellin
 (7) UNIVERSIDAD DEL VALLE (8) CENTRO DE DESARROLLO TECNOLÓGICO - REGIONAL VALLE - ASTIN - SENA
 (9) CENTRO NACIONAL DE FUNDICION - SENA (10) CENTRO NACIONAL DE TECNICOS DE INDUSTRIA - SENA

Table 7.5 EXISTING MAIN FACILITIES FOR MATERIAL / PRODUCT TESTING, MEASURING AND INSPECTION

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
3. Instruments for Analysis										
1) Vacuum Emission Spectrometer										
2) Atomic Absorption Spectrophotometer										
3) Spectrophotometer										
4) X-ray Fluorescence Spectrometer										
5) Infrared Spectrometer										
6) Carbon-Sulfur Analyzer										
7) X-ray Diffractometer										
8) Miscellaneous Chemical Analysis Apparatus										
9) Electron Probe Micro Analyser										
4. Non-Destructive Inspection Apparatus										
1) X-ray Inspection Apparatus										
2) Ultrasonic Flow Detector										
3) Magnetic Particle Detector										
4) Penetrant Inspection Agent										

Notes: (1) IEI (2) IIT (3) EEEB (4) HIMAT (5) UNIVERSIDAD NACIONAL DE COLOMBIA - SECCIONAL MEDELLIN (6) EPPP de Medellin
 (7) UNIVERSIDAD DEL VALLE (8) CENTRO DE DESARROLLO TECNOLOGICO - REGIONAL VALLE - ASTIN - SENA
 (9) CENTRO NACIONAL DE FUNDICION - SENA (10) CENTRO NACIONAL DE TECNICOS DE INDUSTRIA - SENA

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
5. Measuring Instruments										
1) Coordinate Measuring Machine										
2) Profile Projector	○						○	○		○
3) Surface Roughness Tester	○						○			○
4) Roundness Tester	○					○	○			○
5) Measuring Microscope						○	○			
6) Universal Gear Tester										
7) Gage Block						○	○			○
8) Miscellaneous Dimension Measuring Instruments (Micrometer, Height Gage, Vernier Caliper, etc.)						○	○			○
6. Testing and Measuring Instruments for Foundry										
1) Sand Testing Instruments					○					○
2) CE Meter										○
3) Nodularity Detector for Nodular Graphite Casting										

Notes: (1) IEI (2) IIT (3) EEBB (4) HIMAT (5) UNIVERSIDAD NACIONAL DE COLOMBIA - SECCIONAL MEDELLIN (6) EEBB de Medellin
(7) UNIVERSIDAD DEL VALLE (8) CENTRO DE DESARROLLO TECNOLOGICO - REGIONAL VALLE - ASTIN - SENA
(9) CENTRO NACIONAL DE FUNDICION - SENA (10) CENTRO NACIONAL DE TECNICOS DE INDUSTRIA - SENA

7.3 Industrial Parks (Parques Industriales)

Industrial parks offers a variety of advantages for tenant companies; infrastructure, utilities, and public facilities, together with ease in cooperative activities between tenant companies, security, and availability of tax and financial incentives in some countries. Also, there is ample space for expansion available, compared to factories located other than parks.

From the administrative side, the siting of industrial facilities apart from residential areas would ensure better control of noise and other types of pollution, while energy saving can be accomplished by efficient use of transport and electricity.

This section reviews current situation of industrial parks in Colombia and identify problems, followed by a proposal for improvement.

7.3.1 Industrial Park Development Policy (Decree 2143/1979)

Colombia has established a national policy for development of industrial parks, as set forth in Decree 2143 of 1979, entitled "For Promotion of Establishment of Industrial Park Corporation".

Underlying concept of this decree is to foster industries and create employment opportunity in regional cities for the purpose of slowing down population migration into three largest cities of Bogota, Cali, and Medellin. In other words, development of industrial parks is envisaged as a means of regional development through decentralization of industries. In particular, the decree states objectives of industrial park development as follows:

- 1) To contribute to better urban planning in cities other than Bogota, Medellin, and Cali (and areas under their influence).

- 2) To promote emergence of new industries and socioeconom-ic development of each region.
- 3) To ensure effective use of natural resources, technolo-gy and financial resources, and to create employment opportunities in each region.
- 4) To create and scale up small- and medium-scale enter-prises in manufacturing and agro based industries.
- 5) To reduce manufacturing and distribution costs by strengthening industrial linkage, and to reduce costs and expenses borne by tenant industries through the sharing of infrastructure.

In Colombia, industrial parks are developed by private companies or cooperatives, instead of the government or public corporation. The public sector participates in incorporation of a private company to construct and manage the industrial park, followed by equity participation in some cases. Thus, Decree 2143/1979 intends to promote development of industrial parks by granting financial and tax incentives to private developers. In addition, the following incentives are provided for companies siting in the industrial parks:

- 1) Special loans by the People's Finance Corporation (Corporacion Financiera Popular: CFP) to cover working capital, and relocation and upgrading of production equipment
- 2) Low-interest loans by the Industrial Finance Fund (Fondo Financiero Industrial: FFI) and the Private Industry Fund (Fondo de Inversiones Privadas: FIP) under the Central Bank
- 3) Loans financed by industrial development bonds issued by the Industrial Development Corporation (Instituto de Fomento Industrial: IFI)
- 4) Special tax incentive to allow deduction of the invest-ment related to industrial park from corporate revenues

5) Loans for export industries by the Export Promotion Fund (Fondo de Promocion de Exportaciones: PROEXPO)

It should be noted that Decree 2143/1979 is applied only to "certified industrial parks" as defined in the decree. This means, development of industrial parks is permitted in Bogota, Medellin and Cali - there are some in these cities - but they are not eligible for the above incentives. Furthermore, only tax incentive in 4) above is applied only to companies siting in the certified industrial parks, while other financial incentives are applicable to companies locating outside industrial parks.

7.3.2 Current Situation of Industrial Parks

To this date, the following 9 industrial parks have been certified by the Ministry of Economic Development under Decree 2143/1979.

Name	Year certified
Bucaramanga	1980
Cucuta (Oriente)	1982
Quindio (Calarca)	1980
Manizales	1981
Malambo (Barranquilla)	1980
Duitama	1981
Pereira	1980
Popayan	1983
Guarne	1981

Since the government has not carried out the follow-up study on these industrial parks after 1985, quantitative analysis based on latest data is not possible. Results of interview with people associated with industrial parks, however, revealed general agreement in that the certified industrial park program was failure; all the parks except Manizales and Bucaramanga could not attract tenant indus-

tries and are left vacant. Some of the parks have not started site development due to lack of tenant industries, and even in the parks which have been developed and sold, no tenant industries have not settled. Also, no industrial park has been certified after 1985. To improve the situation, official investigation to identify problems related to these parks will be conducted and a meeting to plan necessary actions will be held under participation of representatives from related organizations.

Possible causes for this failure include the following:

(1) Unrealistic planning concept

There was a conflict between economic principles and the basic concept to promote decentralization of industries through the siting of industrial parks in regional cities.

Many companies prefer to locate near their markets. In Colombia which is characterized by rugged topography, transportation costs increase rapidly away from markets. Thus, it is not conceivable that companies in Bogota, Medellin and Cali move to other cities.

(2) Weak industrial base in rural regions

If relocation of industries from the major cities cannot be expected, local industries are to be attracted to the industrial parks. However, industries are not well developed in areas other than the major 3 cities and do not have a need for the industrial parks. Some companies have purchased the sites and have not moved to the parks, because they cannot have funds for further investment or cannot expect sufficient profit to cover the investment.

(3) Insufficient incentives

Very limited incentives are available to companies siting in the certified industrial parks, compared to other companies. As mentioned earlier, financial

incentives cited are equally available to any companies.

Obviously, it is desirable to provide more attractive incentive to bring economic benefits to the tenant companies, including a wider range of tax incentives covering income taxes, customs duties, local taxes, as well as special discount on electricity charges.

Many countries, including Colombia, have been building industrial parks in local cities as a means to decentralize the industries. However, there have been many cases of failure unless very attractive incentives are provided. Without any doubt, it is not economically justifiable for industries located in areas accessible to sources of materials, markets, and infrastructure to move into rural regions.

At the same time, there are many industrial parks in major cities, which are not certified under the decree. Although they are not eligible for the incentives, many of them receive special discounts on utility charges from local governments and are provided with long-term loans and other incentives by developers. Thus, it is reasonable to believe that major demand for industrial parks exists in large cities, particularly Bogota, Medellin and Cali.

7.3.3 Proposed Industrial Park for Metalworking Industry

The metalworking industry has peculiar characteristics compared to other industries:

- 1) The metalworking process consists of many complementary operations which are usually handled by different companies or facilities.
- 2) This entails close linkage between companies.
- 3) The metalworking industry requires a large amount of investment to purchase machinery and equipment.

- 4) Relatively a large space is required in a factory, with overhead traveling crane being required to handle heavy materials, leading to high facility cost.
- 5) There are many stages involving quality control activities to require additional time and cost, and testing equipment is relatively expensive.

Given these conditions, it is highly advantageous to locate metalworking and related industries within a certain area, suggesting feasibility of the industrial park accommodating the metalworking industry.

The industrial park proposed here should meet the following requirements:

- 1) It should be located in any of the major cities of Bogota, Medellin or Cali.
- 2) Credit service to purchase modern equipment should be provided, including lease and hire purchase.
- 3) Tax incentives should be provided as far as possible.
- 4) Cooperatives should be established to promote collective purchase of materials and collective marketing of products, together with facilities to handle.
- 5) A technical center should be established to provide testing equipment that can be shared by tenant industries.

To promote modernization of the metalworking industry, long-term efforts are required with various supports at a national level. At the same time, it is important to establish a model plant with modern equipment and technology, which would stimulate existing industries and help disseminate latest production technology and practice. It is believed that the proposed

industrial park for the metalworking industry would serve these purposes.

**Chapter 8 PROPOSED PROMOTION MEASURES FOR THE SMEs
AND MES IN THE METALWORKING SECTOR**

Chapter 8 PROPOSED PROMOTION MEASURES FOR THE SMEs AND MEs IN THE METALWORKING SECTOR

This chapter proposes promotion measures for the small and medium scale enterprises and microenterprises in the metalworking sector, developed on the basis of analyses of the questionnaire survey, the diagnoses of enterprises, interviews with related organizations, and experiences of the Study Team. The metalworking industry in Colombia is still in the developing stage and needs to clear many problems prior to modernization. More precisely, the metalworking industry has a wide range of problems related to three major factors of development; (1) markets; (2) technology; and (3) finance.

It should be noted that problems associated with these factors, that are closely related to each other, are hindering healthy development of the metalworking industry. For instance, modernization of production technology entails replacement of the existing obsolete equipment, which then requires a significant amount of funds. At the same time, modern production equipment is designed to produce high-quality products in large quantities which would pay off when there is high purchase price. Volume production needs to be supported by a growing market having a sufficient size.

In Colombia, however, the metalworking industries are characterized by obsolete production equipment which constitutes an important part of production technology. Furthermore, institutional financing needed to encourage modernization by the SMEs and MEs is not widely available. Finally, the industries do not have enough of a market to recover the investment for modernization.

Based on these understandings, this chapter sets forth a series of recommendations to address the present problems. Naturally, they do not devise a plan to solve problems addressing the above three factors all at the same time. Rather they are designed to be implemented with patience in consideration to priorities and difficulties.

The Study Team believes that the best approach to solve the existing problems is to implement these promotional measures on the basis of the long-term viewpoint. In particular, it is strongly emphasized repeatedly that the metalworking industry serves as a foundation of industrial development and requires considerable time and expenditure for modernization.

Table 8.1 summarizes a general structure of recommendations made in this chapter and illustrates their roles in general framework of promotion measures for SMEs and MEs. The column "General Promotion Measures for SMEs and MEs" in the table constitutes a comprehensive policy package for promotion of SMEs and MEs, which was designed on the basis of the small business promotion policy in Japan - considered to be best prepared - and in consideration of local conditions peculiar to Colombia. Then, "Current Situation of Metalworking SMEs and MEs in Colombia and Their Problems" points out what lacks in the country. Finally, "Proposals and Recommendations" describes policies, projects and programs which need to be implemented with high priority.

Table 8.1 RATIONALIZATION OF PROGRAMS AND PROJECTS RECOMMENDED IN THIS REPORT

Item	General promotion measures for SMEs and MEs	Current situation and problems of SMEs and MEs engaged in metalworking	Proposals and recommendations (programs and projects to be implemented with priority)
Securing and expansion of market	<p>Securing of opportunity for government procurement</p> <p>Coordination of business activities with large companies</p> <p>Protection of domestic products and nationalization</p> <p>Fostering and protection of subcontracting enterprises</p> <p>Government assistance for export promotion</p> <p>Market information service</p> <p>Government assistance for sales promotion (e. g. sponsoring of trade fairs)</p>	<p>Markets for metalworking and machinery industries are too small.</p> <p>The assembly industry is not developed to generate enough demand for outside manufacturing, which is then monopolized by a few enterprises.</p> <p>Tariff protection has resulted in lack of international competitiveness to prevent the enterprises from entering the international market.</p>	To develop environment for export promotion
Technological innovation	<p>Government assistance in research and development</p> <p>Consultation and advice on production technology</p> <p>Implementation of testing and analysis on a contract basis</p> <p>Technical information service</p> <p>Training and education for engineers</p> <p>Promotion of industrial standardization and quality control</p>	<p>Poor quality of raw materials results in poor quality of final products</p> <p>Obsolete production equipment</p> <p>Insufficient production control</p> <p>Insufficient quality control</p> <p>Lack of technical support organizations</p>	<p>To establish the metalworking development center.</p> <p>To upgrade and bolster SENA's organization and service based on analysis of current situation</p> <p>To establish data banks for international industrial standard</p>
Financial assistance	<p>Establishment of government or semi-government financial institutions for SMEs and MEs</p> <p>Provision of loans under preferential conditions</p> <p>Credit service by loan guaranty and insurance</p> <p>Equipment leasing</p> <p>Provision of working capital by investment corporations</p>	<p>Shortage of financial resources for SMEs and MEs</p> <p>Poor advertisement on directed credit service</p> <p>Complicated loan application with strict requirements</p> <p>Lack of collateral</p> <p>Lack of credit</p>	To establish a loan system for SMEs and MEs in metalworking (including equipment leasing and credit service)
Assistance for improvement of management	<p>Support to organize SMEs and MEs into cooperatives and unions</p> <p>Support for creation of new enterprises</p> <p>Diagnosis and assistance related to management</p> <p>Promotion of modernization for designated industry groups</p> <p>Promotion of industries in designated areas</p> <p>Rationalization and collective siting of enterprises</p> <p>Tax incentive</p>	<p>The national program for development of MEs is underway.</p> <p>Lack of comprehensive plan and policy for SMEs</p> <p>Lack of tax incentive for SMEs, and MEs</p>	To develop industrial parks designed for the metalworking industry.
Preparation for implementation of promotion measures	<p>Strengthening and improvement of government organization for promotion of SMEs and MEs</p> <p>Development and improvement of laws and regulations related to promotion of SMEs and MEs</p> <p>Establishment of department(s) and organization(s) specialized in promotion of SMEs and MEs</p> <p>Integration of development policies</p>	<p>Shortage of government staffs specialized in SMEs and MEs, and lack of government leadership</p> <p>Underdeveloped legal system</p> <p>Insufficient government assistance without consistency and integrity</p>	<p>To improve comprehensive measures for promotion of SMEs and MEs</p> <p>Recommendations on development policy for metalworking industry</p>

8.1 Important Points in Industrialization Policy

This section discusses major issues related to industrialization of Colombia, as perceived by the Study Team, before describing the promotion measures for SMEs and MEs which are major purpose of this report.

8.1.1 Economic Liberalization Policy

Recently, the Colombian government has decided to promote liberalization of economy, which is designed to induce competition to industries in Colombia, particularly manufacturing industries which are left behind in terms of international competitiveness.

While the liberalization policy is to be introduced soon or later to accomplish the above objective, it needs to be implemented carefully through several stages. In particular, "liberalization of external trade" to reduce items, subject to import restriction and to lower tariff rates, a major element of the liberalization policy, involves the following risks:

- 1) It may result in export increase only, without modernization of industries.
- 2) Domestic industries not having international competitiveness are adversely affected by imported products.
- 3) Imports grow faster than exports to reduce foreign currency reserves, resulting in high rate of the devaluation of the local currency and inflation.

Although liberalization of external trade makes industrial materials and machinery available more cheaply, the increase in imports of finished products brings about risk 2) above. In particular, SMEs and MEs with growth potential also may be seriously damaged by imports before materializing the growth. If this occurs, modernization of industries will be hindered. Thus it is important to implement the trade liberalization gradually

according to the actual progress of industry modernization. In particular, it is too risky to suddenly remove protection policy for SMEs and MEs that have not built up strong business foundation and to expose them to strict international competition, which would allow import products to dominate domestic markets, leading to destruction of domestic industries.

8.1.2 Subsidized Financing Scheme Policy for SMEs and MEs

The economic liberalization policy envisages the elimination of subsidized loan system for SMEs and MEs under favorable terms (interest rate in particular). However, considering that financial support is an essential element of assistance for SMEs and MEs, the abolishment of the low-interest loan program is not advisable for the following reasons:

- (1) SMEs and MEs have relatively a small amount of own capital and thus are more dependent upon external sources than large scale enterprises, so that stable supply of low-interest funds is essential.
- (2) SMEs and MEs cannot obtain required loans from commercial banks and other commercial financial institutions because of relatively high lending cost for the financiers.
- (3) Commercial loans for SMEs and MEs are subject to strict terms and conditions, including the interest rate, repayment period, and collateral, compared to those for large scale enterprises.
- (4) Commercial loans for SMEs and MEs are extremely susceptible to fluctuation of money supply, compared to large scale enterprises.
- (5) As a result, SMEs and MEs with weak financial foundation are most damaged by liberalization of economy.

