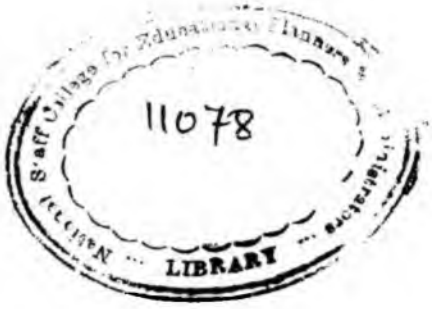
REPORT
OF THE
COMMITTEE ON
TECHNICAL CONSULTANCY SERVICES

GOVERNMENT OF INDIA
PLANNING COMMISSION
September 1970

CONTENTS


11078
LIBRARY

I. *INTRODUCTION*

The lack of Consultancy Services was a serious handicap during the early stages of our development after Independence. For example, the three steel plants at Rourkela, Bhilai and Durgapur were constructed more or less on a turn-key basis with assistance from abroad. The same had to be with many other projects, both in the public and private sectors. However, the progress made during the last decade or so, has led to the establishment of a good number of consultancy, process design and other engineering service organisations. In fact, some of them have been complaining of insufficient utilisation of their services. This may be partly due to lack of appreciation of the role of consulting engineers, absence of information about the services available in the country and the still lingering preference for turn-key jobs from abroad. The problem is somewhat similar to that of securing orders for marketing indigenously manufactured capital goods, for it takes time to create confidence that competent skills exist in the country. Seized of this situation, two Committees were set up, one by the Ministry of Industrial Development to look into the question of foreign technical collaborations and the other by the Planning Commission to study the problems relating to technical consultancy services. The objective of both the studies was to provide the necessary guidelines for speeding up the pace of industrial development with increasing reliance on domestic talent and equipment.

1.2. The Committee on Technical Consultancy Services was set up in February, 1966. The original composition of the Committee was as follows: —

1. Shri S. G. Barve, Member (Industry), Planning Commission, New Delhi. — Chairman

2.	Dr. A. Nagaraja Rao, Adviser (Industry & Minerals), Planning Commission, New Delhi.	..	Member
3.	Shri K. L. Ghei, Special Secretary, Department of Coordination, Ministry of Finance, New Delhi.	..	Member
4.	Shri K. B. Rao, Officer on Special Duty, Ministry of Industry, New Delhi.	..	Member
5.	P. C. Kapoor, Director-General, Technical Development, Ministry of Supply & Technical Development, New Delhi.	..	Member
6.	Shri G. Janakiram, Chief Design Engineer, Heavy Machine Building Unit, Heavy Engineering Corporation, Ranchi.	..	Member
7.	Shri R. P. Sinha, Chief Engineer, Central Engineering & Design Bureau, Hindustan Steel Ltd., Ranchi.	..	Member
8.	Dr. K. R. Chakravorty, General Manager, Planning & Development Deptt., Fertilizer Corporation of India, Sindri.	..	Member

9. Dr. K. S. Chari, .. Member
Central Design & Engineering Unit,
Council of Scientific &
Industrial Research,
New Delhi.

10. Shri Hari Bhushan, .. Member-
Director (Engineering), Secretary
Planning Commission,
New Delhi.

1.3. Owing to the untimely demise of Shri Ghei on the 19th March, 1966, Shri T. Swaminathan, then Secretary, Defence Supplies, was appointed in his place. Shri Swaminathan, however, had to leave, in order to take over as Economic Ambassador at Brussels. Subsequently, the Committee received another shock through the sudden demise of Shri S. G. Barve. In addition, certain other changes in the posts held by the members of the Committee occurred as a result of which the committee was re-organised in April, 1967 as shown below:—

1. Shri M. S. Thacker, Chairman
Member (N. R.),
Planning Commission,
New Delhi.

2. Shri K. B. Rao, .. Member
Adviser (I&M),
Planning Commission,
New Delhi.

3. Dr. B. D. Kalelkar, .. Member
Director General of
Technical Development,
Ministry of Industrial Development,
New Delhi.

4. Shri Ajit Mazoomdar, .. Member
Joint Secretary,
Ministry of Finance,
New Delhi.

5.	Shri G. Janakiram, Chief Design Engineer, Heavy Machine Building Unit, Heavy Engineering Corporation, Ranchi.	..	Member
6.	Shri R. P. Sinha, Chief Engineer, Central Engineering and Design Bureau, Hindustan Steel Ltd., Ranchi.	..	Member
7.	Dr. K. R. Chakravorty, General Manager, Planning & Development Department, Fertilizer Corporation of India, Sindri.	..	Member
8.	Dr. K. S. Chari, Central Design and Engineering Unit, C. S. I. R., New Delhi.	..	Member
9.	Shri R. M. Sharangpani, Chief Process Engineer, Engineers India Ltd., New Delhi.	..	Member
10.	Shri Hari Bhushan, Chief (Engineering), Planning Commission, New Delhi.	..	Member Secretary

1.4. Subsequently, Shri M. S. Thacker relinquished charge as Member of the Planning Commission. Shri Ajit Mazoomdar went on a long period assignment to a foreign country and Shri Hari Bhushan joined the Department of Iron & Steel. Accordingly the Committee had to be re-constituted in February, 1970 as follows:—

1.	Shri R. Venkataraman	Member (Industry), Planning Commission, New Delhi.	Chairman

2.	Shri K. B. Rao	Adviser (I&M), Planning Commission, New Delhi.	.. Member
3.	Dr. B. D. Kalelkar	Director-General, Technical Development, Deptt. of Industrial Development, New Delhi.	.. Member
4.	Shri K. D. N. Singh	Joint Secretary, Deptt. of Industrial Development, Ministry of ID, IT & CA, New Delhi.	.. Member
5.	Shri R. P. Sinha	General Manager, Rourkela Steel Plant, Rourkela.	.. Member
6.	Shri G. Janakiram	Chief Engineer (Technical) Heavy Machine Building Plant, Heavy Engineering Corpn., Ranchi-4.	.. Member
7.	Dr. K. R. Chakravorty	Director (Technical), Fertilizer Corporation of India, Sindri.	.. Member
8.	Dr. K. S. Chari	Director, Fertilizer Institute Division, Fertilizer Association of India, 85-Sundar Nagar, New Delhi.	.. Member

9.	Shri R. M. Sharangpani	Senior Supervising Engineer and Project Manager, Haldia Project, Engineers (India) Ltd., 17, Parliament Street, New Delhi.	.. Member
10.	Shri Hari Bhushan	Senior Industrial Adviser, Department of Iron & Steel, New Delhi.	.. Member
11.	Shri M. Satyapal	Chief (Chemicals), Planning Commission, New Delhi.	.. Member
12.	Shri N. N. Agrawala	Joint Director (Industries), Planning Commission, New Delhi.	Secretary

1.5. The terms of reference of the Committee are:—

(i) To suggest the general type of organisational matters for the technical consultancy establishments which will be suitable for our conditions;

(ii) To recommend suitable measures to expedite the establishment of technical consultancy services to the requisite extent in the country;

(iii) To advise on the pattern of technical collaboration or association, which may be necessary for drawing on foreign technical know-how to the required extent;

(iv) To assess the extent and types of technical consultancy services required to meet the country's needs during the Fourth Plan period and subsequent years;

(v) To assess the existing facilities available in the country, in both the public and private sectors, and locate the gaps to be filled; and

(vi) To advise on the measures to be taken to fill the gap.

1.6. The Committee held several meetings from time to time. Apart from its own deliberations, the Committee took the opportunity to meet representatives of different Ministries of the Government of India, Technical Consultancy Organisations, Contracting Firms, Engineering Associations, Chambers of Commerce, and Public and Private Sector Projects. Talks on general aspects of the functions, definitions, fees and incentives relating to consultancy services were followed by discussions on the adequacy or otherwise of the consultancy services in specific fields, such as, iron and steel, fertilisers, petroleum refining, petro-chemicals and mining.

1.7. At its first meeting, the Committee decided to confine its scope of enquiry to technical consultancy services for setting up new capacities as distinct from production and management consultancy applicable to a plant already in production. Further, the Committee felt that it was not possible to devote much attention to technical consultancy in civil engineering except where it was part of an industrial project, firstly because the scope of such services in industrial and housing construction, roads, bridges, dams, canals, etc. was broad enough to merit a special study by itself; and, secondly because most of the consultancy work in these fields was carried out within the country and did not generally result in an outgo of foreign exchange except in turn-key projects. Without ignoring these fields altogether, the main emphasis of the Committee was on the technical consultancy services necessary for the setting up of new industrial ventures.

1.8. The Committee addressed a detailed questionnaire (given in Appendix I) to about 70 consultancy organisations which included manufacturing units undertaking consultancy, process and design work as part of their activities, and public sector undertakings which had their own engineering and design departments doing consultancy work. More than thirty industrial and business associations were also addressed. Their views were sought in respect of vital gaps in consultancy services in the country the need for and outlines of a code of conduct,

the constitution of a broad-based representative body of consulting engineers, and the measures necessary for promoting the growth of consultancy organisations.

1.9. So long as the country depended mainly on imported equipment and tied credits in such vital fields as power generation, metallurgical equipment, transport equipment and industrial plants, it was only natural that equipment and project designs developed in the countries from where the equipment was imported, were adopted. There was also insistence of the aid givers to use their consultancy services, although this insistence has been gradually relaxed as competent Indian organisations have developed. These difficulties arising out of tied credits and imported equipment together with lack of keenness to make use of indigenous technical resources made it difficult to stimulate the growth of indigenous consultancy services. Large investments have been made and big strides recorded in setting up capital equipment production facilities. It has, however, become increasingly obvious that the country cannot fully reap the benefit of these investments and capacities in the absence of simultaneous development of technical consultancy services within the country.

1.10. One of the factors contributing to continued large scale imports of consultancy services has been the limited use of competent Indian skills. Availability of these services under different programmes of foreign technical assistance has also acted as an inducement to the use of foreign experts rather indiscriminately. Added to these difficulties is the wide gap between equipment and project engineering as developed in the country. This will have to be filled from both sides *i.e.*, by manufacturers of plant and machinery and by consultancy organisations.

1.11. Opinions have differed even on the definition, functions and scope of technical consultancy services, and it has not been altogether easy to identify and locate the various gaps in available consultancy facilities and suggest measures for

covering them. The problems posed were complex and considerable research was necessary.

1.12. In June 1969, the Committee prepared a Draft Report and circulated it for comments. In March 1970, the comments received from different quarters were discussed in a broadbased meeting where all interests were represented. These discussions helped the Committee in framing final views on many specific issues and in finalising the Report.

1.13. The Committee would like to take this opportunity to express its thanks to the many organisations and individuals who gave unstinted help in spite of their many other preoccupations. The Committee also wish to place on record the able services provided by its Secretary, Shri N. N. Agrawala.

II. *NATURE AND TYPES OF SERVICES OF TECHNICAL CONSULTANTS*

The term 'Consulting Engineer' gained currency in the U.K. only after 1906. Neither the clients nor the professional consulting engineers were aware of the specific duties and responsibilities of such engineers. Contracting and consulting work were mixed up. It was only after the consulting engineers organised themselves in 1913 to form an Association, did they clearly identify the:

> "consulting engineer as a person possessing the necessary qualifications to practise in one or more of the various branches of engineering, who devotes himself to advising the public on engineering matters or to the designing and supervising of the construction of engineering works, and for such purposes occupies and employs his own office and staff, and is not directly or indirectly concerned or interested in commercial or manufacturing interests such as would tend to influence his exercise of independent professional judgement in the matters upon which he advises".

2.2. The European Productivity Agency of the Organisation for European Economic Cooperation (Paris) which visited the United States in 1956 to study the working methods and conditions of American Consulting Engineers stated in its report of June, 1958 that the term 'consulting engineer' in its specific sense:

> "applied to an individual who is qualified by his professional skill, experience and integrity, to give independent advice to his client on engineering projects by preparing plans; specifications and estimates and supervising their construction by the contractors. In a broader sense, it also applies to firms or engineers who analyse proposition, check suppliers' or

contractors' drawings, in addition to bid calls and to those organisations which also cover the placing of orders and the inspection and despatch of materials. In the U.S.A. some very large Corporations are considered to be consulting engineers, although they include within the scope of their services the organisation and even the execution of construction works."

2.3. The nature and types of services rendered by Technical Consultants are as follows:

I. **Project Planning**

(i) Market and demand surveys.

(ii) Techno-economic Feasibility Studies.

II. **Project Designing**

(i) Detailed Project Reports.

(ii) Detailed Engineering:

This activity includes, preparation of detailed technical specifications, tender papers, working drawings, estimates of materials etc. for all standard and non-standard machinery and equipment, services and utilities and all civil engineering works; preparation of detailed equipment layout and foundation drawings; preparation of detailed schedule of construction and erection of plant, finalisation of manpower requirements, organisation chart, job specification; arrangements for recruitment and training; preparation of production planning schedule etc.

III. **Project Implementation**

Assistance in appointment of Contractors and Suppliers including advice on tender bids received; supervision of actual con-

struction and erection at plant site; inspection of equipment on behalf of the client; commissioning of equipment after installation; assistance during initial period of plant operation through the provision of specialists, operators and advisers.

IV. Project Evaluation

Consulting Engineers are also called upon to provide independent advisory services to entrepreneurs and financing institutions in respect of schemes received by them. Such services may also be required by the Governments concerned for evaluating project reports submitted by other consultants.

2.4. Professional engineers who normally handle the range of activities from project feasibility studies through project reports to construction and commissioning of the plants, can be broadly classified into the following groups:

(a) Consulting Engineers;

(b) Process Engineers; and

(c) Contracting Engineers

(a) *Consulting Engineers*

The range of activities generally falling within the scope of consulting engineers are: project planning, project designing, project implementation and project evaluation. Frequently, the process employed and the basic data for the process are generally obtained from the Process Engineers, if the Consulting Engineer does not have the necessary expertise himself in this regard.

(b) *Process Engineers*

Process Engineers normally supply the basic process and relevant data pertaining to a specialised process, on the basis of which the engineering design of the plant is developed by

the consulting engineers. Responsibilities of the process engineers may sometimes also extend to such activities as training of personnel and assistance during plant start up, in view of their possessing the expertise on process know-how and process operation. Sometimes, the activities of the process engineer and consulting engineer may be merged into one entity.

(c) *Contracting Engineers*

Contracting engineers normally undertake the construction and erection of plants, based on the design and engineering done by the consulting/process engineers. The work has to be carried out by the contracting engineers strictly as per the design and working drawings. prepared by the consulting/process engineers and generally under the supervision of the latter.

2.5. Within the general definition of consulting and/or process engineers given above there are normally two distinct forms of organisations:

(i) Independent Consulting/Process Engineers who have no direct financial and/or commercial affiliation with manufacturing or contracting interests; and

(ii) Associated Consulting/Process Engineers who either have common commercial interests with or are part of manufacturers/contractors or are the design office of a product or equipment manufacturing unit.