This clearly indicates that effective financial assistance measures need to be established to protect SMEs and MEs from negative

impacts of economic liberalization, including lower interest rates than commercial rates.

8.1.3 Foreign Investment Policy

Many enterprises which have partnership with foreign companies or introduce foreign technology have higher management and technological capabilities. Also, various Asian countries which have successfully industrialized or are currently industrializing have been using foreign investment as an impetus for industrialization. Foreign companies transfer modern production and management technologies, in addition to the capital, and many of them try to establish production bases to serve the existing market. Thus foreign investment creates opportunity to develop export markets. On the other hand, Colombia had been maintaining a policy to restrict foreign investment for a long time, which slowed down the industrialization process. Although laws have been amended to gradually remove restrictions on foreign investment, a significant effect is yet not to be realized.

In turn Colombia is not a very attractive place of investment for foreign industrializing and industrialized countries, because of small domestic market, unstable economic and political situations, and high inflation rates - although lower than other Latin American nations, and relatively high labor cost.

To attract foreign investment to the country, therefore, the following measures need to be taken.

- (1) To induce foreign investment for selected industry groups.
- (2) To create attractive investment environment which contains the following:
 - 1) Improvement of infrastructure
 - 2) Exemption or reduction of corporate income tax for a specific period

- 3) Warranty to protect foreign investment, including guaranty for not nationalizing the industry
- 4) Liberalization of transfer of profit, and reduction of transfer tax
- 5) Lifting of restriction on payment of royalties to patents and technical knowhow.

8.2 Improvement of Public Support for SMEs and MEs

8.2.1 Government Organization

The general area of government organization, through public administration activities, deserves attention for modernization of SMEs and MEs.

Currently, the National Planning Department (DNP) is responsible for planning of promotion policies for the SMEs and MEs, while the Ministry of Economic Development deals with public administration or implementation of the policies. It appears that the Ministry does not have sufficient capability to perform its duties. As of February 1990, the Ministry had only some 100 employees, which is not sufficient to implement policies including promotion of the SMEs and MEs. At present, a fair portion of public administration is carried out by affiliated corporations. The following are recommended measures, based on this situation, to improve public administration related to the SMEs and MEs.

- 1) Need for a section responsible for promotion of the SMEs and MEs: This should be established within DNP and the Ministry of Economic Development. This establishment in the ministry is prescribed under Decree No.78 of 1988 and needs to be implemented as early as possible. In particular, the Ministry of Economic Development needs to upgrade the Small and Medium Scale Enterprises Section and the Microenterprises, Handicraft, and Informal Sector Section. As for DNP, it was decided to establish the division on microenterprises and enterprise cooperation (Division de Microempresas y Empresas Asociativas) under Decreto 2410 issued in October 1989, but no activity is started yet.
- 2) Need for a new organization: Even if the sections are strengthened or newly established, the Ministry will not be able to only take strong leadership due to its shortage of staff. To compensate for this, it is recommended to create a public organization,

which may be called "Smaller Business Promotion Agency", to carry out programs for the SMEs and MEs. This organization needs to have branch offices in major cities. Consideration also should be given to creating a section to promote MEs and SMEs in each local government instead of the branch offices.

- 3) Need of improved coordination: At present, different promotion programs for the SMEs and MEs are carried out by governmental agencies, public organizations, public corporations, financial institutions, and non government organizations (NGOs), but without well organized coordination. To devise more efficient promotion measures with clear objectives and means, it would be suitable for the National Planning Department and the Ministry of Economic Development to take stronger leadership.

8.2.2 Improvement of the Legal Environment

No legal basis for promotion of the SMEs and MEs was available until December 1988 when Law 78 was enacted and a detailed regulation was drafted in 1990 by the Ministry of Economic Development. To ensure coordinated implementation of promotion programs as suggested in 3) above, a comprehensive legislation system should be established on the basis of the Law 78. Based on such system, the Ministry of Economic Development shall be able to coordinate or reorganize related organizations.

Lack of mutual trust between the government and private industries or industrial association should be noted as a problem in connection with creation and use of a legal basis for promotion. When the Study Team asked private industries and associations as to what would be expected from the government, a majority of responses were "The government has not done much for private industries, thus we do not expect much." Nevertheless, the Study Team believes that the government has been making a certain effort under the constrain of a limited budget and work-

force.

One reason for such mistrust between the government and private industries, as seen in many countries, appears to lie in that a legislation system to coordinate the government and private sector is not sufficiently developed and used.

Note: APPENDIX attached at the end of this chapter describes a general outline of the legal system which is based on examples and experience in Japan and Asian NIEs. Naturally, the legal system cannot be applied directly to Colombia because of difference in government organization, legal customs and economic policy. Rather it is intended to serve as a guideline to develop a comprehensive and effective legal system.

8.2.3 Promotion Measures Especially for Micrenterprises

In Colombia, there are over one million microenterprises, which have 10 or less employees, accounting for 40% of the total working population. Of total number of MEs, 80% are considered to remain in informal sector. Given this magnitude of scale, the fostering and protection of MEs are one of the most important issues in Colombia.

MEs, among other things, are characterized that company management is unseparated from a household account.

This generates the following problems:

- 1) Lack of working capital financing capability, including inadequate bookkeeping, to make it difficult to borrow from commercial banks and other financial institutions;
- 2) Low productivity and poor working environment;
- 3) Lack of ability to collect updated information on market, economy and technological development, thus unable to keep up with economic changes; and

- 4) Lack of access to social welfare service for owners and workers including family members of MEs.

Under this recognition, promotion measures for MEs need to be developed from two perspectives; (1) to treat MEs as business enterprises (economic policy), and (2) to treat MEs as minorities in the economic system to require protection (welfare policy).

Government assistance programs for MEs are generally developed and operated within the framework for SMEs as well as MEs; the legal system, institutional credit service, tax system and other measures mentioned in APPENDIX are equally applied to SMEs and MEs. In practice, however, it is often the case that the assistance programs focus on SMEs, while much less accessible by MEs. For instance, the institutional credit system for SMEs and MEs in Colombia is mainly used by SMEs, practically excluding MEs. This indicates that government assistance programs for SMEs and MEs need to include special considerations to MEs.

In March 1984, the Colombian Government started the National Microenterprise Development Program (PNDM) to provide assistance for MEs. PNDM includes the following services.

- 1) Training on management techniques
- 2) Advice on management
- 3) Expansion and improvement of financing for MEs
- 4) Establishment and upgrading of marketing organization
- 5) Promotion of cooperatives and trade organizations
- 6) Development of legal system for promotion of MEs
- 7) Promotion of technological development

The above services cover the most of measures required to develop MEs.

In consideration to the above points, and from the viewpoint to accomplish PNDM's objectives, the following

recommendations are made for promotion of MEs.

(1) Development of statistics about MEs

Although to understand current situation of MEs is most important to prepare or implement promotional measures, there is no statistics available related to MEs. While MEs are not included in industrial statistics, the household study provides only a part of information required. MEs in informal sector are not registered with the chamber of commerce and their data are partially available in related studies which covered major cities only. Thus, it is important to develop national level statistics on MEs, including informal enterprises. In this connection, it may be advisable to introduce the latest statistical techniques by inviting foreign experts.

(2) Promotion of social participation by informal enterprises

When the informal enterprises are defined as those which do not register with the chamber of commerce nor pay any tax, estimated 80% of MEs in Colombia fall under this category. As a result, it is generally perceived that MEs equal informal enterprises. As informal enterprises are not recognized as independent economic units, it is difficult to provide them with assistant programs.

The informal enterprises do not become formal enterprises because of lack of incentive. To have registration with the chamber of commerce requires 13 steps which involve documentation and other complicated work. After registration, the formal enterprises have to bear additional cost, including taxes, contribution to SENA, costs related to preparation of documents to be submitted annually, which are said to reduce the profit by 35% to 40%. Such disincentive clearly discourages informal enterprises to become formal ones.

To improve the situation, the following measures need to be taken:

- 1) To simplify and streamline the registration procedure;
- 2) To simplify annual reporting requirements;
- 3) To grant tax exemption for enterprises reporting income less than a specific level (an actual tax incentive policy will require further study); and
- 4) To provide loans with favorable terms for formalized enterprises.

(3) Institutional finance for MEs

The IDB line which serves as a financial source within the framework of PNDM is expected to continue its effort to increase borrowers. The second IDB line is being negotiated between IDB and the Colombian Government, with agreement being expected soon. In addition, the following recommendations are made on financial sources for MEs other than the IDB line:

1) Allocation of finance to MEs

A certain portion of institutional loans e.g. FFI's directed finance and World Bank's SME loan shall be forcibly allocated to MEs. Otherwise, intermediaries for these institutional loans, commercial banks and finance corporations, tend to make loan to larger size of enterprises other than MEs due to high finance cost to MEs.

2) Introduction of small loan system

Loans to MEs will increase through the above requirements for institutional credit service but by no means sufficient to meet demand by MEs. To compensate for this, it is recommended to establish a quasi-government financial institution specialized in small loans.

The institution is designed to provide small loans under a simplified procedure and without collateral and guarantee. The small loans shall be available only for "formal" enterprises, thus it is expected to serve as an incentive for informal enterprises to become formal ones. Also, the borrowing enterprises are required to receive the same training on management techniques conducted under PNDM. Finally, evaluation of loan application may be replaced with recommendation by a local chamber of commerce.

3) Credit guaranty system

Other than the proposed small loan system, any of institutional credit service and commercial loans require collateral and guarantor. In practice, this prevents MEs from using these services. To redirect the financial sources to MEs, it is important to introduce a program to provide guaranty for lending institutions. The proposed credit guaranty system is designed to allow MEs to secure loan guaranty from a credit guaranty company without collateral and guarantor. In this connection, existing credit guaranty companies including FNG and FOMENTAR need to be upgraded to provide loan guaranty up to a specific amount for enterprises which satisfy certain requirements, through recommendation by the chamber of commerce or other simplified application procedures. It should be noted that the proposed credit guaranty system is made available to SMEs as well as MEs, with preferential treatment for MEs without collateral and guarantor.

The credit guaranty corporation has to bear a risk of repayment for borrowing enterprise to a financial institution in case of default. To spread this risk, it is desirable to establish an insurance company which operating cost should be borne by the government; it is considered as a social cost to foster SMEs and MEs.

The following describes relationship between the borrowing enterprise, financial institution, and credit guaranty company in terms of application process.

- a) A small or medium scale enterprise or a microenterprise intending to receive loan guaranty makes an application to the credit guaranty company.
- b) The company reviews and evaluates the application, and if acceptable, approves the guaranty to the financial institution from which the enterprise intends to have a loan.
- c) The financial institution, upon receiving a notice of approval from the credit guaranty company, executes the loan to the enterprise, which in turn pays a fee to the guarantee company.
- d) If the enterprise fails to repay the loan on or before a due date, the credit guaranty company makes payment in subrogation.
- e) Upon subrogation, the credit guaranty company obtains a claim for the loan from the financial institution. After that, the guaranty company continues efforts to collect the unpaid balance from the enterprise on a long term basis by taking into consideration recovery of the enterprise's business.

At the same time, the credit guaranty company purchases an insurance from the credit insurance company to spread the risk of default, as follows:

- a) The credit guaranty company enters an insurance agreement with the insurance company before granting the approval under b) above.
- b) It is desirable that each loan is automatically insured upon approval by the credit guaranty company, regardless of risk involved.

- c) The credit guaranty company pays to the insurance company a prearranged insurance premium.
- d) When the insurance company make payment in subrogation due to default of the enterprise, the insurance company indemnify the credit guaranty company an amount equivalent to 70% to 80% of the amount subrogated.

This system is characterized by quick approval of credit guaranty which is granted so far as a borrowing enterprise satisfies a certain set of requirements, while the insurance is automatically arranged. This way, the number of insurance increases to reduce a risk for the insurance company. In addition, as the insurance company covers 70% to 80% of the amount subrogated by the credit guaranty company, the credit guaranty company suffers loss of remaining 20% to 30%, thus encouraging it to evaluate the loan application carefully.

4) Equipment leasing system

The equipment leasing system is an effective means for SMEs and MEs to modernize equipment, in particular highly beneficial to MEs who do not have access to financial sources. In general, financial institutions lend a part, say 70% of the fund required so that a borrower is expected to finance the balance by himself. However, small enterprises - MEs in particular - do not have own financial sources and cannot use the institutional credit service. Also, MEs are not capable of selecting adequate equipment and require technical assistance.

The equipment leasing system has two advantages: one is to minimize own financing for equipment investment; and the other is to provide technical assistance in equipment selection.

Under the system, machinery and equipment having appropriate technology are designated and listed up for each industrial subsector and are leased to SMEs and MEs upon application. The term of lease is determined on the basis of service life of machinery or equipment to be leased. The lessee makes a deposit equivalent to some 10% of the value of equipment leased, and repays the remaining amount, including the hire charge equivalent to the applicable interest rate, on an installation basis within the term of lease. The deposit is allocated to the final payment, and ownership of the equipment is transferred to the enterprise upon completion of the payment. At present, leasing by private companies requires higher interest rates than commercial loans, thus not accessible to SMEs and MEs. A further study is needed to introduce the less costly leasing system.

(4) Mutual aid scheme

Owners of microenterprises are susceptible to a risk of bankruptcy all the time, while not benefited from the social insurance scheme despite relatively small income. To provide funds for the owners after retirement, death or termination of business, it is recommended to establish a mutual aid scheme.

Owners of MEs participating in the mutual aid scheme pay a monthly premium and is eligible for an allowance when an owner terminates his business, dies, or retires.

(5) Organization of MEs

As pointed by PNDM, it is important to organize MEs into associations. The organizing of MEs has the following advantages:

- 1) To allow various promotion programs to be implemented smoothly;
- 2) To facilitate technical assistance and training;

- 3) To ensure smooth information service and communication;
- 4) To facilitate cooperative activities between enterprises;
- 5) To facilitate effective communication with government agencies for various applications and requests; and
- 6) To encourage mutual aid programs.

Note that, to make the best use of a public assistance program for MEs, the government should take initiative to encourage effective implementation thereof, and the organization of MEs plays a vital role.

In addition, MEs are closely related to their local community. MEs tend to be engaged in business activities which meet local needs, as a result, a certain area contains similar types of enterprises with less relocation to other areas. Thus organization of MEs is desirable to proceed by starting from a municipal level as a basic unit which will be further organized into a federation for each district, then nationwide.

Although the chamber of commerce is expected to take leadership in organizing MEs on a local basis, it is generally located in urban areas and cannot serve the purpose in rural areas. Thus it is important to organize an association in rural areas under initiative of each municipality and cooperation of NGOs and SENA. Any enterprises engaged in manufacturing industry, commerce and service are to be organized into an association.

On the other hand, the chamber of commerce should be responsible for organizing in urban areas, and it may have to be established where necessary. Both formal and informal enterprises should be entitled to join these associations, so that they can be used as a means of promoting informal enterprises to become formal ones.

8.3 Promotion of Exports of Metalworking Industry Products

Promotion of import substitution is of high importance with regard to products of the metalworking industry, as exports are extremely small and there is a very high level of net imports of products of this industry. Nevertheless, the small scale of the domestic market for such products imposes a limitation to the growth of the industry, unless the export market for its products is developed. Two major policies deserve adoption by the government and related entities, for the promotion of exports, namely:

- 1) Policy that seeks to give international competitiveness to metalworking industry products (e.g., through improvement of production technology), and
- 2) Policy that provides for incentives for promotion of exports

Improvement of international competitiveness through such measures as improvement of production technology can be considered as an extension of import substitution promotion policy, and is not a special measure for imparting competitiveness in export markets. The major aspects whereby competitiveness of industrial goods may be measured are "quality", "price", "delivery performance", and "after-sales service". Of these, "quality" is the most important, as the other criteria can be satisfied through measures such as the rationalization of production.

A simplified way to define the process of producing metalworking goods of high quality would be the purchase of raw materials of high quality, processing of them by use of up-to-date facilities, and maintaining quality control standards. Possible approaches for achieving this have been discussed in a preceding part of this report, and recommendations related thereto are given in the following sections.

Policies for promotion of exports in Colombia are embodied in the Certificado de Reembolso Tributario (CERT), Plan Vallejo, Zona Franca and PROEXPO's programs. These programs, which are intended to promote under exports of all products, deserve to be continued and augmented even under the open policy of the economy. As additional measures that deserve consideration there are

reduction of corporate tax for export industries, reduction of local taxes for such industries, and approval of accelerated depreciation.

To give special emphasis here to the matter of export promotion, first of all it should be pointed out that need exists to be able to easily obtain raw materials of a grade suitable for export products, at a suitable price, and, second, to create an environment favorable to attraction of foreign companies, which will provide the necessary technology. In the case of the metalworking industry, because the quality of the raw materials is readily translated into the quality of the finished product, if low-quality raw materials are used it is not possible to produce high-quality goods no matter what production technology is improved. Further, it is thought that the best way of promoting the transfer of modern production and management technology to Colombia is through promotion of joint ventures with foreign companies.

Regarding the acquisition of high-grade raw materials (steel, etc.), there should be no problem provided that appropriate action is taken, because a study has been done regarding the reorganization of the steel industry, and importation has been liberalized. Therefore, importance of attraction of foreign companies is described in this section.

As a successful example of attracting foreign companies in Asia, the Thai experience will be explained here instead of general discussions. The Thai government had for some time been in favor of attracting foreign investment, and in more recent years has become more aggressive in attracting investment, especially through the Board of Investment (BOI). As a result, since 1987 there has been a swift increase in the number of foreign companies investing in Thailand (see table below).

Foreign investment in Thailand

	<u>Application</u>	<u>Approvals</u>	<u>US\$ million approved</u>
1987	630	385	2,500
1988	1,271	888	7,820

The composition of approvals by country in 1988, show the four most important sources to be Japan, Taiwan, the EC and the United States, that collectively account for 87%. The rate of increase has accelerated in 1989 and most of the total are in export-oriented manufacturing industry. Factors for selection of Thailand as a production base comprise the low-cost, good-quality labor force, political stability, and favorable geographic location for exportation. From the side of the host country, the advantages that accrue to Thailand are:

- 1) Increased receipt of hard currency, from the increase in exports,
- 2) Acquisition of state-of-the-art technology,
- 3) Increased employment, and
- 4) Increased income.

For Thailand, which had been an agricultural developing country, the rapid progress of industrialization has made it into a newly-industrializing nation, and the economy has been transformed to one that is increasingly benefiting from the exports of manufactured goods.

In addition to the above factors, Thailand has benefited by the appreciation of the value of the Japanese Yen and the Taiwan New Dollar, which has reduced those countries' export competitiveness and encouraged them to transfer production bases to locations outside their own borders. But the BOI adopted the following specific policies which have served to make the aggressive effort to attract foreign industry.

- 1) Implementation of a campaign to attract industry, by using mass media (newspapers, TV, etc.) in countries identified as being high in importance as sources of investment.
- 2) Holding of seminars in the target countries, to explain how and why the environment for investment in Thailand was good.
- 3) A direct mail campaign to companies believed to be potentially interested in investing in Thailand, fol-

lowed by telephone contacts.

- 4) Organization of group tours to Thailand, with tour members being managers of companies identified as having high interest in investing in Thailand, so they could see local conditions for themselves.
- 5) Development of industrial parks having qualities attractive to foreign companies.
- 6) Improvement of incentives for foreign companies, and especially export-oriented companies.
- 7) Improvement of industrial infrastructure, including roads, telecommunications, power utilities and ports and harbors.

For the first five of these, extensive use was made of foreign consultants.

Efforts to attract foreign companies have not been limited to Thailand; all the newly-industrializing countries of the region (Korea, Taiwan, Singapore, Hongkong) have developed their economies by use of this policy. In the case of Colombia, however, although in recent years the country has become increasingly interested in attracting foreign investment, the past restrictions on foreign capital have caused delay in making efforts toward that end. In order to increase exports of metalworking industry products, from a medium- and long-term viewpoint, it will be a realistic and swift method to attract foreign companies and promote importation of foreign technology.

8.4 Sector Loans for the SMEs and MEs in the Metalworking Sector

8.4.1 Need for Sector Loans

Results of the questionnaire survey and corporate diagnosis indicated that the most serious problem faced by the SMEs and MEs in the metalworking sector is difficulty in securing financial sources. The questionnaire survey shows that more than 70% of MEs and more than 60% of SMEs requested governmental support in the area of finance. Access to formal financial services becomes difficult with decrease in company size. For commercial banks and other financial institutions, it is not preferable to provide loans to the SMEs and MEs involving relatively high cost and risk. This situation is not unique to Colombia but presents a major problem in promotion of the SMEs and MEs in most countries, and for this reason they are developing institutional credit service systems.

The institutional credit service for the industrial sector in Colombia consists of the FFI's loans, which mainly serve the SMEs as well as some of the MEs, and the World Bank's SME loans. The former is funded by the Colombia government. In addition to these services, the IDB's line is available for the MEs. However, these credit services are not well known among the enterprises, and available financial resources are not sufficient to overcome credit supply shortage, that is the largest hindrance for development of the SMEs and MEs.

At the same time, modernization of production facilities and equipment is considered to be an urgent problem for promotion of the metalworking industry, and requires a considerable investment. In this connection, introduction of sector loans for the metalworking industry is necessary to solve this problem. Results of the questionnaire survey indicate that the SMEs and MEs see complicated procedures, lack of collateral, and strict qualification for loans as the most discouraging factors, rather than high interest rates. Thus, the proposed sector loans should give consideration to these factors.

8.4.2 Outline of the Sector Loans

(1) Eligible sectors

The proposed sector loans will primarily serve the metalworking and machinery industry. Also, industrial sectors which require a significant investment for modernization and receive high priority in national development policies, e.g., the plastic, wood, and food processing industries, may be added. In this case, the program may be called "modernization loans" rather than "sector loans".

(2) Eligible company sizes and purposes of loans

The sector loans will be provided to SMEs and MEs for the purpose of purchasing production machinery and equipment. A list of "modern machinery and equipment suitable for use in Colombia, and up-to-date in nature" should be prepared with specifications and updated annually.

(3) Methods of financing

As the means of providing finance, an ordinary loan may be used, but it is proposed here that leasing or the hire-purchase system be adopted. The hire-purchase system involves the lending of equipment by the implementing agency to the use-company for a specific period of time, after which ownership is transferred to the company. This arrangement has the following advantages in comparison to an ordinary loan.

- 1) Ordinarily, a loan is not provided for the entire amount of funds needed for equipment investment; some portion of the funds must be procured by the company itself, but companies on the scale of MEs or SMEs, lacking collateral and credit, are restrained from acquiring money for equipment investment by this method. A lease eliminates this problem.

2) Frequently, companies on the scale of MEs or SMEs lack a strong technological base, and cannot make proper decisions on selection of equipment when they are to make an investment. When a lease is used, the implementation body selects the equipment equipped with modern and appropriate technology with the side effect of supplementing the technological capability of the client company.

In addition, replacement of obsolete equipment possessed by MEs and SMEs will be gradually but forcibly attained. It is possible for ordinary loans to be used as sector loans, but in such a case the loan-supplying agency should make the decision on what equipment is to be acquired.

(4) Implementation body

It is not legally permissible for the central bank to provide finance by means of leases or the hire-purchase system. Nevertheless, according to the Law No. 78/1988 which may be considered as the basic law related to MEs, the CFP is empowered to use lease financing. It is therefore suitable for the implementing agency to be the CFP. It is also possible that regional governments may serve as the liaison office but further study is needed to determine if such a method is suitable for use in Colombia.

(5) Loan conditions

Be it the lease or the hire-purchase, it is desirable to set an effective interest rate for industries as low as possible.

The term of lease should be set within service years of machinery and equipment, e.g., 5 to 8 years. The service life of each machinery and equipment should be determined when the equipment list is developed.

(6) Guaranty

The sector loan program should preferably be accompanied by a guaranty service using low credit rates for the SMEs and MEs. This may be provided by FNG or FOMENTAR, or in the form of mutual guaranty by borrowers, who are required to form a group of 10 to 20 companies for loan application and guaranty.

(7) Technical support

In addition to the credit service, the sector loan program should include advice related to appropriate technology for equipment modernization. It would be suitable to obtain the cooperation of technical experts through private and public bodies such as universities and FEDEMETAL. Also it is recommended to use foreign experts for development of the equipment list and the initial stage of implementation.

(8) Financial sources

1) Financial source for the credit line

Foreign exchange will be required for the sector loans because most of the modern machinery and equipment would be met by imports.

The loan program should be started on an experimental basis and moved to the full-scale operation only after a favorable outlook is verified. At the outset, whether activities are limited to metal-working industry, or also include other industries, the required pool of funds would be on the level of US\$20 million. Of this amount, about 20% should be provided by Colombia as counterpart funds. Also, it is desirable to grant exemption of import duties on the imported equipment and machinery, which would help minimize the financial burdens of the companies.

2) Financial sources for loan guaranties

The guaranty cost should be considered as a social cost incurred in the process of industrialization.

3) Financial sources for technical support

Costs related to technical support may be covered in the form of international cooperation or by the spread in the credit line.

8.5 Upgrading of SENA and Expansion of Services

8.5.1 Need for Upgrading and Service Expansion

SENA is a national training institute, the largest in Colombia, having sound financial resources; it operates 20 branches and 95 facilities throughout the country, employing over 8,200 persons, and obtains operating funds from contributions by public and private industries, 2% of wages and salaries.

According to the questionnaire survey, entrepreneurs and managers who completed SENA's training courses accounted for 31% of the MEs employing 2 to 5 persons, 15% of the MEs with 6 to 10 employees, 14% of the Sml-Es, and 6% of the Med-Es.

SENA is considered to be a very active vocational training institute compared to similar institutions in other developing countries, where vocational training services are directly provided by the labor ministry but are often scaled down or suspended in many countries due to insufficient budget allocation.

On the other hand, SENA's sound financial base and nationwide service network serve as primary factors for supporting the proposed improvement of functioning and reorganization of SENA.

According to interviews with enterprises and trade organizations, SENA has a divided reputation; while some highly praise its activities, others criticize that it emphasizes business management rather than production technology and does not have equipment and ability to teach latest production technology. This proposal is based on the concept retaining services that have earned a high reputation, and improving and upgrading those criticized.

Strengthening and restructuring of SENA have been proposed by various authorities, with notable increase in recent years. For instance, the president office reportedly examines the issue and intends to issue a presidential decree to upgrade SENA to an organization to promote

industrialization in a comprehensive manner in addition to vocational training. Also, SENA carries out a study in the same line. Thus, the following recommendations have presumably been considered by SENA and other related authorities. Nevertheless, the Study Team would like to propose these recommendations from own standpoints, with hope that any of them can be used for helping SENA better contributing to industrialization of the country.

8.5.2 Recommendation for Restructuring SENA

SENA is under the jurisdiction of the Ministry of Labor and Social Security and as such is limited by law to functioning as a vocational training organization but recently many people have come to think that in view of the high importance of industrial development, SENA should be utilized more fully, by extending its activities beyond training. The following recommendation is made on the basis of the latter viewpoint.

The following four recommendations are presented for the restructuring of SENA, including improvement of its functions.

- 1) To carry out a comprehensive study on SENA's restructuring,
- 2) To make a significant effort to supply testing and inspection services,
- 3) To establish new training centers (for plating and casting), and
- 4) To improve research and development activities.

(1) Comprehensive study on SENA's restructuring

According to SENA's personnel and users, there are opinions that the equipment presently possessed is not adequate for fulfilling the key function of SENA, namely to provide basic industrial training, while many argue that much of the equipment is outmoded, meaning that training in the use of new technology cannot be provided. Also it was heard that funds for

procurement of new equipment are insufficient for SENA. International cooperation has made it possible for new equipment to be provided to the Centro Nacional Colombo Italiano, which is a part of the Centro Nacional de Tecnicos de Industria, and to the Centro de Desarrollo Tecnologico (CDT ASTIN), but these are oriented toward medium- or larger-scale enterprises, and there have been almost no instances of this new equipment having been utilized on behalf of MES and SMEs.

The present report proposes that a metalworking industry promotion center be established, but it may be possible to attain this objective by improvement of the equipment at the disposal of SENA. From this viewpoint, it is thought to be necessary to carry out a comprehensive study on the restructuring of SENA. This study should cover the following subjects.

- 1) Clarification of the suitable role for SENA to play in industrialization,
 - 2) Review of the suitability of the legal basis for SENA's existence, and its being under the jurisdiction of the ministry as at present,
 - 3) Evaluation of the present level of existing facilities, and of its modernization,
 - 4) Review of the internal organization of SENA toward the objective of improving service,
 - 5) Cooperative relationships, existing and desired, between SENA and other bodies, including private organizations,
 - 6) Review of SENA's existing plans for restructuring, and
 - 7) Fund requirements, and schedule for restructuring of SENA after restructuring.
- (2) Strong need for supply of testing and inspection services

To attain overall development of Colombia's industry, it is necessary precondition that export-oriented products be made not only by attempting to improve the

quality of finished goods but by starting with raw materials of quality that meets or surpasses international standards. It is necessary to improve the industrial standards now in use in Colombia, and because it is necessary to check on whether finished products meet internationally-accepted industrial standards, as well as to check on standards while goods are in production, use of testing and inspection services is necessary.

As many MEs and SMEs do not have equipment for inspection and testing, there is a need to operate a technical center providing them with those services. In Section 8.6 the recommendation is made to establish a "Metalworking Industry Promotion Center", and it is desirable that SENA participate in the activities of such an organization. While it would be possible to make "a broad contract with outside parties regarding specific programs for training", whereby inspection and testing services of raw materials and products could be offered to businesses, this is not thought to be satisfactory to enable SENA to fully contribute to the industrial development effort.

(3) Establishment of new training centers (for plating and casting)

It is proposed that a new plating center be provided for SENA, as it does not now have one, and that the existing casting center, which has antiquated equipment, be complemented by a new center.

In order to fully obtain benefits from SENA training facilities, it is necessary to insure that employers will have an adequate understanding of the center's work so that they make the most of employees who have been trained there. SENA should make efforts toward that end. Moreover, it is permitted by law that products made during the training process can be sold, and efforts should be made by SENA to sell those products in order to gain income thereby.

1) Plating center

a) Reason for establishment

In comparison to the large number of factories in Colombia that do plating for automobile parts and other products, plating technology in the country has not kept up to the times. One reason for that is the absence of a SENA plating training center, and therefore establishment of a new center to engage in that work is hereby proposed. The center would provide guidance in plating process technology, do training of plating workers, and undertake research on new technology. It would be furnished with environmental protection equipment that meets projected future standards to be adopted in Colombia.

b) Facilities

- Pre-plating processing

Sandblasting equipment and buffing equipment

- Zinc plating

Upto-date, automated equipment is to be installed and made so it can be used in fully-automatic, semi-automatic, or manual modes. It shall be equipped for medium-size parts, with a rack process which can be converted to a barrel process for plating of small parts. The equipment shall be also capable of chromate, unichromate and black chromate processing after plating for decorative purpose.

- 3-layer plating line of copper, nickel and chromium

A manual 3-layer plating line shall be provided as typical functional plating. The tanks for alkali degreasing, water rinsing and electrolytic degreasing shall be used in common with those for zinc plating. Those tanks can be used for other plating changing solutions.

- Anodizing line

Anodizing line is provided for anodic oxide coating on aluminum and aluminum alloy metal. Water rinsing tanks and electrolyte tank for this line are used jointly with those on the galvanizing line.

- Chemical analysis laboratory

In the chemical analysis lab, solution analysis equipment, and, for testing and inspection of plated products, adhesion testing equipment, plating thickness measurement equipment, salt spray tester, etc. shall be installed.

- Rectifier Room

A rectifier shall be installed in a separate room for prevention of corrosion. A control box is to be installed at the inlet of the plating tank.

- Ventilation facilities

To protect workers, noxious gases generated at tanks will be removed by means of a local exhaust system and processed to render it harmless before the gases are released into the atmosphere. There are to be three systems, one each for acids, alkalis and hexavalent chrome.

- Environment protection equipment

Effluent processing equipment shall be installed to process and remove cyans, hexavalent chrome, acids, alkalis and heavy metals.

c) Number of trainees and training period duration

It is expected that each group of trainees will be from 10 to 20 persons in size. A training period ("Apprenticeship") of two years would be suitable. This center, however, is to be capable of giving shorter training programs.

d) Equipment list

The list of equipment, layout, process flow, organization, project cost and construction schedule are discussed in Section 8.9.

2) Casting center

a) Reason for establishment

The casting center is to have the major objective of elevating casting technology by providing practice and lecture on the various processes used in the production of castings, and as a secondary objective, to use its training equipment to provide testing and inspection services for MEs and SMEs in the private sector.

b) Equipment

- Melting equipment

A high frequency induction furnace is to be furnished for cast iron, ductile cast iron and cast steel, as well as a crucible furnace for non-ferrous alloy casting. The reason for selecting a high-frequency induction furnace for iron, ductile iron and steel castings is

in comparison with use of a cupola, control of molten metal is easier, and high temperatures can be easily attained. Also, it generates fewer airborne particles and thus is preferable from the viewpoint of the environment.

- Die casting process

Die casting equipment is provided for study and training of the die casting technology necessary for aluminum alloy casting.

- Precision casting (Lost-wax method)

One set of lost-wax equipment as a typical precision casting is provided to make precise and comparatively small components.

- Molding and core making

So that various sizes and forms of castings can be made, two processes for molding are to be used: the carbon dioxide molding and the green sand molding. Processes for core making are to be of shell core, carbon dioxide core and self hardening core making.

- Plastic pattern making equipment

This is equipped for study and training of the technology of making modern plastic patterns instead of wooden patterns.

- Cleaning and fettling

A table type shot blasting machine, a double headed grinder, high frequency grinders, etc. shall be provided.

- Heat treatment furnace for castings

A low-temperature furnace for aluminum alloy castings and a high-temperature furnace for steel castings are to be provided.

- Quality control equipment

For purposes of quality control, a CE meter for melting control, temperature measuring devices, sand testing equipment, casting hardness testing equipment, chemical analysis equipment, strength measurement equipment and devices are to be provided.

c) Casting capacity

Iron and ductile iron castings: up to 300kg/unit
Steel castings : up to 250kg/unit
Copper or aluminum alloy castings: small pieces
Total: 500-600 tons a year

d) Number of trainees and duration of training period

The training period is to last two years, and each class is to comprise about 40 trainees, so from a total of 80 trainees would be enrolled. During the first year, lectures would concentrate on basic education for casting shop workers, and the second year would be devoted to actual practice. The second year would include training in work at melting, molding, core making, post-processing, inspection, quality control and other aspects of production work.

e) Required equipment; other information

The equipment required, layout, work flow, organization chart, project cost and construction schedule are as shown in Section 8.9.

(4) Research and development activities

Research and development work can be commissioned to universities and research institutes, but to the maximum extent possible use should be made of the facilities and financial resources of SENA. At CDT-ASTIN in Cali, there are research and development activities which are being carried out with the cooperation of COLCIENCIAS and other public bodies such as universities, but this is not adequate for the needs of a training program. Greater flexibility in interpreting legal mandates could be useful in this regard.

8.6 Development of Industrial Parks Specialized in Metalworking Industry

8.6.1 Need for the Specialized Industrial Parks

The government implemented a program to develop industrial parks under Decree 2143/1979, for the purpose of promoting industrialization of rural cities. However, the program is considered to be unsuccessful, probably because it excluded the major industrial areas of Bogota, Medellin, and Cali, while there is not a sufficient number of industries that find industrial parks in rural cities to be attractive. This situation is by no means unique to Colombia; similar industrial park development projects aiming at regional development in many other countries could not attract much industry. As a result of this problem, more and more policy makers and development experts think that industrial parks should be located in the vicinity of major industrial areas.