2.6. The question whether consulting/process engineers should or should not have direct or indirect interest as contractors or as suppliers of machinery was discussed at length by the Committee at its own meetings as well as during its meetings with the representatives of the consultancy organisations, other associations and individuals. There was no complete unanimity in the views expressed. Some held that consultancy and supply of equipment were not separable under given conditions or that manufacturing interests were not necessarily prejudicial to the role of a consultant. Most of the

public sector manufacturing units held the view that it would lead to quicker growth of consultancy services, if the manufacturing units developed consultancy services as part of their organisations. During the discussions, representatives of manufacturing units, such as, Heavy Electricals, Bhopal; Heavy Engineering Corporation, Ranchi; and Mining and Allied Machinery Corporation, Durgapur, pressed their claim that it would be desirable to foster within their organisations the consultancy services relating to their fields. On the other hand, strong feelings were expressed by some Government Departments, Organisations, Consultancy firms and others that a distinction must be made between consulting engineers and contractors/equipment manufacturers. It is only an independent consultant who can render unbiased advice to the client and thus safeguard his interests. World Bank and other international institutions insisted on engagement of independent consultants.

2.7. The Committee did not find any uniformity of practice abroad. Whereas in the U.K., the consulting engineers are forbidden to have any interest in contracting or manufacturing, consulting engineers/firms in U.S.A. could take up construction also, and plant suppliers could also function as consulting engineers. However, even in U.S.A. the code of conduct accepted voluntarily by the consulting engineers through membership of the Association of Professional Engineers progressively tends to discourage them from undertaking both the functions *viz.*, as a consultant and as a contractor for the same project. Even in USSR, where the plant suppliers contractors, consulting engineers as well as projects all lie in the public sector, the manufacturers of plant and machinery are quite distinct and separate from the consultants and planners. On the other hand, in Japan, Contracting-*cum*-Consultancy organisations predominate and these have been very successful in exporting know-how, plant, equipment etc.

2.8. The confusion regarding the scope of activity of consultancy organisations was particularly pronounced in the matter of division of responsibilities between consulting engineers, process suppliers and equipment manufacturers. In the above

context, it becomes essential to define the organisational groups either functioning separately or with overlapping responsibilities as: (a) the professional consulting engineers or project consultants, (b) process know-how suppliers, and (c) equipment designers and manufacturers, and to deal with these groups separately.

(a) *Consulting Engineers*

2.9. The contention of some representatives of the profession was that they were employed by the owners of the project, whose interest was their prime consideration. With this identity of interest, they developed the overall concept of the project and steered it to its successful completion to achieve the overall objectives of the project. In discharge of their responsibilities, it was necessary that they were not tied up either with any particular process know-how or product design of a manufacturing concern, and they were able to evaluate comparative merits and then select the best of the available processes and equipment. They were, thus, in a position to offer to the client independent advice and proper overall basic system design. Where the consultants had direct or indirect interest as suppliers of machinery or contractors or had any other commercial interests, it was likely to influence their independent judgement and the client might be deprived of the benefit of securing the best equipment and construction at the lowest cost.

2.10. It was further argued on behalf of the independent consulting engineers that the customer, although confined within the limitations of the standardised products, should still have as much freedom to look after his interest as possible. They felt that there would be a certain amount of inertia and vested interest with any manufacturer of equipment tending to oppose change, improvement or radical innovation in designs unless subjected to pressure from the customers and their consultants. The consulting engineer, not being tied down to such considerations and with his preference for improved machinery, could keep the manufacturing organisations more alert and aware of

the imperative need for keeping abreast of the latest technology, and be in a position to offer the same to the customers.

2.11. Other views expressed were that the consultancy services as developed so far in the country are being offered not only by the independent consultancy organisations but also by the equipment manufacturers, product manufacturers and contractors. It has been stated that the experience gained by a manufacturing organisation having design and consultancy cells, has been of tremendous advantage in shaping a continuous and harmonious rapport with their clients. The technical services rendered by the plant manufacturers including consultancy services sometimes form a package deal of collaboration and are offered directly and confidentially without introducing a third party as a consultant. It was also pointed out that under the present conditions in India, there was not very great scope for the working of independent consultancy firms. Such firms may not grow rapidly. This difficulty could be met by the expansion and growth of contracting engineers and equipment designers. If the consulting engineer was also a contractor, he could take up a job on turn-key basis assuming entire responsibility. Experience gained as a contracting engineer will not only be a complementary qualification for one functioning as a consultant but it will also enable him to offer such services to foreign countries. It was from this point of view that in Western Europe and U.S.A. engineers, contractors and manufacturing concerns had legal status as professional engineers.

2.12. It has also been suggested besides the equipment manufacturers, a product manufacturing unit should also be permitted to enter the field of consultancy. Such a unit may have the experience and possess engineering knowledge of a better quality in its particular field than most of the consultancy firms.

2.13. There is no denying the fact that a number of equipment and product manufacturers have set up well-equipped research and design cells which undertake consultancy as well as

the process design work. These cells along with their manufacturing counterparts are in a position to offer turn-key projects to their clients and also give necessary guarantees regarding performance. The Committee, therefore, feels that it might not be desirable to upset these arrangements at this stage of our development. For all practical purposes, consulting engineers could be divided into two categories, namely, (a) Independent consulting engineers, and (b) Associated consulting engineers—those associated with product/equipment manufacturers and/or undertake contracts. Each consultancy organisation should specify in which category it falls, and it should then be left to each client to decide whether he would prefer to employ an 'independent consultant' or an 'associated consultant'. Gradually as the know-how becomes widespread and many manufacturers are able to offer identical/substitute equipment, independent consultants will acquire greater importance.

(b) *Process Engineers*

2.14. These engineers offer process flow-sheet and design of the various sections constituting the plant. They may function with separate entity of their own or form part of consultancy organisations or as part of equipment manufacturers. They may, in certain cases, also undertake supply of necessary plant and equipment, essentially got fabricated according to their designs. Since basically the firms are sellers of design and know-how, the Committee felt that such firms ought to be encouraged, provided design engineering work and further development of process know-how were progressively carried on within the country.

2.15. These firms normally cater to a specific section of plant for which either the general consultant or the clients can engage their services. Thus, in many cases, their supplies form only a section of the total plant, such as, a sulphuric acid plant being installed as a part of a fertilizer or a steel plant. The customers can directly engage their services or through the overall consultant to facilitate coordination. In the alternative case where it is proposed to set up a plant which entirely

falls within the scope of the process suppliers and plant designers, it would be for the customer either to engage them to the exclusion of the professional consulant or through them. Where an entire plant is set up in this manner, the responsibilities of consultants, process suppliers and plant designers are combined. Thus, there is considerable flexibility in the manner in which a process engineer may, in fact, operate depending on the circumstances and the wishes of the client. In accordance with the prevailing practices and considering the need to encourage the development of process firms engaged in process engineering, the Committee has come to the conclusion that process engineers need not be excluded from functioning as consulting engineers.

(c) *Contracting Engineers*

2.16. The third group is represented by the contractors who undertake the construction of the plant for the client and offer performance guarantee. This function is generally undertaken by an equipment manufacturer, a product manufacturer or a process design engineer. It has been pointed out to the Committee that there should be a large number of contract engineers in the country, who should provide a good base for the selection to project owners. It was further pointed out that it would be detrimental to the country to give a legal status to only independent consultancy organisations without any corresponding legal status to contracting organisations as it would eliminate the 'turn-key' plant concept. Further, an illustration was given of Japan where the functions of consultancy and contracting have been combined and it is this type of organisations which predominate and are successful in exporting the know-how, plants and equipment and undertake turn-key projects. In view of such conditions, there should be no compulsion for the consulting engineers to be independent of or unattached to any manufacturer.