This was confirmed by results of a field survey of a small-scale industrial park located in the Bogota area, which successfully attracted a sufficient number of industries. At the same time, the Study Team through the diagnosis survey on metalwork shops in existing urban areas, identified that smaller companies had relatively little space, and a poor working environment, making it difficult for them to expand production facilities. Furthermore, shops often are not built with a structure which has or can accommodate an overhead traveling crane to handle heavy items.

Results of the questionnaire survey indicate the degree of interest in industrial parks by the SMEs and MEs, as follows:

No. of enterprises

	responded	showed interest	Percentage
MEs	73	61	83.6%
Sml-Es	96	80	83.3%
Med-Es	32	17	53.1%

The table suggests that one half of the Med-Es and over 80% of the Sml-Es and MEs are willing to move into an industrial park under favorable conditions.

It is proposed that an industrial park be created for metalworking industry.

Given the above background, industrial parks accommodating metalworking industries are thought to have the following advantages:

- 1) Availability of well-developed infrastructure (including roads, communications, and utilities),
- 2) Sharing of common service facilities, e.g., laboratories and other facilities related to product development, inspection, and testing,
- 3) High degree of security and safety measures,
- 4) Availability of large space to allow future expansion, and
- 5) Ease in establishing cooperation among tenant industries which are all engaged in metalworking industry, including collective buying and product marketing.

8.6.2 Outline of the Specialized Industrial Parks

General concepts and design principles of an industrial park specialized in the metalworking industry are present-

ed below as a basis of detailed planning, although a detailed feasibility study should be carried out regarding its implementation. The conceptual plan of the proposed industrial park is given as Table 8.7.

(1) Objective

To provide a model case of metalworking industries by siting them in industrial parks with modern facilities and equipment, thereby encouraging the metalworking industry as a whole to initiate modernization.

(2) Eligible industries

The SMEs and MEs which are specialized in metalworking operations and are willing to introduce modern production equipment.

(3) Locations

Bogota, Medellin and Cali areas. An industrial park will be developed in one of these areas on an experimental basis, then other areas if favorable results are obtained. Following successful development in these areas, study would be made for additional estates in Barranquilla and Bucaramanga.

(4) Site area and the number of tenant industries

Approximately 10 to 15 ha of land will be developed to accommodate 20 to 30 enterprises. The site area will include roads and common service facilities.

(5) Common service facilities (CSF)

Including machinery repair shops, product inspection facilities, material testing laboratories, measuring instrument testing facilities, exhibition spaces, education and training facilities, utility services, and security offices.

(6) Incentives

1) Tax incentives

Including exemption or reduction of income taxes on tenant industries, import duties on equipment and materials, and local taxes, as well as introduction of special depreciation methods.

It is preferable to provide incentive equivalent to privileges granted to industries located in boundary areas.

2) Financial incentives

Low-interest-rate hire-purchase, or low-rate leases will be introduced to purchase production equipment. Under the hire-purchase system, an organization responsible for development of the industrial parks will lease the production equipment to tenant industries for a certain period of time (e.g., 10 years), thereby eliminating need for collateral and relaxing conditions required for general loans.

(Note) It is assumed that the sector loan proposed in Section 8.4 is applied for this industrial estate.

It is expected that international cooperation would be available for creation of this industrial park. The possibility of an investment by IFI in the company which will develop the estate is also worthy of study.

(7) Implementing agency

A public corporation or other public body would be suitable as implementing agency. It is thought necessary to obtain participation from private organizations concerned with technical support services such as FEDEMETAL, and to invite foreign experts to work with Colombian staff.

8.6.3 Development Procedure

The industrial parks should be developed under strong leadership of the project implementation body, including factory design. This will ensure introduction of modern production equipment and technology, which would otherwise not be possible solely at the initiative of tenant industries. The implementation body will be responsible for implementing the development project in accordance with the following sequence. It shall:

- (1) Conduct a feasibility study on the development project by appointed consultants and to identify products to be manufactured in the industrial park;
- (2) Conduct a feasibility study on the manufacture of the identified products, and shall select suitable products;
- (3) Plan and design metalwork shops (20 to 30 shops) to manufacture the selected products, using latest equipment and technology;
- (4) Invite private enterprises to participate in the development project based on results of the feasibility study;
- (5) Build the metalwork shops and purchase machinery and equipment;
- (6) Lease the completed shops to enterprises upon application, while retaining ownership of the shops, and
- (7) Transfer the ownership of the shops to the tenant industries after a certain period of time, e.g., 10 years (hire-purchase system).

This development method has two major advantages; the implementation body designs, builds and owns the shops for a certain period of time, so as to ensure effective modernization; and the tenant industries, mainly the SMEs and MEs, can operate the modernized shops without raising a large amount of funds.

In Section 8.9, the layout, equipment cost and a general development schedule of a relatively small estate (10 ha, 20 companies, the minimum of the common service facilities) for metalworking industry is provided for reference.

8.7 Metalworking Industry Promotion Center

8.7.1 Need for the Promotion Center

Modernization of production technology primarily aims to manufacture and supply "high-quality" products at a "reasonable price" and within a required "delivery time". Among these three major requirements, to manufacture high-quality products is considered to be most important. This means, if a manufacturer intends to export products, it will not be able to compete in international markets unless the products attain sufficient quality levels; the price and delivery schedule are questioned only after the quality requirement has been cleared. In Colombia, however, the metalworking industry serves mainly domestic markets and does not face an urgent need for quality improvement.

Customers in Colombia tend to prefer cheap products with relatively poor quality to higher price products with high quality, partly because they do not realize that the high-quality products are economical in the long run, and partly due to shortage of funds.

In other words, most of the customers intend to pay the same price for high-quality products as well as products with similar appearance but poor quality. This discourages suppliers to improve product qualities, thus staying in domestic markets where low-quality products are accepted.

This appears to be one of the major reasons why Colombia's metalworking and machinery industries lag behind those of other countries. Quality improvement measures include education of consumers and suppliers, development and propagation of industrial standards, education of engineers, introduction of modern equipment, and subsidies. This section proposes the establishment or improvement of the metalworking industry promotion center to provide testing services.

In Colombia, there are few testing organizations which can be used by the SMEs and MEs at a local level. On the other hand, a testing facility is too expensive to be owned by relatively small companies. Results of the questionnaire survey and corporate analysis indicate that most of companies surveyed do not conduct sufficient tests and inspection on products and materials.

8.7.2 Outline of the Promotion Center

(1) Major functions

The proposed metalworking industry promotion center will have the following functions.

- 1) Testing services for private companies and issuance of certificates.

Testing services will include the following tests and inspections:

- a) Measuring of mechanical properties of materials and products (including tensile strength, impact strength, breaking strength, bending strength, hardness, and internal stress);
- b) Metallographic tests on materials and products (including macro and micro metallography);
- c) Chemical composition analyses of materials and products (including qualitative and quantitative analyses);
- d) Measuring of accuracy of products and tools (including dimensions, angles, and surface roughness);
- e) Non-destructive tests on products (including magnetic particle, ultrasonic, and X-ray tests);

- f) Surface inspection on products (plating and coating thicknesses), and
 - g) Testing of molding sand (grain size, shape, clay content, combustibles, moisture content, small mills, strength, air-premeability, and packability).
- 2) Technical advice and consultation services for private companies including the following services:
 - a) Technical consultation, and
 - b) Extension service for technical advice.
 - 3) Technical and market information services for private companies including the following services:
 - a) Periodical publication, and
 - b) Sponsoring of technical seminars and workshops.

(2) Organizational positioning of the center

Although several entities are conceivable as the parent body for operation of the center, it is proposed here that the center be operated by a joint venture in which a university(ies), private association(s) such as FEDEMETAL, and SENA participate. The reason for this is as follows:

- 1) Universities have access to the latest technology and information, and have research and development capability;
- 2) Private associations can insure that the center be familiar with actual needs of private companies, and insure that private companies are provided with reasons to make use of the center, and
- 3) In addition to making use of the organizational capabilities of SENA and its experience in operat-

ing a similar center, it would be suitable to propose that SENA provide financial support for this new center.

(3) Locations

It is recommended to establish the promotion centers in five major cities of Bogota, Medellin, Cali, Barranquilla, and Bucaramanga.

Of the alternatives, namely, (a) to set up the five centers at the same time, or (b) to start with one center to check results before establishing other centers, the latter is recommended and Bogota should preferably be selected as the first location.

(4) Required equipment

Since the proposed center will conduct ordinary tests and inspections required for quality control in the metalworking industry, a set of basic testing equipment will be sufficed.

On the basis of the above concept, a conceptual design of the center has been prepared and the data listed below are provided in Section 8.9 associated with the design.

- Layout
- Equipment list
- Work flow
- Center organization
- Construction schedule

8.8 Data Bank for International Industrial Standards

According to its 1988 annual report, ICONTEC is developed approximately 2,500 Colombian standards. Major areas encouraged for standardization are agriculture, livestock farming, metalworking, electrical products, civil engineering and architecture, safety and sanitation, and chemical processing. These standards are principally based on ISO, with reference to other major standards including SAE, JASO, JIS, DIN, IEC, and BS.

At present the Colombian standards do not cover all necessary industrial areas and do not meet requirements for international markets, probably due to shortage of manpower and budget of ICONTEC. As a result, many of universities and export industries adopt foreign industrial standards. Similarly, foreign importers of Colombia's industrial products often offer specific industrial standards other than non-Colombian standards.

Given the situation, it is recommended to establish data banks for international industrial standards which are easily accessible to private enterprises. The data banks will maintain industrial standards in industrialized countries which are made available to users, together with consultation service. It should be established at least in Bogota, Medellin, Cali, Bucaramanga, and Barranquilla, managed and operated by ICONTEC.

8.9 Project Cost, Schedule and Economic Effects

In Sections 8.4 to 8.7 a number of programs and projects are recommended to be implemented for promotion of SMEs and MEs in the metalworking industry. For the purpose of clearly showing what is entailed in the implementation of these programs and projects, the technical information listed below is appended to this section. Appropriate to the present stage of planning, the information provided is of general nature.

Tables and Figures of Technical Information

	<u>Layout</u>	<u>List of E & M</u>	<u>Organi- zation Chart</u>	<u>Work Flow</u>	<u>Project Cost</u>	<u>Implemen- tation Schedule</u>
Foundry Center for SENA	F8.1	T8.3	F8.2	F8.3	T8.4	F8.4
Electroplating Center for SENA	F8.5	T8.5	F8.6	F8.7	T8.6	F8.8
Industrial park for Metalworking industry	F8.9	-	-	-	T8.8	F8.10
Metalworking Promotion Center	F8.11	T8.9	F8.12	-	T8.10	F8.13

Notes: F; Figure, T; Table

The method of estimating the project cost is discussed in 8.9.1, and in 8.9.2 the project cost is summarized and an implementation schedule is furnished. In 8.9.3 a discussion is provided of the economic effects in Colombia if the programs and projects are implemented.

8.9.1 Method of Estimation of Center Construction Cost

The cost in United States dollars was ascertained for the construction cost components, namely procurement of equipment, ocean freight and insurance, port and landing-related charges, stevedorage, inland transport costs and insurance, land acquisition cost, building construction cost, installation and installation supervision, and other related costs. The conditions and standards used in this process were as

follows.

(1) Basic conditions

1) Costs in foreign currency

Japanese domestic prices prevailing as of March 1990 were used for equipment, marine transport and other costs.

2) Costs in Colombia

Inland transport, land acquisition, construction and other costs arising in Colombia, as well as taxes, were determined as prices or percentages as of the visit of the Study Team to Colombia in March, 1990.

3) Conversion rates

465 Colombian pesos per U.S. dollar
155 Japanese yen per U.S. dollar

(2) Plant direct cost

1) Equipment and facilities: Procurement in Japan (FOB price). In the case of plating tanks, however, as fabrication is relatively simple, these are presumed to be procured locally. The cost of preparation of instructions and manuals for use and maintenance of equipment is provisionally assumed as 5% of the FOB price.

2) Supplies and spares: Two years' requirement of supplies and spares needed for operation of the equipment and facilities is provided for. For those which are expected to be easily obtainable in Colombia, local procurement was assumed.

3) Transport and insurance costs

Assuming that the equipment and facilities are procured in Japan, costs were calculated for transport

from Japan to Buena Ventura, for overland transport, port and warehouse fees, stevedorage, and inland transport to the assumed site of the Bogota region, including insurance. These were calculated as prices and percentages.

FOB charge (including packing)	FOB price x 7/100
Marine transport	US\$ 266/F.T.
Marine insurance	C&F x 4/1000
Port fees (Colombia)	CIF x 1/100
Stevedorage (Colombia)	CIF x 4/1000
Land transport (Colombia)	US\$ 26/ton
Insurance for same (Colombia)	FOB price x 8/1000
Assembly and erection (Colombia)	Construction cost x 3/1000

4) Land acquisition cost

The standard land price for the industrial zone in Bogota, as provided by CAMACOL (Camara Colombiana de la Construccion) was used: US\$ 86.0 per square meter.

5) Ownership registration: land acquisition cost
x 17/1000

6) Land purchase tax: None exists in Colombia

7) Land preparation

Because some cost is normally necessary even for a relatively level site, the following was used, assuming the site is reasonably level: US\$ 2.6 per square meter.

8) Building construction

CAMACOL standard prices were used; these are for a one-story brick building, with no interior subdivision, equipped with electric power lines, and water and drain piping: US\$ 194.0 per square meter. Corrections were made on the basis of this rate in

view of the expected need for two-story buildings or buildings with many interior subdivisions.

9) Paving within the site; landscaping, fences:

The following prices were used.

Paving within site (15-cm concrete)	US\$ 23.7/sq m
Paving within site (20-cm concrete)	US\$ 36.6/sq m
Landscaping	US\$ 2.6/sq m
Fencing (brick)	US\$ 31.2/sq m

It was assumed that the percentages to be generally paved, to be paved for vehicle traffic, and to be landscaped are, respectively, 40%, 30%, and 30% of the total area exclusive of the building area.

10) Installation of equipment

Installation costs were calculated on the basis of unit labor costs. Costs available from CAMACOL were as of 1989; these were corrected to 1990 levels by use of information obtained from construction contractors, to the following rates.

Supervisor	:	US\$ 12.0/day
Foreman	:	US\$ 9.0/day
Ordinary laborer (A):		US\$ 6.5/day
Ordinary laborer (B):		US\$ 4.5/day
Cleaning staff	:	US\$ 2.2/day

11) Office equipment costs

The cost of office equipment, including vehicles, spares and supplies, are provisionally assumed to be 2 to 3% of the FOB cost of equipment.

12) Engineering fee and installation supervision fee

Estimates were made of the required costs (mainly design, supervision of installation, etc.) for each model plant, separately.

13) Overheads

Regarding construction of model plants, as necessary overheads, either 5% or 10% of the plant direct cost as indicated in Tables 8.4, 8.6, 8.8 and 8.10 (Estimated project cost) were used.

(3) Customs duty and taxes

The kinds of taxes, and taxation rate, which would be applicable to the equipment and facilities, are as follows. Average tax rates were calculated by use of the Arancel de Aduanas Legis with regard to customs charges.

Customs : CIF x 10% (for general machinery)
 : CIF x 15% (inspection equipment)
LEY75 : CIF x 18%
IVA : (CIF + customs + LEY75) x 10%

(Note: Liberalization of imports through a reduction of customs charges may take place in the future, but is not assumed here.)

(4) Contingency and interest during construction

As contingency and interest costs, 20% of the total estimated project cost (Table 8.4, 8.6, 8.8, and 8.10) exclusive of land acquisition cost was used.

(5) Major equipment

The cost and specifications of the major equipment are summarized in Tables 8.3, 8.5 and 8.9. Specifications and quantities were determined on the basis of plant scale.

8.9.2 Project Cost and Implementation Schedule

For the above, a sector loan program and four projects, the required capital and schedule are shown in Table 8.2. If all programs and projects are implemented as proposed, a total of US\$94.1 million is required (of which the portion in foreign currencies is US\$56.3, and the portion in local currency is equal to US\$37.8 million. A certain amount of explanation is made for the specific projects and programs.

(1) MEs and SMEs metalworking industries sector loan

A total of US\$20 million of which 80% is foreign currency and 20% Colombian pesos is assumed.

It is provisionally assumed that the average loan size to any one company would US\$200,000, and that 100 companies would receive loans. A schedule for loan disbursement over a three to five years initial period would be desirable.

(2) SENA's casting centers

The cost per casting center is US\$9.6 million (foreign currency, US\$5.7 million; local currency, US\$3.9 million). Of the local currency, US\$1.5 million would be required for taxes, import duty, special import duty and import value added tax. The construction period needed to build a center is estimated as 24 months.

(3) SENA plating centers

The cost per plating center is US\$3.0 million (foreign currency, US\$1.7 million; local currency, US\$1.3 million). Of the local currency, US\$0.4 million is for taxes. Center construction would require 17 months.

(4) Metalworking industrial parks

Project cost is US\$56.8 million per park (foreign currency portion, US\$30.1 million; local currency portion, US\$26.7 million). This project cost includes the civil

construction work for preparation of the site, and construction of 20 factories including common service facilities. If the site preparation and common facilities costs are excluded, the project cost would be reduced to 35% to 40% of the above figure. The total time required for construction of 20 factories and a common service facility, including identification of the products to be made in the factories, is estimated to be 31 months.

(5) Metalworking promotion centers

The project cost per center is estimated at US\$4.7 million (foreign currency, US\$2.8 million; local currency, US\$1.9 million). Of the local currency, about US\$800,000 is estimated to be for taxes. Construction period: estimated as 20 months.

8.9.3 National Benefit Expected from Program and Project Implementation

A variety of national benefits would be expected on the Colombian economy by implementing of the proposed programs and projects. Major effects are as follows:

(1) Promotion of industrialization

The share of manufacturing industry in GDP is currently stable at about 21%. The contribution of the metalworking industry to total GDP, however, has been declining to be about 2.4% in 1986. Regarding exports, coffee, oil and coal comprise a 66% share, and if flowers, bananas and sugar are added the share of these is 74% (as of 1987). Because of the high dependence of the economy on primary products, the economy's stability is subject to strong influence from the world market price as experienced in a boom or a slump of coffee price. The development of the metalworking industry would increase manufacturing's contribution to the national economy, and also to stabilization of the economy.

(2) Correction of social disparities; and promotion of regional development

Implementation of the proposed promotion measures for SMEs and MEs will correct the social disparities or disadvantages sustained especially for MEs, by means of equation of income differential and diffusion of social security to MEs. Moreover, since SMEs and MEs are inherently enterprises that are firmly rooted in the local or regional economies, promotion of their growth and development would mean a contribution to the improvement of regional economies.

(3) Effective use of resources

SMEs and MEs in metalworking industry in Colombia presently make use of pre-modern production methods and is extremely inefficient. Modernization of production would mean an improvement in the effective use of raw materials, energy, utilities and other resources.

(4) Increase in employment

SMEs and MEs are more labor-intensive than bigger business, and hence have greater labor-absorption capacity. Development of the SMEs and MEs thus has a strong impact on employment; as mentioned earlier, SMEs and MEs are closely related to a local economy, their growth will significantly contribute to increase in local employment.

(5) Improvement of the balances of trade and of payments

In 1987, machinery accounted for 17.3% of total imports. If electric machinery imports (6.6%) and transport equipment imports (10.7%) are added, the total is 34.6% of total imports. Promotion of the metalworking industry, under those circumstances, by the substitution of imports, will conserve foreign currency. Moreover, if modernization of the metalworking industry is successful, an increase in exports can be achieved.

(6) Repercussion effects in other industries

Capital investments are required if the metalworking industry is to be modernized. Such investments would have secondary or repercussion effects in the construction, transport and other industries. Further, by making it possible to supply improved-quality agricultural equipment and construction equipment in reasonable price to the domestic market, the modernization of agricultural and construction sectors will be improved.

Table 8.2 SUMMARY OF PROGRAM/PROJECT COST AND SCHEDULE

Program/Project	Project cost (million US\$) ^{1/}			Duration of ^{2/} Construction
	Foreign	Local	Total	
(1) Sector loan for SMEs & MEs in metalworking industry ^{3/}	16.0	4.0	20.0	3- to 5-year disbursement
(2) Foundry center for SENA	5.7	3.9	9.6	24 months
(3) Electroplating center for SENA	1.7	1.3	3.0	17 months
(4) Industrial park for metalworking industry	30.1	26.7	56.8	31 months
(5) Metalworking promotion center	2.8	1.9	4.7	20 months
Total	56.3	37.8	94.1	

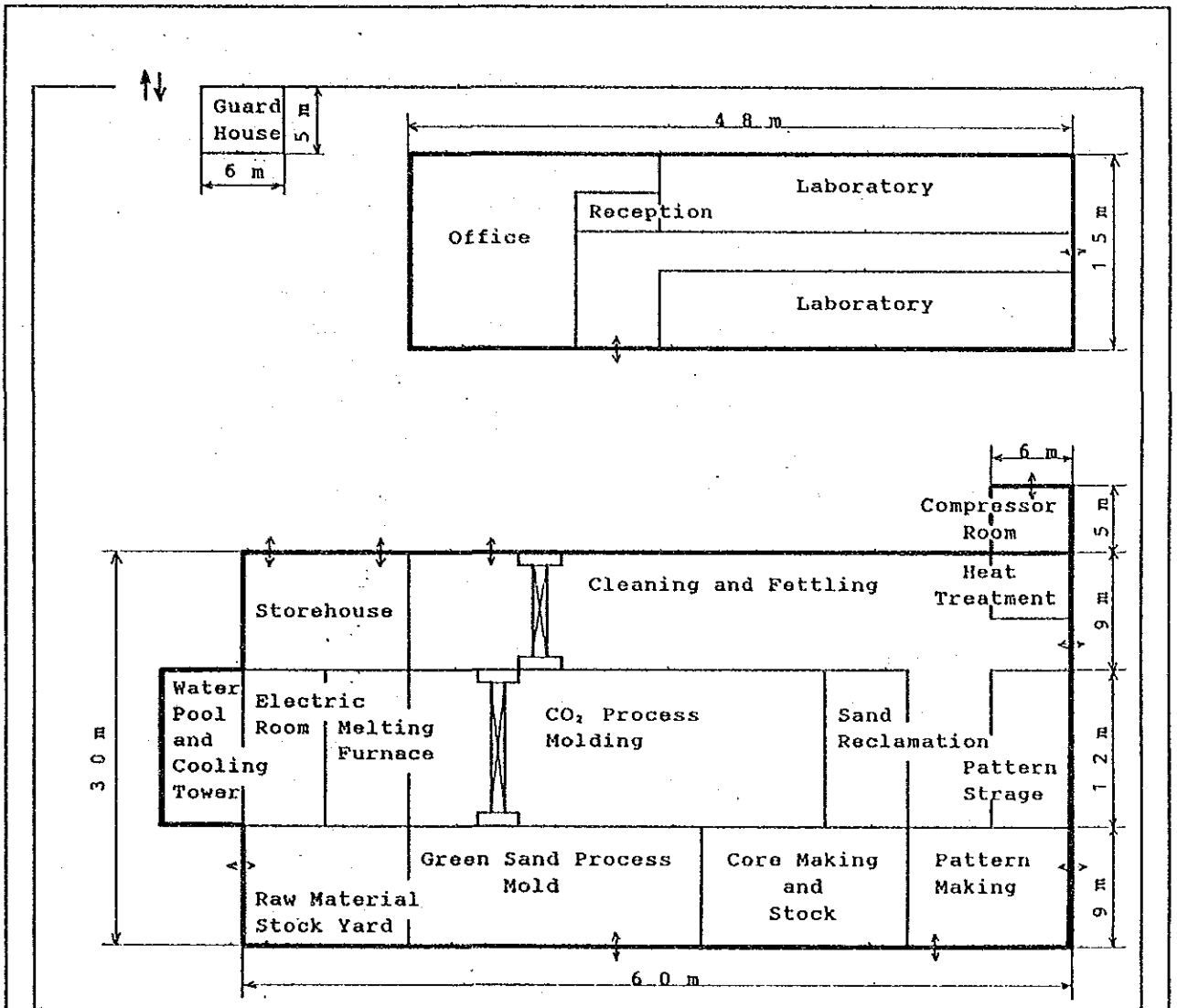
(Notes)

^{1/} See Table 8.5, 8.7, 8.9, and 8.11 in detail.

^{2/} Duration from the award of contract to the commencement of operation

^{3/} A 20% of total loan amount is assumed to be raised as local counter fund.

Figure 8.1 LAYOUT OF FOUNDRY CENTER



Land Area: 80 m x 70 m

Factory : 60 m x 30 m + 6 m x 5 m

Office and Laboratory (first floor): 48 m x 15 m

Training Schoolroom and Looker Room (second floor): 48 m x 15 m

Guard House: 6 m x 5 m

Table 8.3 EQUIPMENT & MACHINERY LIST OF FOUNDRY CENTER

1/4

Process	Name	Q'ty	Specifications
Melting	* High frequency induction furnace	1 set	500kg, 600kw, 0.5kHz
	* Crucible furnace	1 set	200kg/batch in case of Cu
	* Mixer for lining material	1 set	Capacity: 0.1m ²
	* Balance for molten metal	1 set	Capacity: 1000kg
	* Balance for auxiliary materials	1 set	Capacity: 20kg
	* Ladle	7 sets	500kg, 200kg, 50kg
	* Ladle drying and heating equip.	1 set	Diesel oil burner
	* CE Meter with recorder	1 set	Range of CE: 3.20 to 4.83%
	* Portable digital thermometer	1 set	Rated scale: 0 to 1760°C
	* Optical pyrometer	1 set	Max. 1600°C
Molding	1) CO ₂ molding process		
	* Continuous mixer	1 set	3t/Hr
	* Compaction table	1 set	1500×1000, Max. load:1000kg
	* Sand rammer	1 set	Ramming speed: approx. 800bpm
	* CO ₂ gas supplying equipment	1 set	Gas vaporizer capa.:100kg/Hr
	* Agitator for coating materials	1 set	Container capa.:approx. 80 l
	* Boume meter	2 sets	Boume degree: 30 to 40, 40 to 50
	* Shake-out machine with dust hood	1 set	1500×1000, Max. load:750kg
	* Sand crusher	1 set	3 t/h
	* Return sand hopper with belt feeder	1 set	10m ³ , Capa.:3 t/h
	* Sand reclaimer with belt feeder	1 set	600kg/batch, Capa.:3 t/h
	* Dual sand hopper with vibratory feeder	1 set	10m ³ +10 m ³ , Capa.:3 t/h
	* Belt conveyor	1 set	Capa.:3 t/h
	* Bucket elevators	3 sets	3 t/h
	* Control panel	1 set	
	* Dust collector	1 set	Air volume:300m ³ /min.
	2) Green sand molding process		
	* Green sand mixer	1 set	300kg/batch
	* Jolt squeeze molding machine	2 sets	Max. flask: 500×400 ×150/150
	* Green sand conditioning process	1 unit	Capa.:3 t/h

Process	Name	Q'ty	Specification
Core making			
	1) Chemical binder sand core		
	* Versatile mixer	1 set	Max. processing capa. :60 l
	* Agitator for coating material	1 set	Container capa. :approx. 80 l
	2) Shell core		
	* Shell core machine	1 set	Core box: 300 ×300 ×70/70
	3) CO ² core		
	* Core sand mixer	1 set	50 kg/batch
	* Agitator for coating material	1 set	Container capa. :approx. 80 l
Cleaning	* Table type shot blast with dust collector	1 set	Max. load: 1000 kg
Fettling	* Double headed grinder w/dust collector	1 set	Wheel:405D×50t ×38.1d
	* High frequency electric grinder	2 sets	Wheel:180D, Frequency: 250Hz
	* High frequency electric straight grinder	2 sets	Wheel:75D, Frequency:250Hz
	* High frequency generator	1 set	Frequency:250Hz
	* Pneumatic chipper	2 sets	Chipping speed: approx. 4200bpm
	* Pneumatic chipping hammer	2 sets	Chipping speed: approx. 1900bpm
	* Gas cutting device	1 set	LPG and oxigen
	* Electric welder	1 set	300A, 200V, 13.0kw
Heat treatment			
	* Batch type heat treatment furnace	1 set	0.8m×1.5m×0.5m, Max. temp:550 °C
	* Batch type heat treatment furnace	1 set	1m×1m×2m, Max. temp:1100 °C
Pattern making			
	* Vertical band saw	1 set	Work table: 1250 L×1000w
	* Planer	1 set	Work table: 2440 L×440W
	* Thicknesser	1 set	Max. capa: 600W×300t
	* Circular saw bench	1 set	Work table: 740 ×900
	* Disk and belt sander	1 set	620W×200W
	* Spindle sander	1 set	Length of bed: 2550L
	* Vernier height gauge	1 set	Measuring height: 600mm
	* Cast iron surface plate	1 set	1000×750 ×190mm

Process	Name	Q'ty	Specifications
Evaporated pattern making			
	* Plastic foaming machine	1 set	with hopper
	* Spare foaming machine	1 set	with absorber
	* Boiler	1 set	
	* Vibrating table	1 set	
Die casting process			
	* Die casting machine	1 set	Electric type, 20 ton,
	* Melting furnace	1 set	Crucible type, 20 kg. oil burner
	* Die	1 set	
	* Oil tank	1 set	20 l
Precision casting process			
	* Wax pattern making machine	1 set	
	* Slurry mixer	1 set	Tank capa. : $\phi 400 \times 500H$
	* Fluid sand bed	1 set	with blower
	* Lost wax dryer	1 set	
	* Furnace	1 set	
	* Blaster	1 set	compressed air type
	* High frequency induction furnace	1 set	20 kw, 3000 Hz, 15 kg
	* Air conditioner	1 set	
Others	* Crane	2 sets	Max. capa. : 3 tons
	* Fork lift truck	1 set	Max. capa. : 2 tons
	* Air compressor	2 sets	Discharged vol. : $3.7m^3 /min.$
	* Flasks for CO_2 molding process	10 sets	
	* Flasks for green sand molding process	11 sets	
	* Production tools	1 lot	
Test and Inspection			
	1) Mold sand test		
	* Universal sand strength tester	1 set	Compression, Tensile and Shear.
	* Permeability tester	1 set	0 to 10,000 mm
	* Sand rammer	1 set	50 D \times 50 M
	* Infrared moisture tester	1 set	0 to 100% wet base.

Process	Name	Q'ty	Specifications
	* Ro-tap sieve shaker	1 set	13 kinds of sieve meshes.
	* Electronic balance	1 set	330 g to 10 mg
	* Compactability tester for green sand	1 set	Pressing by compressed air
	* Sand mixer	1 set	15 kg/batch
	* Sand testing washer	1 set	35 w single phase motor
2)	Mechanical properties test		
	* Universal testing machine	1 set	Capacity: 30 ton
	* Charpy impact testing machine	1 set	Capacity: 30 kgf-m
	* Brinell hardness tester	1 set	Test load: Max. 3000 kg
	* Rockwell hardness tester	1 set	Test load: Max. 150 kg
3)	Macro- and microstructure test		
	* Metallurgical microscope	1 set	50× to 1000×
	* Specimen cutting machine	1 set	Wheel: 255D×1.2t×31.75d
	* Rotary polishing machine	1 set	Disk: 8" dia×2 pcs
4)	Chemical composition analysis		
	* Vacuum emission spectrometer	1 set	Nos. of elements: approx. 20
	* Specimen grinding machine	1 set	Grinding stone: 255D×174d×84t
	* Carbon and sulfur analyzer	1 set	C: 0 to 5 wt%, S: 0 to 1 wt%
	* Electronic analytical balance	1 set	210 g to 0.1 mg
	* Constant temp. electric drying oven	1 set	Temp. 40 to 250°C, 450 × 450 × 450
	* Muffel furnace	1 set	Max. temp.: 1200°C, 120 × 220 × 100
5)	* Non-destructive inspection		
	* Ultrasonic flaw detector	1 set	
	* Magnetic flaw detector	1 set	
6)	Dimensional and visual inspection		
	* 3D coordinate measuring machine	1 set	X: 700, Y: 600, Z: 600
	* Surface plate	1 set	1.0 m × 0.75m × 0.19m
	* Miscellaneous measuring instruments	1 lot	
7)	Test pieces machining		
	* Lathe	1 set	Center distance: 500 mm
	* Shaping machine	1 set	Stroke: approx. 750mm
	* Cutting grinder	1 set	Wheel: 405D × 3.0t × 25.4d
	* Power hacksaw	1 set	Power: 1.125 kw
	* Bench drilling machine	1 set	Drill dia.: 3 to 13 mm