2.17. Some of the product manufacturing units like the Fertilisers and Chemicals Travancore Ltd. and the Fertiliser Corporation of India, have set up consultancy and design engi-

neering organisations which are capable of taking up consultancy, design and even turn-key jobs for the setting up of fertilizer projects. They can, therefore, act both as consultants and contractors. Being affiliates of the manufacturing organisations, these units, F.E.D.O. and P&D Division of F.C.I. claim experience of working on fertilisers and of having the know-how for such projects. There is some force in the argument that these organisations can recommend know-how about which there is no doubt and of which they have full experience. One has to be sure that as consultants they have no particular bias and have kept their knowledge up-to-date regarding the latest technology and developments. Similarly, H.E.C., Ranchi, MAMC, Durgapur, Engineers India Ltd., which are manufacturers of equipment or are process-design engineers, undertake contracts to construct projects. They work in collaboration with other consulting engineers, if necessary, and undertake turn-key jobs.

2.18. It has been suggested that contracting engineer should be recognised and given due importance, for it is he who assumes overall responsibility for the project time-wise, cost-wise and quality-wise.

2.19. The Committee after considering the different views came to the conclusion that consultancy functions can be performed by either the independent consultants or the associated consultants. It is for the client to choose between the two categories of consultants.

2.20. While the equipment manufacturers need not be precluded from acting as consultants, the Committee would like to stress that the equipment manufacturers should mainly concentrate their efforts in the direction of improvements in equipment design and standardisation. The equipment manufacturers should have a well organised Research and Development cell to undertake this work. Availability of standardised equipment and capacity of the equipment manufacturers to adjust and modify their equipment suitably without foreign assistance

to meet the particular needs of a project facilitates the lay-out and construction of industrial plants, *e.g.*, an equipment manufacturer should not only be able to offer a standardised thermal set of 120 MW capacity but if in a particular case it is necessary to instal a 115 or 125 MW set, it should be in a position to do so itself rather than import the know-how for such slight modifications. The equipment manufacturing units should, therefore, be able to develop new and varied types of equipment designs. They should intensify their efforts more on equipment development and research which could help in the standardisation of the products, selection of indigenously available raw materials in place of imported ones, development of components either within their plants or through ancillaries, improving the efficiency of their operations and reduction in costs. They should also try to digest and consolidate design and documentation which they have already secured from abroad and which can help them in import substitution and standardisation. In other words, manufacturing organisations should provide essentially the necessary technical base for the design of the plants in their lines of manufacture making the country independent of foreign collaborations.

2.21. Taking all these factors into consideration, the Committee is of the view that:—

(i) Both types of consulting engineers (independent as well as associated) have developed in India and helped the growth of indigenous projects. They are also undertaking exports of consultancy services and 'turn-key' projects. There appears to be no need to disturb the existing pattern although with the growth of a large number of competing equipment and product manufacturers, the independent consulting engineers will grow and gain in importance;

(ii) There is wide scope for the simultaneous growth of Process and Equipment Design Organisations whose efforts would be complementary to those of consulting engineers;

(iii) The manufacturers of equipment should concentrate their efforts more on product design and development;

(iv) The consulting engineers who form part of or are associated with any contracting organisation or manufacturer of product or equipment, should specify their status clearly so that the client knows their interests before-hand; and

(v) The consulting as well as the contracting engineers are essential for erection of projects and both should be given due recognition.

III. *REGULATION OF THE PROFESSION*

The profession of consulting engineers is new to India and steps need to be taken to regulate and control the practice of this profession by individuals or organisations.

3.2. The relationship between a Consulting Engineer and his client is a professional one. Historically, the professional man has been identified by three criteria:

(i) he must be highly competent as a result of his education, preparation and experience,

(ii) he must assume a responsibility to his client and to society which transcends personal gain, and

(iii) he is able to maintain best of human relations so that he makes effective use of his talent and time.

3.3. The profession of a Consulting Engineer is much like the medical and legal professions. In all such professions, one is judged by the fact whether one subscribes to and practises faithfully the codes of ethics enjoined upon him by his own profession. For proper growth, the position in regard to the profession of consulting engineers can be no different. In fact, in most advanced countries this is exactly how this profession has developed. Assurance of ethical practices and conduct has been achieved essentially through the self-regulatory measures adopted by the profession itself and not through recourse to legal or legislative actions.

3.4. The Committee devoted considerable time to this problem since a proper solution will greatly influence the future development of this profession. They came to the conclusion that steps must be taken urgently to establish a professional All India Institution(s) or Association(s) whose membership by a consultant or consulting organisation would infuse confidence in a client and which would itself be the watch-dog of the profession both in respect of its interests as also its performance—

collectively or individually. There can be one all-India Institution/Association to represent both the 'independent' and 'associated' consultants; or else, there may be two such institutions/associations to represent separately the two types of consultants. The proposed national Institution(s) or Association(s) of consulting engineers will formulate Code of Conduct adherence to which must be a pre-condition for continuing membership of the Institution/Asociation. These two important matters are discussed in greater detail hereunder.

3.5. If the profession of consulting engineers is to develop on healthy lines, it is vital that undesirable elements and practices are kept out. Like the other professions, such as, medicine, law, chartered accountancy etc., this could, in the Committee's view, be best achieved by requiring the consultants or consulting organisations to be a member of the proposed All-India Institution(s)/Association(s). One of the main functions of such an institution/association would be to lay down proper standards of education, experience, capability, capacity etc. for eligibility for membership, more or less on the same lines as has been done by the Institute of Chartered Accountants. It would also lay down the rules and code of conduct to be followed by its members and make their continuing membership conditional on faithful adherence to such a code of conduct.

3.6. There are, at present, two associations of consulting engineers in the country. The Consulting Engineers Association (India), New Delhi, was sponsored by the Institution of Engineers and incorporated in 1959. Its membership is open only to senior practising engineers of good reputation and possessing 15 years approved experience and holding corporate member-partners of the Institution of Engineers or any other recognised professional institution. The Institute of Consulting Engineers was set up in 1958 and has its headquarters at Calcutta and branch centres at Madras, Bangalore, Bombay and New Delhi. It is claimed that many prominent consultants are its members.

3.7. The Committee was of the view that the best course to set up an All-India Institution(s)/Association(s) would be

for the Government to appoint at the earliest opportunity a broad-based Experts Panel to examine this matter in depth and to draw up a Charter/Constitution for the proposed Institution(s)/Association(s). The Panel should consist of 7-9 representatives of Consultancy organisations of both the categories—independent and associated, process engineers, contractors, product and equipment manufacturers both in the private and public sectors and Government departments dealing with consultancy and projects in one form or the other, with a senior Government official as its Chairman. The Panel may examine whether there should be only one Institution/Association to represent all interests or else there should be two separate Institutions/Associations to represent 'independent' and 'associated' consultants respectively. Another point which the proposed Panel may consider is whether one of the existing Institutions/Associations may be given the status of the proposed all-India Institution/Association with some changes in its constitution and the other merged into it or else a new Institution(s)/Association(s) with its own constitution may be set up.

3.8. The Committee further feels that in the light of the recommendations of the Experts Panel, the All-India Institution(s)/Association(s) may initially be established on voluntary basis and, in course of time, it may be given a legal status in the same way as the Institute of Chartered Accountants of India which was established through an Act of Parliament. The composition of the Governing Council would, no doubt, be one of the matters for examination in depth by the suggested Experts Panel, though in the Committee's view Government representation on the Governing Council would not only be desirable but essential to enable it to function properly.