Figure 8.2 ORGANIZATION CHART OF FOUNDRY CENTER

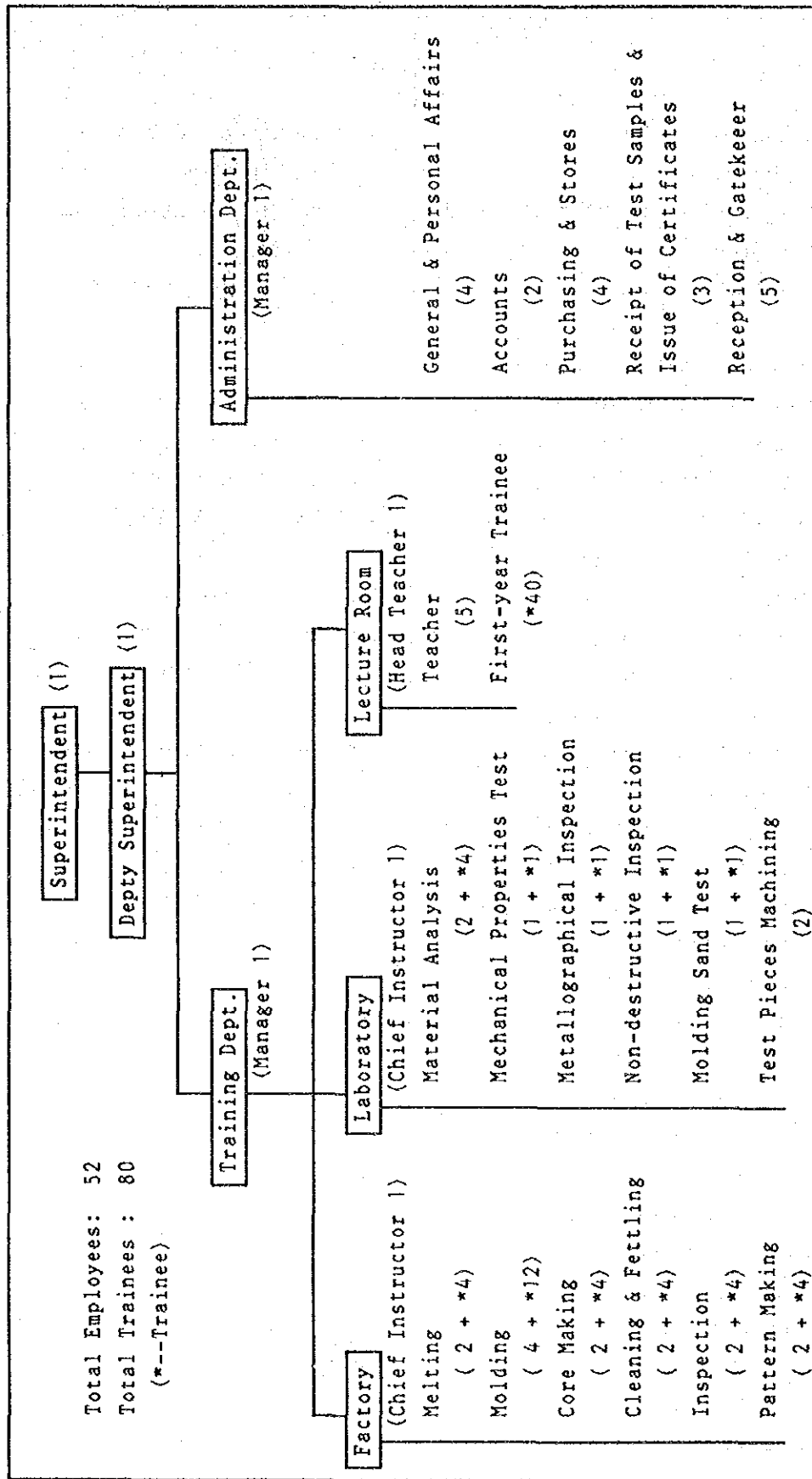


Figure 8.3 WORK FLOW CHART OF FOUNDRY CENTER

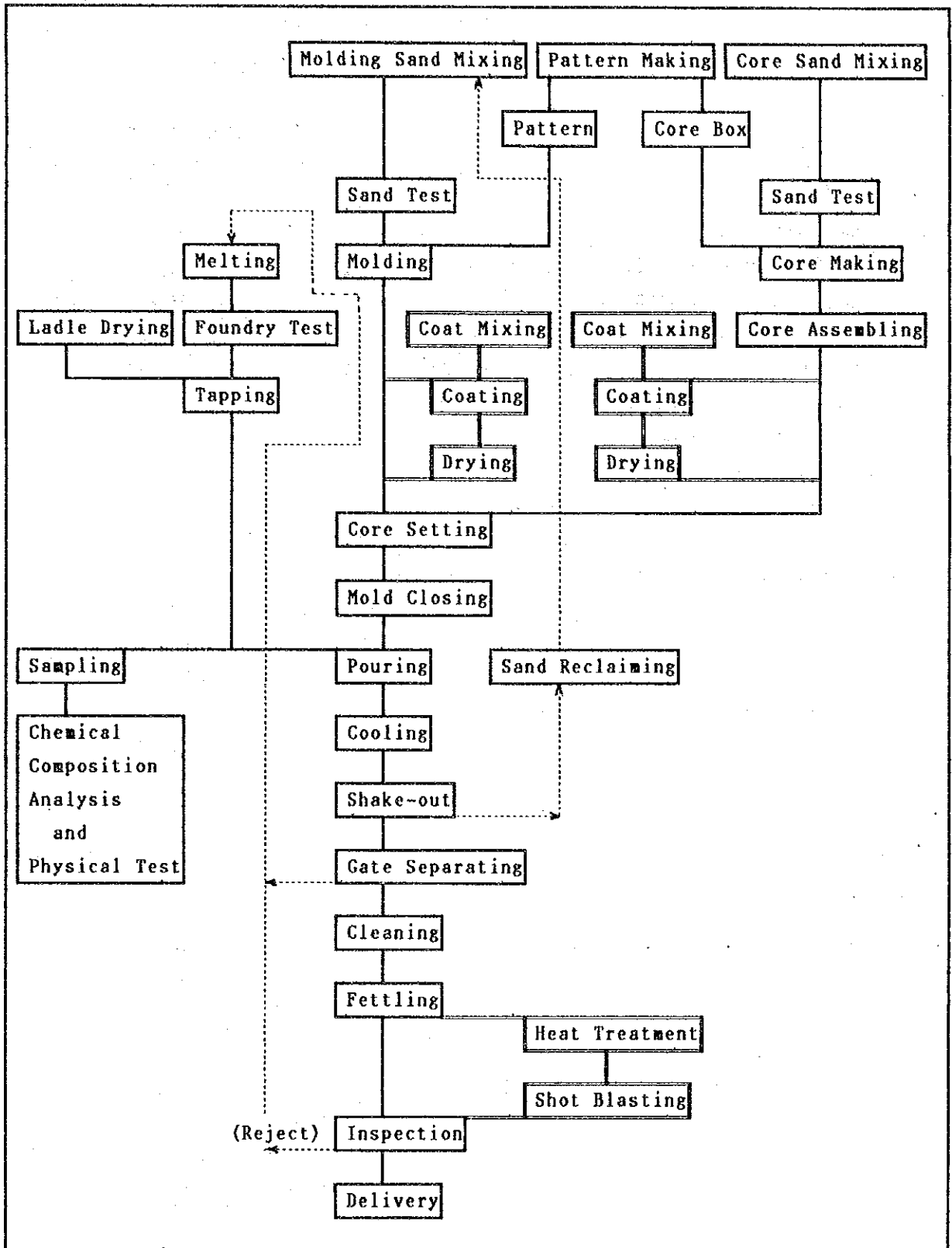


Table 8.4 ESTIMATED PROJECT COST OF FOUNDRY CENTER

(Unit: US\$ 1,000)

Item	Foreign	Local	Total
(1). Plant direct cost			
1) Equipment, materials(FOB)	3,186.6	212.9	3,399.5
2) Spare parts (FOB)	91.0	3.2	94.2
3) Ocean freight and insurance	360.3	-	360.3
4) Port charges and inland transportation	-	85.6	85.6
5) Building construction	-	860.6	860.6
6) Installation of machinery Adjustment & trial run	-	11.1	11.1
7) Accommodation & facilities(2%)	-	70.0	70.0
8) Engineering & supervising	865.7	0.8	866.5
9) Over head expense(5%)	273.0	14.4	287.4
Sub total	4,776.6	1,258.6	6,035.2
10) Land acquisition and preparation	-	504.4	504.4
Pavement/Fence/Turf	-	70.3	70.3
Sub total	-	574.7	574.7
(2) Tax & duty			
1) Import tax (CIF x10%)	-	363.8	363.8
2) LAY 75 (CIF X 18%)	-	654.8	654.8
3) IVA(CIF+Import tax+LAY 75)x10%	-	465.7	465.7
Sub total	-	1,484.3	1,484.3
(3) Contingency & others(20%)			
	955.3	548.6	1,503.9
Grand total	5,731.9	3,866.2	9,598.1

Figure 8.4 MASTER SCHEDULE OF CONSTRUCTION
(FOUNDRY CENTER)

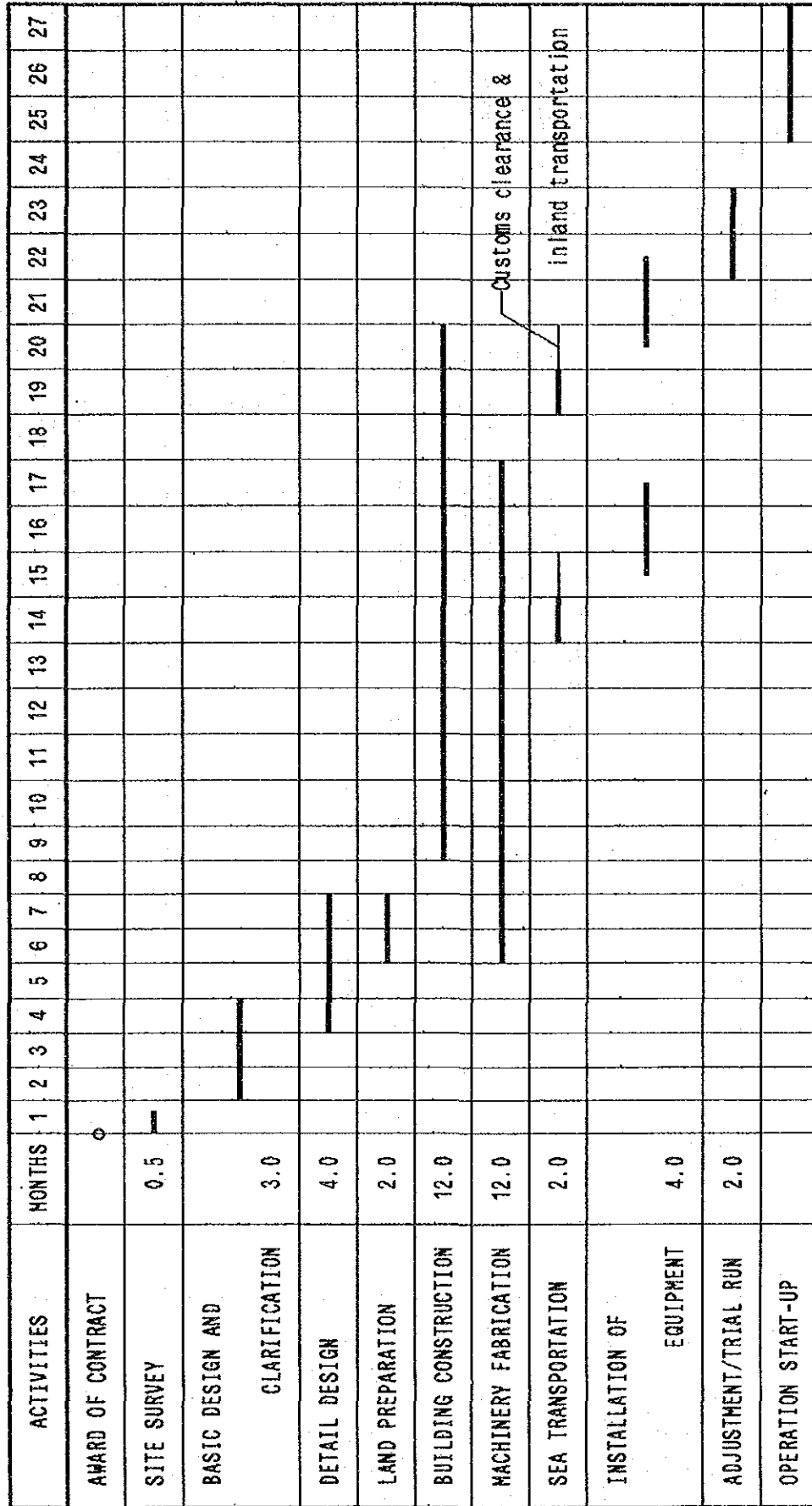


Figure 8.5 LAYOUT OF ELECTROPLATING CENTER

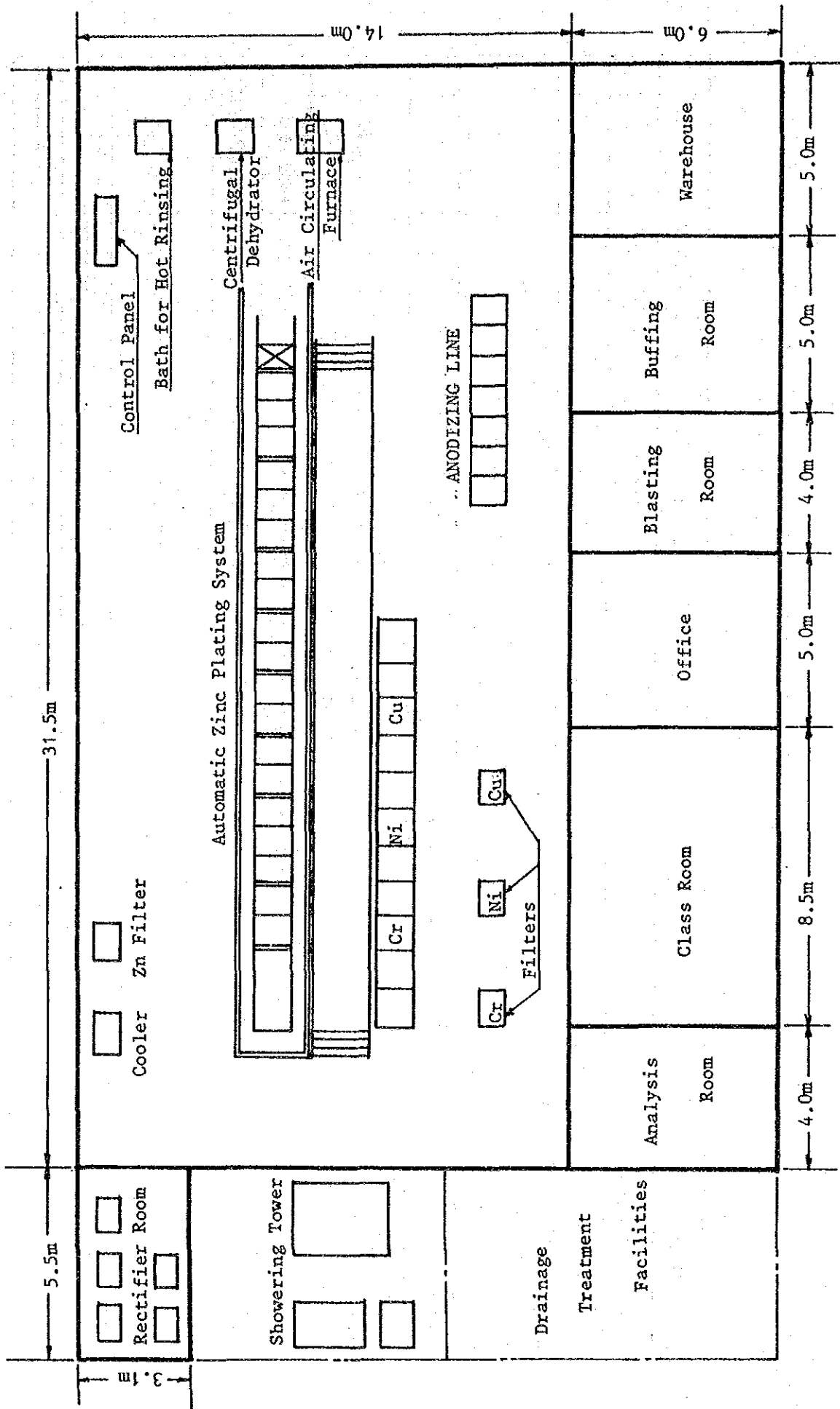


Table 8.5 EQUIPMENT & MACHINERY LIST OF PLATING SHOP

1/2

Name	Q'ty	Specifications
Bath for Trichlene Cleaning	1	1,050 × 350 × 900, SUS ³⁾
Do. for Alkali Degreasing	1	800 × 1,000 × 1,500H SS ²⁾ +Rubber Lining
Do. for Rinsing	9	Do.
Do. for Acid Emulsion	1	Do.
Do. for Electrolytic Degreasing	1	Do.
Do. for Neutralising	1	Do.
Do. for Zinc Plating	1	2,000 × 1,000 × 1,500H SS+Rubber Lining
Do. for Recovery	2	800 × 1,000 × 1,500H SS+PVC
Do. for Nitrating	1	Do.
Do. for Chromate	1	Do.
Do. for Uni-chromate	1	Do.
Do. for Black-chromate	1	Do.
Do. for Etching	1	300 × 450 × 600H SUS+Rock wool
Do. for Anodizing	1	300 × 450 × 600H SS+Rubber lining
Do. for Dyeing	2	300 × 450 × 600H SUS
Do. for Sealing	1	Do.
Do. for Acid Activation	1	1,000 × 1,000 × 1,500H SS+Rubber lining
Do. for Rinsing	7	Do.
Do. for Copper Plating	1	1,000 × 1,000 × 1,500H SS+PVC
Do. for Nickel Plating	1	Do.
Do. for Chromium Plating	1	Do.
Hopper	1	SS+SUS
Table and Steel Frame	1 sytem	2,000 × 22,000 × 1,500H
Carrier	2	2,250 × 1,500 × 2,750 Go-back 0.75 kw Up-down 0.75 kw
Platform for Worker	1	900 × 20,000 × 850H SS
Driving Device of Barrel Rotation	2	1.5 kw
Barrel	5	φ 400 × 650L, PVC
Hanger	5	Cu
Basket	5	φ 400 × 200H, SUS

Notes: 1) Dimensions in mm, 2) SS means carbon steel, 3) SUS means stainless steel.

Name	Qty	Specifications
Filter for Zinc Plating	1	14,000l/Hr
Do. for Copper Plating	1	Do.
Do. for Nickel Plating	1	Do.
Do. for Chromium Plating	1	Do.
Do. for Anodizing Line	1	800l/hr
Rectifier for Electrolytic Degreasing	1	12V×1,000A
Do. for Zinc Plating	1	12V×2,000A
Do. for Copper Plating	1	12V×1,000A
Do. for Nickel Plating	1	Do.
Do. for Chromium Plating	1	Do.
Do. for Anodizing line	1	25V×50A, Thyristor type
Cooler for Zinc Plating	1	16,000kcal/Hr×8.6 kw
Bath for Hot Rinsing	1	600×600 ×800H, SUS
Centrifugal Dehydrator	1	Heater 5 kw, Motor 2.2 kw
Air Circulating Furnace	1	Heater 9 kw, Fan 0.4 kw
Heater for Alkali Degreasing	4	3 kw, immersion type
Do. for Acid Emulsion	3	Do.
Do. for Zinc Plating	4	Do.
Do. for Electrolytic Degreasing	4	Do.
Do. for Copper Plating	4	Do.
Do. for Nickel Plating	4	Do.
Do. for Chromium Plating	4	Do.
Do. Hot Rinsing	3	Do.
Showering Tower for Acid and Alkali	1	Fan 7.5 kw, Pump 3.7 kw
Do. for Zinc Plating	1	Fan 7.5 kw, Pump 1.5 kw
Do. for Chromium Plating	1	Do.
Control Panel	1	1,800×450 ×2,000H, 150 kVA
Facilities for Laboratory	1 unit	
Waste Water Treatment System	1 unit	
Sandblaster	1	Box type, 1,000×1,000 ×1,000
Buffing Lathe	5	Regular type
Utilities	1 system	
Others	1 set	

Figure 8.6 WORK FLOW CHART
 (1) ZINC PLATING AND CHROMATE TREATMENT

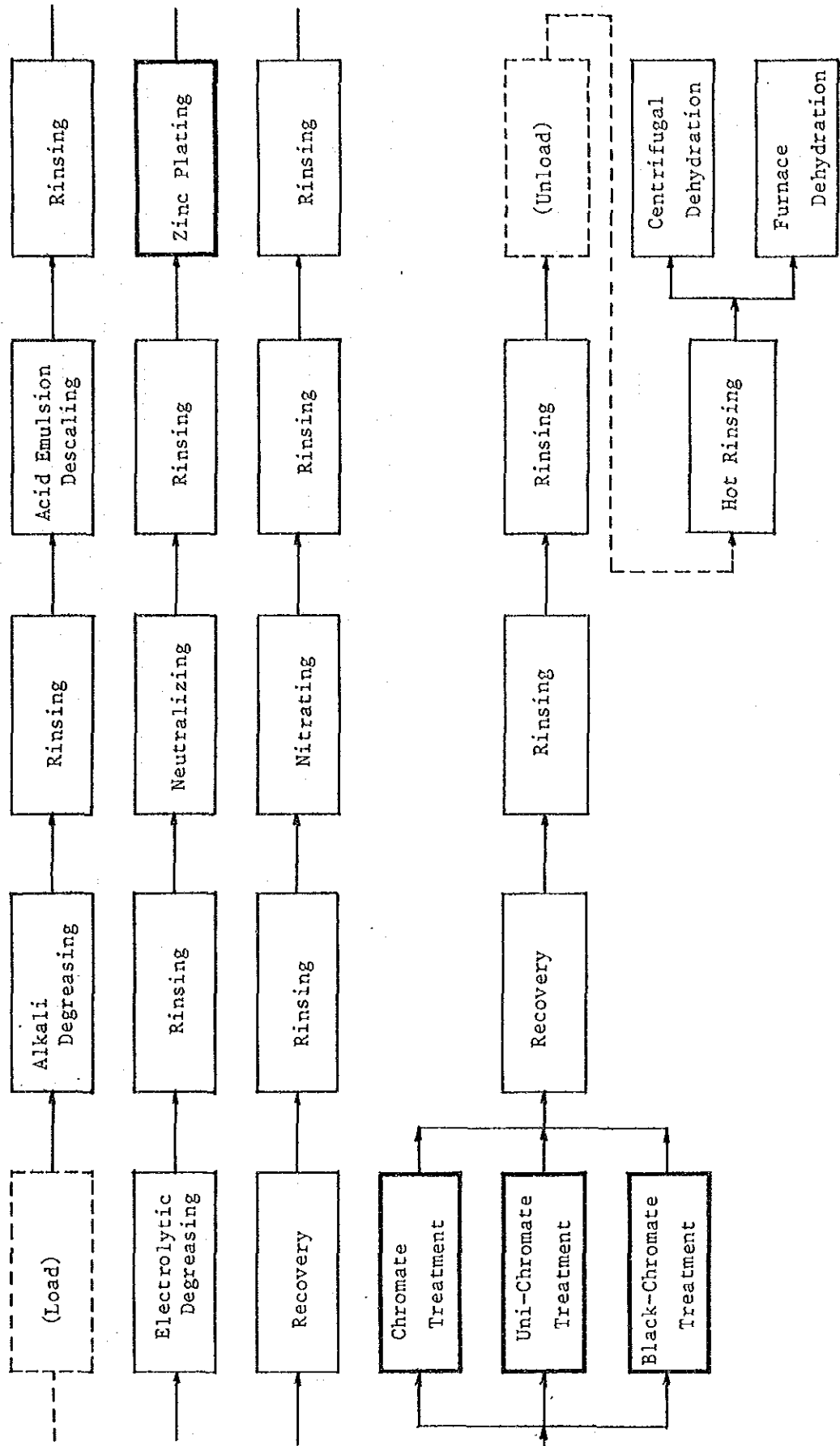


Figure 8.6 WORK FLOW CHART

(2) CU - NI - CR ELECTROPLATING

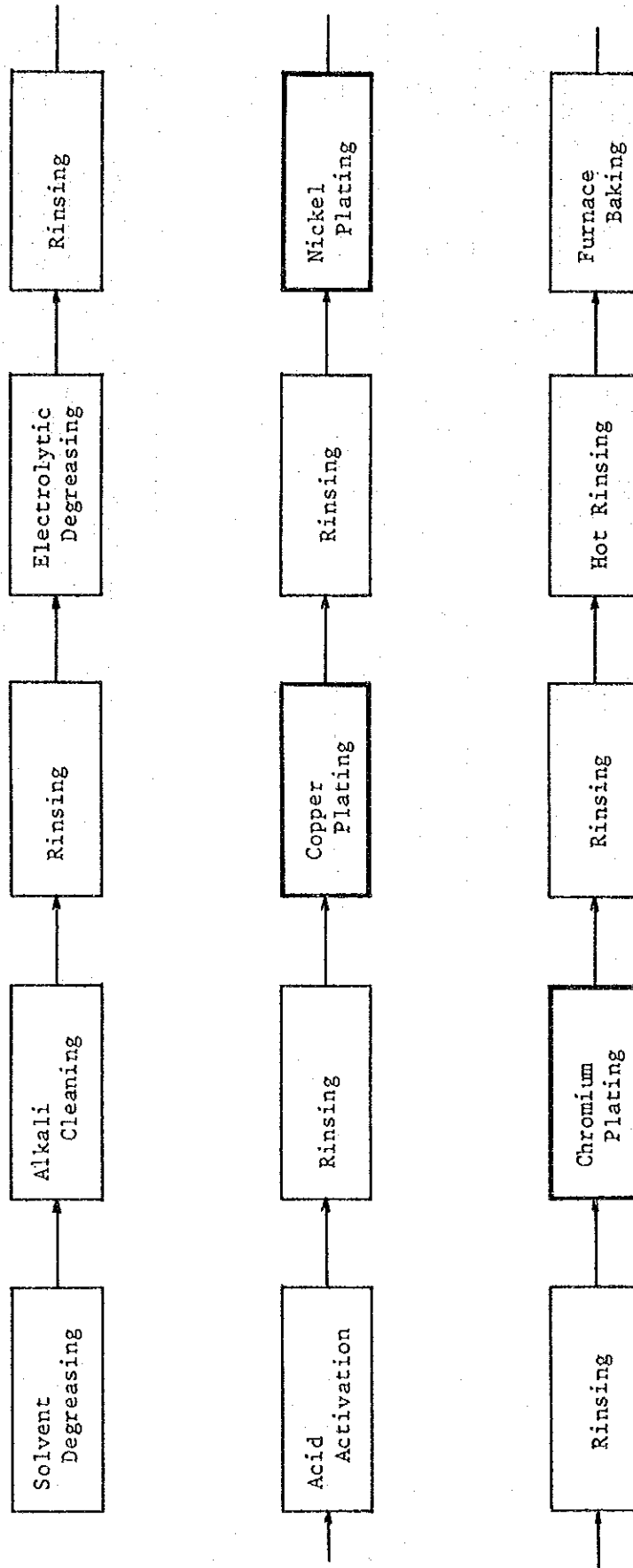


Figure 8.7 ORGANIZATION CHART OF ELECTROPLATING CENTER

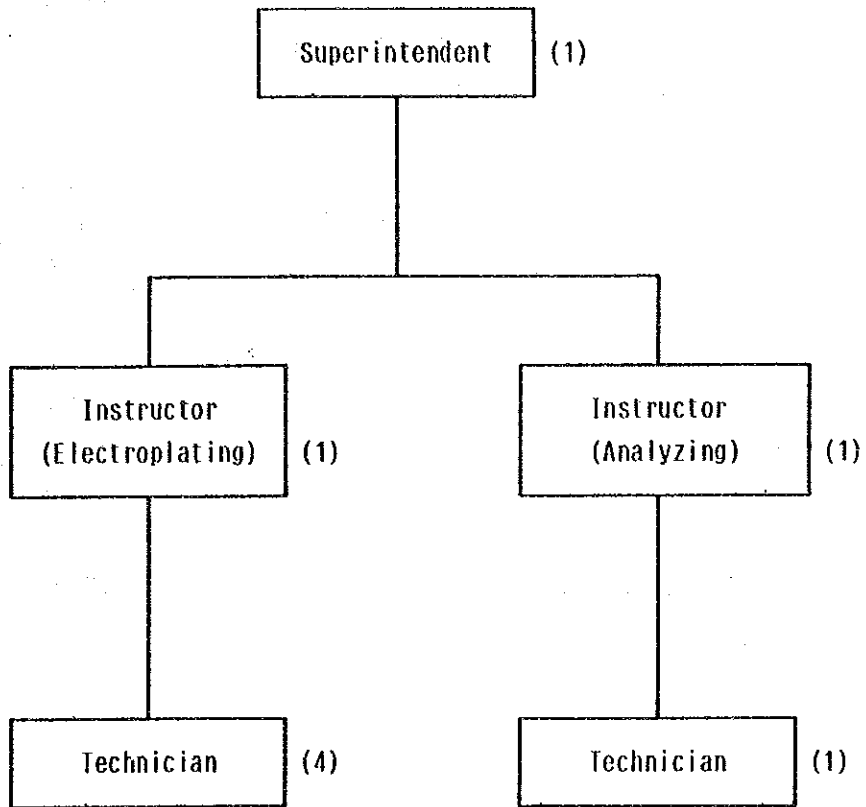


Table 8.6 ESTIMATED PROJECT COST OF ELECTROPLATING CENTER

(Unit: US\$ 1,000)			
Item	Foreign	Local	Total
(1) Plant direct cost			
1) Equipment, materials(FOB)	939.0	229.0	1,168.0
2) Spare parts (FOB)	31.7	12.9	44.6
3) Ocean freight and insurance	55.4	-	55.4
4) Port charges and inland transportation	-	23.4	23.4
5) Building construction	-	136.3	136.3
6) Installation of machinery Adjustment & trial run	-	5.6	5.6
7) Accommodation & facilities(2.6%)	-	30.3	30.3
8) Engineering & supervising	266.1	0.6	266.7
9) Over head expense(10%)	164.3	8.6	172.9
Sub total	1,456.5	446.7	1,903.2
10) Land acquisition and preparation Pavement/Fence/Turf	-	206.5	206.5
Sub total	-	45.8	45.8
Sub total	-	251.3	251.3
(2) Tax & duty			
1) Import tax (CIF x10%)	-	102.6	102.6
2) LAY 75 (CIF X 18%)	-	184.7	184.7
3) IVA(CIF+Import tax+LAY 75)x10%	-	131.4	131.4
Sub total	-	418.7	418.7
(3) Contingency & others(20%)			
Sub total	291.3	173.1	464.4
Grand total	1,747.8	1,289.8	3,037.6

Figure 8.8 MASTER SCHEDULE OF CONSTRUCTION
(ELECTROPLATING CENTER)

ACTIVITIES	MONTHS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
AWARD OF CONTRACT	0	○																										
SITE SURVEY	0.5	—																										
BASIC DESIGN AND CLARIFICATION	3.0		—	—	—																							
DETAIL DESIGN	2.0			—	—																							
LAND PREPARATION	1.0				—	—																						
BUILDING CONSTRUCTION	9.0						—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
MACHINERY FABRICATION	4.0							—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
SEA TRANSPORTATION	1.0											—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
INSTALLATION OF EQUIPMENT/PIPING, ETC.	2.0																—	—	—	—	—	—	—	—	—	—	—	—
ADJUSTMENT/TRIAL RUN	0.3																											—
OPERATION START-UP																												—

Table 8.7 DESIGN BASIS OF INDUSTRIAL PARK
FOR METALWORKING INDUSTRY

(1) Land area
10 ha. = 100,000m²

(2) Number of factories to be located
20 factories

(3) Common Service Facilities (CSF)

- 1) Administration office
- 2) Machine shop with calibration room
- 3) Heat treatment shop
- 4) Laboratory

(4) Use of land

for 20 factories	: 69,000m ²
for CSF	: 6,000m ²
for infrastructure (road etc.)	: 25,000m ²

(5) Buildings

20 factories : 36m × 15m = 540m²/factory
540m²/factory × 20 factories = 10,800m²

CSF

- Administration office = 12m × 18m = 216m²
- Machine shop with calibration room = 12m × 48m = 576m²
- Heat treatment shop = 12m × 36m = 432m²
- Laboratory = 6m × 18m = 108m²

(6) Utilities & manpower

	Electricity (kWh/H)	Water (m ³ /day)	Manpower (persons)
20 factories	1,440	80	520
CSF	685	25	127
Total	2,125	105	647

(7) Equipment and materials cost

20 factories : US\$ 15.4 million
CSF : US\$ 4.5 million

Figure 8.9 LAYOUT OF INDUSTRIAL PARK FOR METALWORKING INDUSTRY

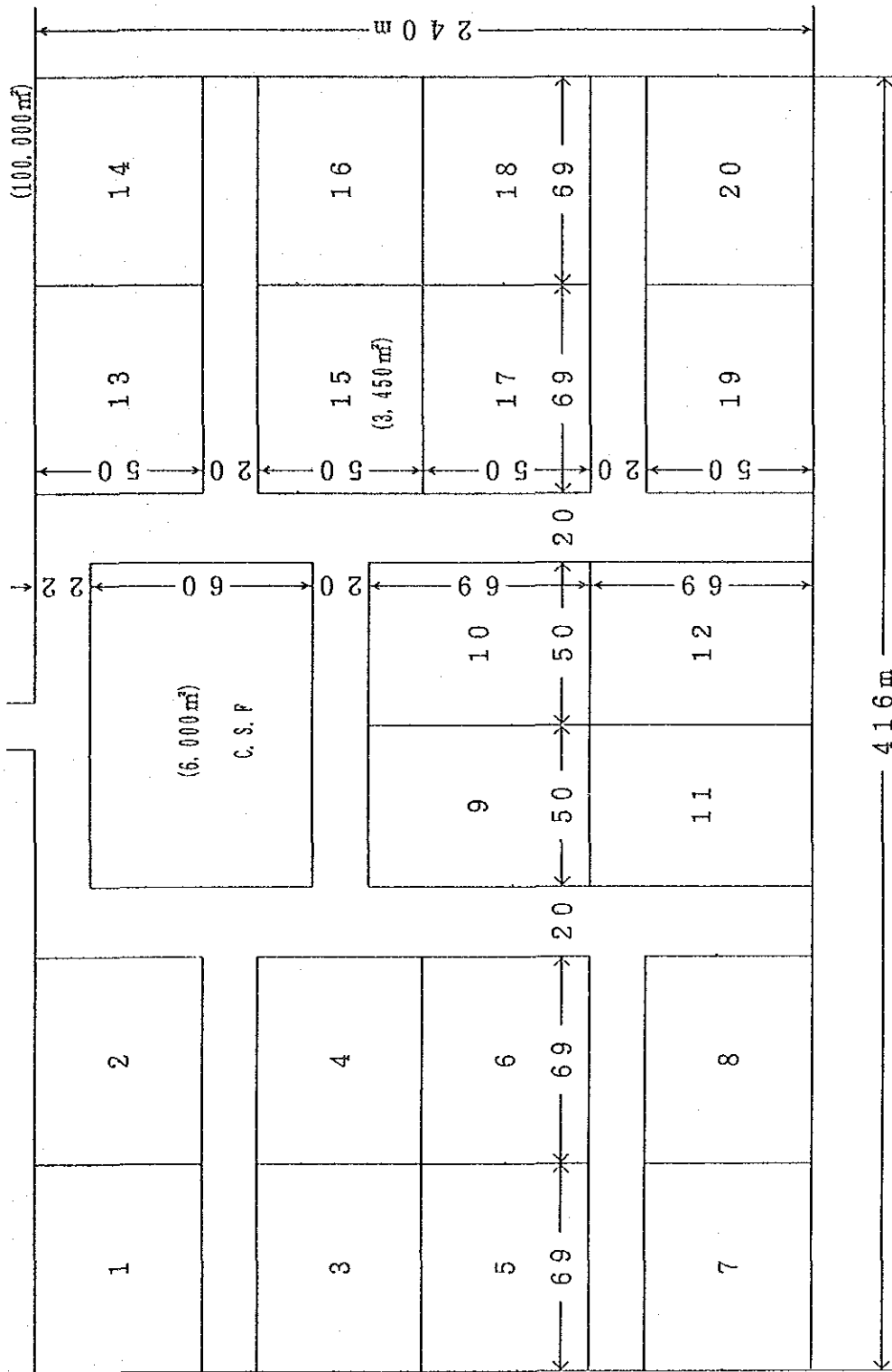


Table 8.8 ESTIMATED PROJECT COST OF INDUSTRIAL PARK
FOR METALWORKING INDUSTRY

(Unit: US\$1000)

Item	Foreign	Local	Total
(1) Plant direct cost			
1) Equipment, materials (FOB)	18,646.3	1,253.7	19,900.0
(20 factories)	(14,281.3)	(1,118.7)	(15,400.0)
(CSF)	(4,365.0)	(135.0)	(4,500.0)
2) Spare parts	932.3	62.7	995.0
3) Ocean freight & insurance	1,696.8	—	1,696.8
4) Port charges and inland transportation	—	484.8	484.8
5) Building construction	—	2,353.6	2,353.6
(20 factories)	(—)	(2,095.2)	(2,095.2)
(CSF)	(—)	(258.4)	(258.4)
6) Installation of machinery, adjustment & trial run	—	79.6	79.6
7) Accommodation & facilities	—	484.8	484.8
8) Engineering & supervising	2,580.0	645.0	3,225.0
9) Overhead expenses (5%)	1,192.8	268.2	1,461.0
Sub-total	25,048.2	5,632.4	30,680.6
10) Land acquisition & preparation	—	9,006.2	9,006.2
pavement/Fence/Turf	—	1,968.7	1,968.7
Sub-total	—	10,974.9	10,974.9
(2) Tax & duty			
1) Import tax (CIF×10%)	—	2,127.5	2,127.5
2) Lay 75 (CIF×18%)	—	3,830.0	3,830.0
3) IVA (CIF+Import tax+Lay75)×10%	—	2,723.3	2,723.3
Sub-total	—	8,680.8	8,680.8
(3) Contingency & others (20%)	5,009.6	1,431.3	6,440.9
Grand total	30,057.8	26,719.4	56,777.2

Figure 8.10 MASTER SCHEDULE OF CONSTRUCTION
(INDUSTRIAL PARK FOR METALWORKING INDUSTRY)