3.9. Once such an Institution/Association has been established—and no time must be lost in doing so—the consulting engineers will find it to their advantage to be a member of this Institution/Association, whether practising individually or as an organisation. Those unable to secure membership will, in course of time, lose confidence and may not succeed in getting

any good business. When this Institution/Association gets a legal status, it will be possible to debar non-members from practising as consulting engineers.

3.10. In India, where most consultancy firms are of comparatively recent origin, an All-India Institution/Association following high standards will have a number of advantages, *e.g.*:

(i) Being an All-India Organisation with Government participation, it will be able to lay high standards of discipline for the consultants;

(ii) Its standing will inspire great confidence of the clients in its members;

(iii) It would more effectively represent the interests of the profession before Government and the public;

(iv) The unhealthy and self-defeating spectacle of rival claims by different bodies claiming to represent the same interests would be avoided;

(v) It would undertake, on behalf of its members, an examination of major projects planned for the future in order to identify the extent to which work could be assigned to its members;

(vi) It would provide an effective forum through which its members could advantageously consult each other on matters of common interest;

(vii) It would serve as the centre for documentation of information on consultancy and projects and thus it will be the store-house of the latest techniques and processes known to Indian consultants.

3.11. Having regard to the foregoing, the committee came to the conclusion that in the context of:—

(i) ensuring proper and reliable standards of services;

(ii) enforcing a uniform code of conduct and ethics upon the professions; and

(iii) providing proper recognition to the profession, it is most desirable that a single or two broad-based, fully representative national Institution(s)/Association(s) be set up, as early as possible.

3.12. The Committee is convinced that if the profession is to develop on sound and proper lines, to perform the vital tasks which come within its scope, besides the creation of an Institution/Association as described above, it will be necessary to enjoin a Code of Conduct which must be faithfully adhered to by all those practising in this profession. In most of the advanced countries, the conduct of consulting engineers is strictly regulated by codes of ethics enjoined upon them by their respective professional bodies. The Committee had an opportunity of examining these codes of conduct and would like to draw attention to some of them.

Practice in U.S.A.

3.13. In the United States, the profession of consultancy is controlled, on the one hand, by legislation and, on the other, by the voluntary rules of the consulting engineers' associations. There are no federal laws (such as, those applicable to doctors, lawyers, accountants, etc.) specifically concerned with consulting engineers. There are, however, State laws confined to two aspects of professional practice only—the public registration of engineers and the prohibition of corporations from practising as consulting engineers.

3.14. State registration of consulting engineers was originally introduced to protect the public against bad work and unsound advice provided by persons without proper technical qualifications. Registration was necessary if any person offered his services to the public as a consulting engineer. It was not usually necessary for engineers employed in the office of a consulting engineer to be registered as professional engineers. The partners of the firm were required to be registered as professional engineers. It was also laid down that engineering plans should usually be signed by a registered engineer.

3.15. In each State, an 'Engineer' was defined in terms of specific category of activity. Registration was required in all cases where the engineer was a highly trained specialist of university standard, civil, mechanical or electrical, etc. In some States, registration was required for categories of engineers who were not of University Graduate standard. The title of the professional engineer did not necessarily cannote a high level of technical qualification. Registration was independent of technical education or qualification of the engineer and was usually dependent on a specified period of service in a responsible position interpreted as covering the period when he had made reasonable advance and was undertaking responsible engineering design work. Registration entitled the Engineer to use the initials "P.E." (Professional Engineer) after his name.

3.16. Two aspects which have been specifically mentioned by the OEEC as somewhat unsatisfactory were: —

(a) the word 'Professional' did not imply the person having any absolute standard of ethics; and

(b) the qualifications for registration were entirely technical and no distinction was made between an independent consulting engineer and the engineer employed in industry. Further, the qualifications varied widely and in many cases did not provide as good a protection for the public as membership of one of the Associations of Consulting Engineers did.

3.17. The European Productivity Agency of the OEEC has stated that, over the years, a number of State Associations of Consulting Engineers have been formed in the USA whose membership is restricted to qualified engineers and who are independent of commercial interest and are practising as independent consulting engineers. The ethics, by-laws and the code of practice of these associations are of a fairly high standard and comply generally with those of the Member Associations of the *Federation Internationale des Engineurs Counseils* (F.I.D.I.C.). It is further stated that each of the established associations have adopted some sort of code of ethics. As a

preliminary to the formation of the Consulting Engineers Councils, the constitution and the by-laws of the ten associations which were eventually to become the founder associations of Consulting Engineers Councils in U.S.A. were tabulated. The tabulation indicated that a Member must be (a) licensed and registered, (b) actively engaged in professional engineering practice, (c) a principal in a consulting engineering firm, (d) not connected with sales, and (e) not a salaried employee. In brief, it could be said that in USA also there is a continuing development towards a uniform code of ethics of high standard for the consulting engineers. According to the Agency, very real attempts were being made to educate the public as well as all classes of engineers about appreciating the standing and dignity of the independent consulting engineers.

Practice in Europe

3.18. With regard to the practices prevailing in Europe, some idea could be obtained from the Code of Conduct guiding the FIDIC. The FIDIC was founded in 1913. The Associations of Consulting Engineers of different countries are the members of the FIDIC. FIDIC was formed:—

(a) to establish and maintain an international body of competent, reputed and independent experts;

(b) to promote the application and observance of such rules of conduct as would guide the true consulting engineer in his profession; and

(c) to watch his performance and reputation.

3.19. The aims and objects of professional associations affiliated to the FIDIC are as follows:—

> "Consulting engineer belongs to an honourable profession free from commercial bias. He must be of strict integrity. He is not connected with trade or commercial business. He is remunerated solely by the fees paid to him by his client.....
> His position in the industrial world is equivalent to

that of the Barrister-at-Law in the legal field and the Doctor of Medicine in the medical world.....
He must retain absolute independence of action with regard to contractors and he must never accept from them any kind of favour which might compromise the impartiality of his decision or prejudice his duties to his client."

3.20. Compliance with these principles involves certain restrictions on the consulting engineer's activities which he must observe to establish and retain the confidence of his client. He is to share these restrictions with the lawyer, doctor and the architect. He is not to advertise or solicit for work. The Agency of the OEEC has further stated that "the dividing line between the professional and contracting service is frequently lost sight of even by authorities and administrations who should know better." For instance, many administrative and government departments have laid down a rule that competitive bids must be called for in the case of all projects over a certain value and they try to apply these rules to consulting services. This procedure is neither in the public interest nor is required by law.

Practice in U.K.

3.21. In U.K. a code of conduct is made applicable through Membership of the Association of Consulting Engineers which was formed with the object of promoting the advancement of the profession of consulting engineers by associating together for consultation and cooperation those engineers whose work was of a purely consultative character. One of the primary objects of the Association is to ensure that consulting engineers who undertake to advise on engineering matters shall be fully qualified engineers in the respective fields and should function in all professional matters in a strictly fiduciary capacity to their clients. The rules of professional conduct as laid down for the membership of the association include:

(1) A member in his responsibility to the client and to the profession, shall have full regard to the rules of

the professional institution to which he belongs and to the public interest;

(2) A member shall discharge his duties with complete fidelity;

(3) A member shall order his conduct so as to uphold the dignity, standing and reputation of the profession. He shall not conduct himself in a manner, nor act in any capacity, nor hold any appointment which, in the opinion of the Council, prejudices his position as a Consulting Engineer, or as a member of the association, or is prejudicial to its interest;

(4) A member shall not act so as to injure, directly or indirectly, the professional reputation, prospects or business of another member—provided that this rule shall not be taken a prohibiting expression of technical opinion on behalf of his client before a tribunal, or in a commissioned report, or of lodging a complaint of the conduct of another member to a competent body which lays down rules of conduct;