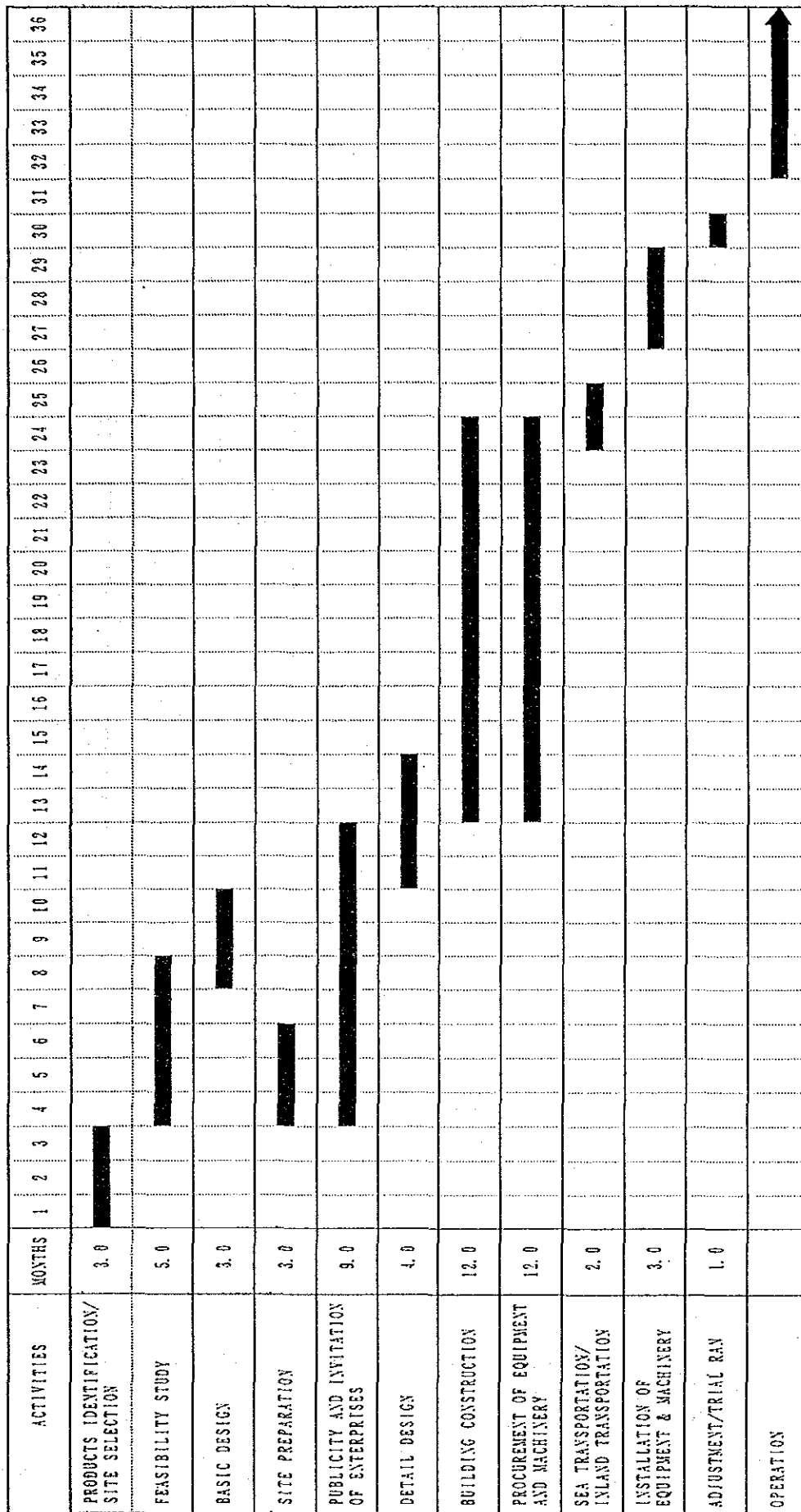
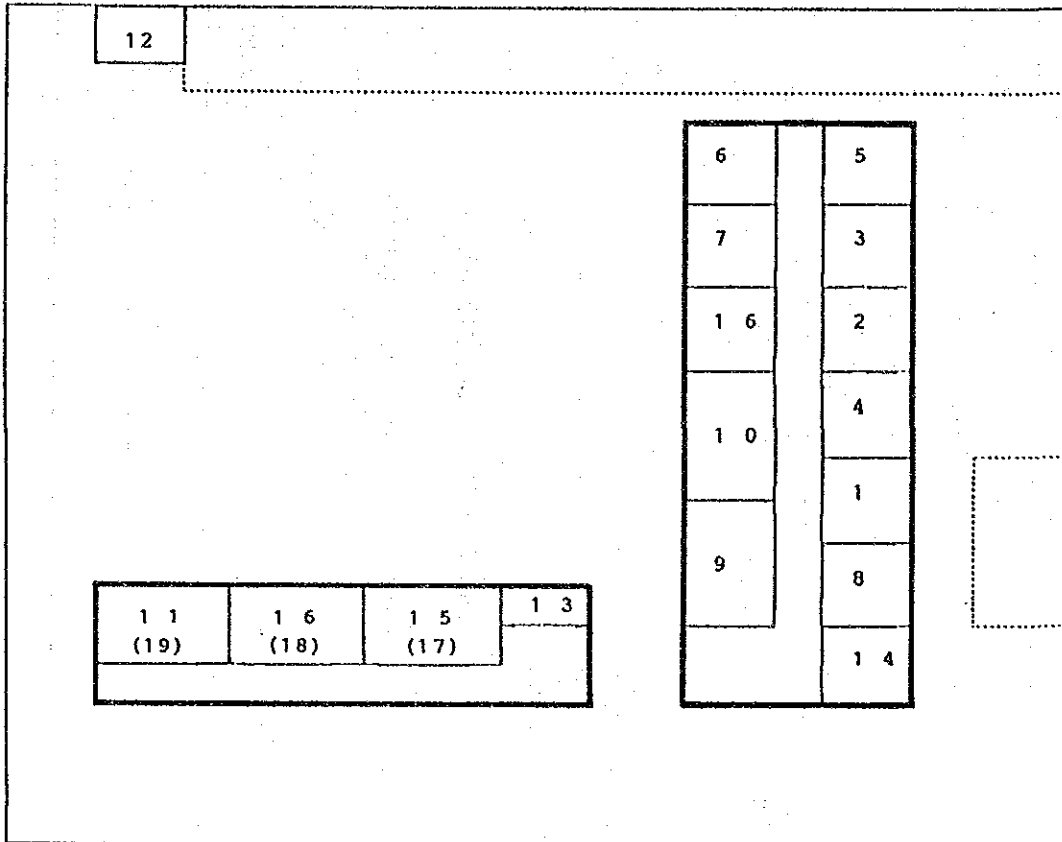


Figure 8.11 LAYOUT FOR PROMOTIONAL CENTER OF METALWORKING INDUSTRY



- | | |
|---------------------------------------|---------------------|
| 1. Mechanical Properties Testing Room | 17. Conference Room |
| 2. Metallographical Inspection Room | 18. Conference Room |
| 3. Instrumental Analysis Room | 19. Designing Room |
| 4. Chemical Analysis Room | |
| 5. Non-Destructive Inspection Room | |
| 6. Precise Measurement Room | |
| 7. Molding Sand Testing Room | |
| 8. Test Pieces Machining Room | |
| 9. Test & Inspection Dept. Office | |
| 10. Technical Adviser Office | |
| 11. Library | |
| 12. Guard House | |
| 13. Reception | |
| 14. Test Samples Receiving Room | |
| 15. Administration Dept. Office | |
| 16. Conference Room | |

Land Area : 70 m × 60 m
 Main Office Building : 33 m × 9 m × 2
 (Two-story)
 Work Shop : 42 m × 15 m

Table 8.9 EQUIPMENT LIST FOR METALWORKING INDUSTRY PROMOTION CENTER

(1/3)

Purpose	Name of Equipment	Specification	Quantity
1) Test and Inspection Facilities			
(1) Mechanical Properties Test	1) Universal Testing Machine	Capacity : Max. 50 tons	1 set
	2) Charpy Impact Testing Machine	Capacity : 30kg f.m	1 set
	3) Brinell Hardness Tester	Test Load : Max. 3000kg	1 set
	4) Rockwell Hardness Tester	Test Load : Max. 150kg	1 set
	5) Shore Hardness Tester	Type D	1 set
	6) Micro Vickers Hardness Tester	Test Load : Max. 200g	1 set
(2) Macro- and Microstructure Tests	1) Metallurgical Microscope	50 x ~1500 x	1 set
	2) Hot Type Sample Mounting Press	Heater : 100V, 300W	1 set
	3) Specimen Cutting Machine	Cutting Wheel : 255D x 1.2t x 31.75d	1 set
	4) Rotary Polishing Machine	Disk : 8" dia. x 2 pos	1 set
	5) Hot Type Dryer	Heater : 100V, 400W	1 set
(3) Chemical Composition Analysis	1) Vacuum Emission Spectrometer	Wavelength Range : 175~415 na	1 set
	2) Specimen Grinding Equipment	Grinding Stone : 250D x 174d x 84t	1 set
	3) Atomic Absorption Spectrophotometer with Hollow Cathode Lamps	Wave Length Range : 190 ~ 700 na	1 set
	4) Spectrophotometer	Wave Length Range : 190 ~ 700 na	1 set
	5) Carbon and Sulfur Analyser	Analytical Range : c: 0-5 wt% s: 0-1 wt%	1 set
	6) Electronic Balance	330g~0.01g	1 set
	7) Electronic Analytical Balance	210g~0.1 mg	1 set
	8) Distilled Water Production Device	Capacity : 1.8 l/h	1 set
	9) Constant Temperature Electric Drying Oven	Temp. : 40~250°C, 450 x 450 x 450	1 set
	10) Muffle Furnace	Max Temp. : 1200°C, 120 x 220 x 100	1 set
	11) Hot Plate	Max Temp. : 400°C, 300 x 300 x 197	1 set
	12) Miscellaneous Glasswares		1 set

Purpose	Name of Equipment	Specification	Quantity
(4) Non-Destructive Inspection	1) Ultrasonic Flaw Detector		1 set
	2) Magnetic Flaw Detector		1 set
	3) X-ray Inspection Apparatus	25~150 kV, 12/3 mA	1 set
	4) X-ray Internal Stress Measuring Equipment	30 kV 10 mA	1 set
(5) Precise Measurement	1) 3D-Coordinate Measuring Device	X : 700, Y : 600, Z : 600	1 set
	2) Profile Projector	Projection : 300 mm dia.	1 set
	3) Surface Roughness Tester		1 set
	4) Roundness Tester		1 set
	5) Surface Plate	1.5m x 1.0m x 0.2m	1 set
	6) Miscellaneous Measuring Instruments		1 set
(6) Test Pieces Machining	1) Lathe	Center Distance : 500 mm	2 sets
	2) Shaping Machine	Stroke : 762 mm	1 set
	3) Cutting Grinder	Cutting Wheel : 405D x 3.0t x 25.4d	1 set
	4) Power Hacksaw	Power : 1.5 kW	1 set
	5) Bench Drilling Machine	Drill Dia : 3~130	1 set
(7) Molding Sand Tests	1) Universal Sand Strength Tester	Compression, Tensile, Shear Strength	1 set
	2) Permeability Tester	0~10,000mm	1 set
	3) Sand Runner	50p x 50H	1 set
	4) Infrared Moisture Tester	0~100% wet base	1 set
	5) Fineness Testing Sieve & Sieve Shaker	Approx. 143 cycle/min	1 set
	6) Electronic Balance	330g - 10mg / 60g - 1mg	1 set
	7) Compactability Tester	Pressing by compressed air : 10 kg/cm ²	1 set
	8) Sand Mixer	15kg/batch	1 set
	9) Sand Testing Washer	35W Single Phase Motor	1 set

Purpose	Name of Equipment	Specification	Quantity
2) Other Facilities			
(1) Design Training	1) Drawing Stand		10 sets
	2) Personal Computer		1 set
	3) Plotter		1 set
(2) Seminar	1) Overhead Projector		1 set
	2) Slide Projector		1 set
	3) Microphone and Loud-speaker		1 set
(3) Library	1) Personal Computer		1 set
	2) Copying Machine		1 set

Figure 8.12 ORGANIZATION CHART OF METALWORKING INDUSTRY PROMOTION CENTER

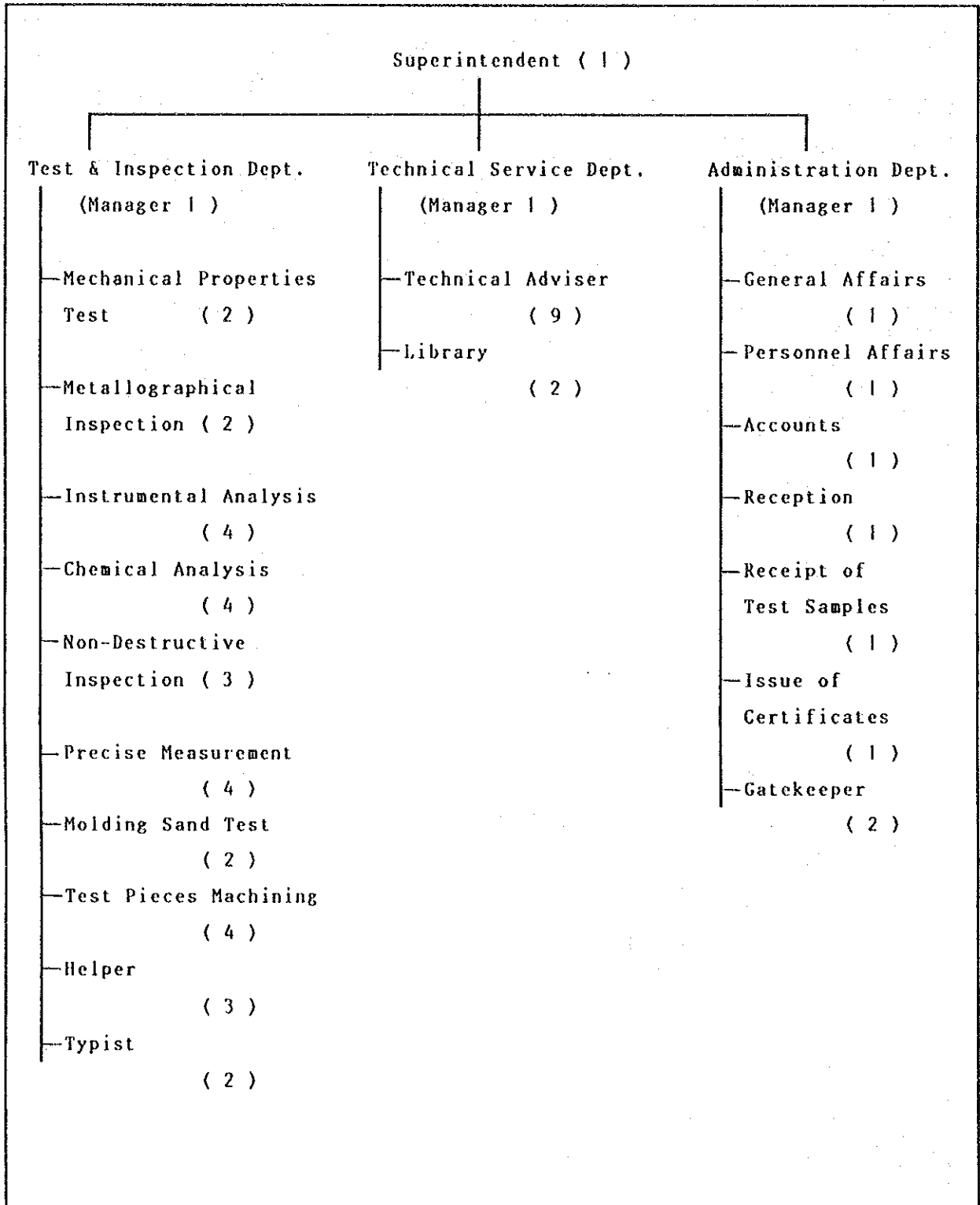


Table 8.10 ESTIMATED PROJECT COST OF METALWORKING INDUSTRY
PROMOTION CENTER

(Unit: US\$ 1,000)

Item	Foreign	Local	Total
(1) Plant direct cost			
1) Equipment, materials(FOB)	1,138.1	16.1	1,154.2
2) Spare parts (FOB)	54.2	-	54.2
3) Ocean freight and insurance	464.1	-	464.1
4) Port charges and inland transportation	-	43.9	43.9
5) Building construction	-	260.4	260.4
6) Installation of machinery	-	3.0	3.0
Adjustment & trial run			
7) Accommodation & facilities(3.2%)	-	38.7	38.7
8) Engineering & supervising	444.2	0.7	444.9
9) Over head expense(10%)	234.2	12.3	246.5
Sub total	2,334.8	375.1	2,709.9
10) Land acquisition and preparation	-	412.9	412.9
Pavement/Fence/Turf	-	76.9	76.9
Sub total	-	489.8	489.8
(2) Tax & duty			
1) Import tax (CIF x10%)	-	248.5	248.5
2) LAY 75 (CIF X 18%)	-	298.2	298.2
3) IVA(CIF+Import tax+LAY 75)x10%	-	220.3	220.3
Sub total	-	767.0	767.0
(3) Contingency & others(20%)			
	467.1	228.4	695.5
Grand total	2,801.9	1,860.3	4,662.2

Figure 8.13 MASTER SCHEDULE OF CONSTRUCTION
(METALWORKING INDUSTRY PROMOTION CENTER)

ACTIVITIES	HONTHS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	
AWARD OF CONTRACT		○																											
SITE SURVEY	0.5	—																											
BASIC DESIGN AND CLARIFICATION	3.0	—	—	—	—																								
DETAIL DESIGN	2.0		—	—	—																								
LAND PREPARATION	1.0			—	—																								
BUILDING CONSTRUCTION	11.0						—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
MACHINERY FABRICATION	10.0						—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
SEA TRANSPORTATION	1.0																	—	—	—	—	—	—	—	—	—	—	—	
INSTALLATION OF EQUIPMENT	1.5																				—	—	—	—	—	—	—	—	
ADJUSTMENT/TRIAL RUN	2.0																				—	—	—	—	—	—	—	—	
OPERATION START-UP																													