(5) A member shall not, directly or indirectly, attempt to supplant another member; nor shall he intervene in engineering work of any kind which to his knowledge has already been entrusted to another member;

(6) A member shall not review or take over work of another member acting as a consulting engineer for the same client, until he has either obtained the consent of such member, or has been notified by the client in writing that the connection of such member with the work has been terminated;

(7) A member shall not knowingly compete with another member on the basis of professional charges;

(8) A member shall not, either himself or through any person or firms, canvass, advertise for, or solicit professional employment; neither shall he offer to make

payment by way of commission or otherwise, for the introduction of employment;

(9) A member shall not be a direct or salaried employee of any company, firm or person carrying on any commercial contracting or manufacturing business which may be involved in the class of work to which his appointment relates. Neither shall be, without disclosing the fact to his client in writing, have any substantial financial interest in a company nor shall he be an agent for any such company, firm or person;

(10) A member shall not receive, directly or indirectly, any royalty, gratuity or commission on any transaction or on any article or process in connection with the work to which his appointment relates, unless acceptance of such royalty, gratuity or commission has been authorised in writing by his client;

(11) A member shall not, except with the authority, of, and on behalf of his client, place contracts or orders. Nor shall he be the medium of payments on his client's behalf, unless instructed to do so, but shall only issue certificates to his client for payment;

(12) A member shall accept remuneration only from his client unless he has his client's authority in writing to do otherwise. He shall not accept any trade, commission, discount, allowance, indirect payment or other consideration in connection with any professional work on which he is engaged;

(13) A member shall not practise in respect of work on sites in the United Kingdom under the protection of limited liability; and

(14) A member when working in another country shall order his conduct according to these rules; but where there are recognised standards of professional conduct laid down in that country by a competent body recognised by the Council, he may order his conduct according to such standards.

3.22. The questionnaire issued by the Committee elicited the opinion of the consultancy organisations regarding compulsory registration of the Consultancy Engineering firms and whether there is need for a code of conduct for them. Most of them have favoured compulsory registration on the lines of the legal and accountancy professions. However, a few of them expressed themselves against any kind of registration and suggested that panels of qualified firms may be formed as they thought that registration was premature at this stage. Similarly, with regard to the code of conduct, a large number was in favour of the adoption of a professional code of conduct; only very few were against such adoption of code. During the detailed discussions which the Committee held with the representatives of the Consulting Engineers and other commercial and industrial associations, the views expressed generally favoured the need for a code of conduct.

3.23. The main task before the Committee was to suggest measures for fostering consultancy services in the country, so that they can take an increasing measure of responsibility and share of work which has hitherto been carried out by foreign consultants. One of the most important pre requisites for such a changeover is the creation of mutual trust between clients and consultants and a feeling of confidence among the clients who risk their money, that their interests will be safe in the hands of Indian consultancy services and that safeguards would be available against improper advice. In the opinion of the Committee, such an atmosphere cannot be created unless it is preceded by a code of conduct strictly binding on the consulting engineers.

3.24. The question, therefore, is what could be the best model for the professional code of conduct to be adopted in India. Various models as followed by the Association of Consulting Engineers in the U.S.A. *Federation Internationale des Engineurs Conseils* and the Association of Consulting Engineers in the U.K. have already been cited in the preceding paragraphs. From our point of view, the U.S. practice suffers from

excessive decentralisation and lack of uniformity since different States follow different practices. This mode will be unsuited to us because the bulk of our industrial activity is directed by the Centre through the Industries (Development and Regulation) Act and bulk of investment in the public sector is undertaken by the Centre. A uniform practice and code of conduct governing the activities of the consultancy services in India would be better suited and would in fact be easier to enforce. In the case of FIDIC, the code represents only the common denominator and is not comprehensive enough for our use. The professional rules of conduct for Consultancy Services as outlined by the Association of Consulting Engineers in the U.K. are no doubt comprehensive but do not provide a suitable model for the development of code of conduct for the consultancy services in our country. Whereas the code of conduct followed in the UK prohibits a consulting engineer from practising as a limited liability company, most of the consultancy organisations registered/functioning in the country are private limited companies without any apparent disadvantage. Moreover, a number of consultancy organisations in India are attached or associated with manufacturers or contractors.

3.25. Considering all these points, the Committee came to the conclusion that the first step in the direction of regulating the consultancy profession and introducing high standards of conduct is to establish a single or two All India Institution(s)/Association(s). As soon as this Institution/Association is established, it may frame a suitable Code of Conduct applicable to Indian conditions. It may not be advisable to adopt in entirety the U.K., U.S.A., Japan or any other foreign model and due account should be taken of the developments which have taken place in the country. The objectives of the proposed Code should be to encourage growth of consultancy services on sound lines, to make the services efficient, reliable and internationally competitive. The Code may also be such as to promote mutual relationship between the consultants, contractors and project owners through all stages of the implementation of projects.

IV. *CONDITIONS OF ENGAGEMENT AND SCALES OF FEES*

Representatives of the consultancy services emphasised that there has to be a premium on quality in consultancy engineering services. The cost incurred on such services is only a small fraction of the total cost but the satisfactory selection of process, plant and machinery, quick implementation, efficient running and cost of production depend largely upon a proper selection of consultants and hence the quality of expertise engaged by them. They were equally emphatic in asserting that fees should be fixed on the basis of established norms and mutual discussions. Any bargaining in regard to fees tends to lower the standards of service which would discredit the profession as a whole, making it more difficult than ever to restore confidence in their competence.

4.2. These representatives also held the view that the fees charged by a firm of consulting engineers not only cover the quantum of work to be done but also bear some relation to the accumulated experience of the firm's engineers on which would depend the quality of work. In India, where specialisation and experience are comparatively limited and are being built up for the first time, it would undermine their efforts in building up competent services if there is resort to bargaining. There was unanimity of opinion that engagement of consultants and fixing of their fees should be done in accordance with international practices adjusted to Indian conditions and that, if it were done on lowest tender basis, it would be harmful to the growth of professional and competent services in the country.

4.3. The Committee had an opportunity to study the relevant conventions established in this respect in some other countries, notably in the U.S.A. and U.K. The Committee noted that not only detailed procedures and guidelines have been laid down for engaging the services of consultants and fixing compensation for their work but the consultants themselves, accord-

ing to the codes of conduct enjoined on them, are forbidden from submitting priced proposals under conditions that constitute price competition of professional services.

4.4. The procedure laid down by the International Bank for Reconstruction and Development for the engagement of consulting engineers is equally clear in avoiding competitive bids. They have emphasised that the object must be to obtain the best qualified firm which would be in a position to undertake the work at the lowest reasonable price. They have laid down that consulting engineers should not be required to tender or bid against each other for appointment on the basis of fees alone, in fact, their professional rules expressly forbid them from knowingly doing so. They may, however, compete against each other on the basis of qualifications, experience and professional competence—same as in the case of lawyers and medical practitioners.

4.5. The Association of Consulting Engineers U.K., has classified the services of consultants in the context of their engagement and service fees and also laid down broad guidelines for fixing remuneration for consulting engineers depending on their professional standing. Fees to be computed can be either on a time basis or on the basis of an agreed lump sum or a combination thereof, or, alternatively, computed as an agreed percentage of the estimated capital value.

4.6. The Association has also laid down model forms of agreement for:

(a) the design and supervision of works of civil engineering construction;

(b) the design and supervision of works particularly of electrical and mechanical nature;

(c) the design and supervision of structural engineering works in buildings and other structures (where the architect has been appointed by the client); and

(d) the design and supervision of engineering services and associated equipment for building and other structures.

4.7. They have further enumerated the various factors which may vary the terms as outlined in the model forms, particularly in case where the amount of work required differs substantially from the normal; for example, where:

(i) the design work is of an unusually complex character;

(ii) the works are to be constructed by means of an abnormally large number of separate contracts;

(iii) a substantial proportion of the project involves alterations or additions to existing structures, plant or service;

(iv) the completion of the project is retarded through circumstances over which the consulting engineers have no control; and

(v) the work is for a client of long standing who regularly retains the same consulting engineers for the execution of the major portion of his work, etc. etc.

4.8. In the United States, the guidelines for engaging consultants and for making payments to them are given in the Manual of the American Society of Civil Engineers. The Manual has made out an additional point that it is not in the best interests of the client or the consulting engineers to accept assignments on an anticipation basis. This does not refer to the general discussions with the client but to such practices as preparing preliminary reports and estimates without charge, in the expectation of being retained if the project is undertaken (a practice which appears to be followed in our country very often *vis-a-vis* foreign suppliers). The danger inherent in such a practice, which requires a favourable recommendation for the project under investigation by the Consulting Engineer as a precondition for the compensation, is self-evident.

4.9. The main features of the policy for selection laid down by the American Society of Civil Engineers are as follows: —

(a) **The firm should be of high ethical and professional standing and should be prepared to submit references from persons or firms of known repute.**

(b) The principal and other existing members of the firm must be registered professional engineers.

(c) A principal member of the firm's staff must have at least ten years' recent experience in responsible charge of engineering works of the type involved in the project.

(d) At least two additional members of the firm's staff must have a minimum of five years experience in responsible charge in the field covered by the project.

(e) Firms interested in engagement should disclose complete information of their qualifications.

(f) If a client has previous experience with a consulting engineer, who has in the past rendered satisfactory service, he may consider it unnecessary to go through the procedure of selection. Otherwise, the following procedure is followed: —

(i) Obtain from the Association's professional services Directory or other technical publications the names of at least 3 firms who, on *prima facie* evidence, appear to be qualified for the assignment. (Advertisement by the prospective clients for this purpose is not permitted).

(ii) List the firms so selected in order of adjudged suitability after obtaining their willingness to undertake the assignment and after a careful review —through personal discussions—of each firm's capabilities, capacities and past performances.

(iii) Call the firm adjudged most suitable for negotiations in regard to remuneration etc. If a satisfactory agreement is not reached, the firm should be so advised. Thereafter a similar procedure should be adopted with next firm and so on. All such negotiations must be confidential and negotiations with one firm must not be disclosed to the next.

(iv) After completion of such negotiations, the firm should be personally called upon to submit its detailed proposals in writing and a formal contract entered into.

4.10. As in the case of the Association of Consulting Engineers of U.K., alternative fees by way of per day or hourly basis, retainer, salary cost with a multiplier plus direct non-salary expenses, cost plus fixed payment, fixed lumpsum payment etc., have been detailed. Norms of consulting engineering fees separately for assignments which are of above average complexity and those below average complexity have been stated for general guidance. Obviously, the larger the project, the lesser are the ocnsulting engineering expenses as a percentage of the total expenditure.

4.11. Where the fees are to be charged as percentage of the total cost of the project, guidelines have been provided for estimating the total cost taking into account such factors as contingencies, engineering, legal and administrative costs, financing and interest during construction over and above construction costs which may be estimated by the engineer.

4.12. Keeping in view the practices prevailing elsewhere the Committee came to the conclusion that the selection of consulting engineers in India should also be made on similar lines. This should be on the basis of proven competence and not on the lowest price. The proposed code of conduct should debar price-cutting and unhealthy competition amongst the consulting engineers and they should observe the same standards as are followed by the medical practitioners and chartered accountants.

4.13. The opinion regarding issue of tenders for allotment of consultancy jobs was divided. Engagement of consultants depended largely on the confidence a project owner had in a particular consultant. The method of calling the tenders for consultancy work should, therefore, be used only sparingly.

4.14. Negotiations for settling consultancy and contract jobs were sometimes essential to strike a proper bargain. The quality of the performance of a job depended more on the competence and reputation of the consultants, once a settlement had been arrived at.

4.15. The Committee further recommends that the proposed Experts Panel should examine this matter in greater detail and set guidelines for the fixation of fees and other terms and conditions of appointment. The Institution(s)/Association(s) of consulting engineers when set up can undertake to introduce these guidelines and standards amongst the consulting engineers.

4.16. The Institution(s)/Association(s) should also prepare in course of time a model contract form for consultancy and contract jobs to safeguard the interests of both the clients and engineers. This will be helpful in introducing high professional standards.

V. *MEASURES FOR THE PROMOTION OF INDIGENOUS CONSULTANCY SERVICES*

Case for Indigenous Consultancy Services

Developed countries have been spending large amounts on research and development of new products and processes. India has been acquiring these processes and know-how through lump-sum initial payments, royalty, import of equipment, equity participation etc. Reliance upon the import of know-how, technology and equipment from advanced countries in the past was necessary and helpful in accelerating the growth of industries. Over the last few years, the industrial spectrum has widened and considerable technical expertise and know-how has developed. The country is now in a position to fabricate a substantial part of the machinery required even for the most complex plants. On the other hand, know-how is available only in a limited way for some industries or sections of an industry. The country is, therefore, faced with two situations, *viz.*, on the one hand, induction of foreign know-how and equipment to supplement indigenous availabilities is still necessary and unavoidable; on the other, there is need to ensure the maximum utilisation and development of indigenous talents and facilities.

5.2. Foreign consultants are often employed for the purpose of obtaining the necessary project reports, process designs and engineering. The experience of the foreign consultants utilised in the past has not been an unmixed blessing. Sometimes these consultants, being unfamiliar with the Indian equipment, raw materials or industrial conditions and having a bias for the conditions operating in the developed countries, have suggested designs, lay-out and equipment which have not proved suitable to the Indian conditions. The pressure from aid-giving countries has also compelled the country to utilise more of the imported equipment than was actually necessary. The foreign consultants have often suggested designs and equipment of the readily-made plants available in their countries, thus necessitating larger outflow of foreign exchange from the country. The

foreign consultants generally prefer to do the entire design and engineering work in their own country and thus, India loses opportunity to gain the necessary knowledge and experience in this field. Consequently, whenever similar projects have to be set up later on, repeated imports of equipment and technical consultancy services become necessary.

5.3. The country, has, therefore, to adopt policies which ensure:

(a) the utilisation of the best possible and up-to-date techniques of production suitable for Indian conditions;

(b) Maximum utilisation of the consultancy and engineering services available in the country and their further development; and

(c) Import of foreign know-how and consultancy services only, where necessary, for the development and improvement of the industrial structure of the country.

5.4. There are no two opinions that with the development of machine building capacity as well as consultancy and design abilities in the country, maximum work should be done with the help of Indian talent. The deleterious effects of continued dependence upon foreign consultants for the utilisation of our own machine building capacity and growth of industry and technology are even far more serious. To the extent the work is not done within the country it means a direct outgo of foreign exchange. In some cases, where indigenous ability for fabrication of equipment had been utilised, the foreign exchange required for the project had been substantially scaled down. For example in the case of Haldia project, a fresh study brought down the size of foreign exchange requirements from over Rs. 21 crores to less than Rs. 7 crores. In the case of Marmugao ore-handling equipment, the estimated foreign exchange requirement was substantially reduced to about Rs. 2.5 crores on the basis of some of the designs provided by Indian consultants.

5.5. Time is, therefore, opportune when there should be maximum utilisation of Indian consultancy, design and

engineering services and import of know-how or equipment is permitted only when it is unavoidable. In other words, effective steps are necessary for removing a bias in favour of foreign consultancy and equipment and for creating necessary goodwill for the indigenously available facilities in this regard. For this purpose, the Committee considers that the following steps may be helpful:

(a) The proposed All-India Institution(s)/Association(s) should prepare annually a monograph of know-how, processes, designs, technologies, installations and equipment which are available in the country on the basis of information collected from consultants, engineers, contractors and manufacturers. This will on the one hand publicise the facilities available in the country and on the other permit proper discretion regarding imports.

(b) All cases of engagement of foreign consultants whether for public or private sector must require prior approval of Government.

(c) Frequently in the case of private sector projects consultancy charges are a covert element in the price of imported equipment. This element must be clearly spelt out.

(d) In all foreign collaboration agreements a condition should generally be included to the effect that Indian consultancy organisations will be associated for preparing feasibility study report, lay out designs and for planning the engineering work. This will pave way for building up and improving the technological base of Indian consultants and process engineers.

(e) Even where foreign consultants have otherwise to be appointed, it should be made conditional that as far as possible, and keeping in view the technology of production suitable for India, designs shall be developed on the basis of indigenously available equipment.

5.6. Divergent views were expressed before the Committee regarding import of know-how and consultancy services. One view was that import of technical know-how and consultancy services for a manufacture of one item should be permitted only once and thereafter it should be passed on to other manufacturers. Another view was that in order to keep up-to-date, alternative technologies for manufacture of the same product, should be allowed to be imported in order to provide a better, cheaper, diversified and up-to-date technological base to the industrial structure of India. Other views have been that only consultants should secure process know-how and hold patents obtained in the natural course of their work, since in that case it could be multiplied within the country. But it was also feared that this procedure would conflict with the ability of the consulting engineers to select the best available process in preference to the one acquired by him and this would be contrary to the clients interest. In such cases, the consulting organisation might get committed to using only one process and recommend it to the exclusion of any other know-how which may later on be found to be technically superior. Much, however, depended on the working of the particular consultancy organisation. Where the process know-how tends to become obsolete, the consultant should switch over to a new process. The consultant should not be tied to a particular know-how in a permanent or static way.

5.7. It was also argued that if consultants secured the know-how, they could help set up any number of plants through once obtaining the process know-how or product design instead of every party securing these separately and individually. Although this may not save the total payments to be made by individual units for use of a proprietary process, it had the advantage of quicker implementation and lower expenditure of foreign exchange through maximisation of detailed design engineering and equipment supply from domestic sources. In addition, it would counter the insistence of foreign parties upon making a package deal for the design engineering and export of their plant and machinery. This will help saving foreign

exchange and better utilisation of our own machine building capacity, and providing the opportunity to gain experience in design engineering and to develop enough technical expertise to do it on our own and improve or modify the imported know-how or product, keeping in view our own local raw materials and other factors.

5.8. It would be desirable not only to permit the consultants to secure process know-how and product design in preference to such induction by individual entrepreneurs but to encourage them in actually doing so. Securing of process know-how through consultants, however, need not prevent a project from getting process know-how directly, provided (a) it does not involve payment other than for proprietary rights; (b) it does not involve extra expenditure of foreign exchange on import of plant and machinery services which are otherwise capable of being fabricated within the country; and (c) provided that the project is not prohibited from passing on the know-how to others.

5.9. One other measure which the Committee felt very strongly was that whenever a project secured process know-how from abroad, it should do so on a non-exclusive basis so that it could transfer such knowledge to subsequent units whether in the public or in the private sector.

5.10. A stage has already been reached when import of package deals and turn-key jobs, is not necessary. A substantial part of all projects, both in fabrication and design work, can be undertaken in the country. Package deal and turn-key jobs should not therefore be ordinarily permitted.

Import of Know-how

5.11. The Committee noted that in those cases where process know-how is secured from abroad, there is normally an insistence that the design engineering should also be imported along with the bulk of plant and machinery, supervision of erection etc. The Committee recognised the difficulties in the development of indigenous process know-how in a short period

and, therefore, conceded the necessity of continued imports of know-how for the more sophisticated industries. Nevertheless, serious efforts have to be made to alter this position. Luckily, development of process know-how in most of the fields is no longer the monopoly of one or two countries. Under these competitive conditions, if a concerted effort is made to secure any particular know-how it is likely to succeed. The Committee also noted that often an offer of indigenous consultancy and design engineering is sought to be rejected on the ground that it would imply a party obtaining it from a competitor. Such a plea is totally untenable and unacceptable. If the know-how and design engineering services available in the country are to be utilised, necessarily—at least in the bulk of such cases—they would have to be secured from a competitor.

5.12. The Committee was of the view that consultants should be allowed to secure process know-how or help the client to secure it from the best available sources. What is mistakenly believed is that the use of process know-how involves securing the design engineering etc., from abroad. This is not correct. If the process know-how is to be obtained from abroad, it does not and should not preclude the use of Indian consultants for design engineering, supervision of erection and the obtaining of plant and machinery from indigenous sources.

5.13. The Committee was of the view that where the process know-how is not available indigenously, either from process suppliers or from existing plants, then only should the process know-how be secured from abroad. This should preferably be either by the consultant or on a non-exclusive basis by the client, so that the foreign exchange expenditure is limited and all the other associated work can be carried out by the Indian consultancy organisations.

5.14. Rapid developments are taking place all over the world and products, processes and technologies are being evolved. We should no doubt have our own Research and Development work, but we cannot obviously undertake all development without spending too much time and money. The R&D work

for the time being, will have to be confined to certain areas where the results can be obtained quickly and without too much expense. It is necessary that the consultancy and process engineers acquaint themselves with the developments in foreign countries. The Indian consultancy as well as process and design organisations should, therefore, be allotted foreign exchange for import of necessary literature and for undertaking study and reorientation tours to foreign countries. These expenses are essential for keeping the knowledge up-to-date and to offer best advice to the clients.

Finance from Banks

5.15. Consultancy and process design work are a regular business and need working funds, from time to time. The banks should evaluate these needs on merits and they should loan funds to meet these requirements. This would be of great help to the indigenous consultancy and process design firms.

5.16. Keeping all factors in view, the Committee feels that:

(a) Import of process know-how and product design should preferably be through consulting and process engineering organisations. This would help the setting up of the required number of projects avoiding the need to import the same know-how repeatedly. This will also ensure quicker implementation and lower expenditure of foreign exchange.

(b) This should not, however, tie the consultants and process engineers to a particular know-how, technology or process in a permanent or static way. The consultants and process engineers should keep themselves up-to-date and give up their interest in technologies and processes in which they hold rights in favour of latest and most up-to-date know-how. Client's interest in avoiding obsolescence has to be safeguarded.

(c) In order to broad-base the industrial structure of the country and introduce latest know-how, import of new

and improved processes and technologies for manufacture of the same product should be permitted, when there is a demonstrable advantage in doing so.

(d) Import of know-how and process designs should be as far as possible, on non-exclusive basis.

(e) Import of package deal and turn-key jobs should not ordinarily be permitted. It should be permitted only when there is no other alternative available to the country.

(f) Product and Equipment manufacturers may not be precluded from acquiring the know-how and process designs from foreign countries to keep themselves up-to-date subject to the conditions that it is not on exclusive basis and it does not involve expenditure on machinery and equipment which can be fabricated in the country.

(g) Facilities of foreign exchange for import of literature and for studies and reorientation in foreign countries should be given to the Indian consultancy and process design organisations to enable them to acquire up-to-date knowledge.

(h) The banks in India should regard consultancy and process design work as a regular business and offer advances on merits for meeting working capital requirements.

(i) Proper liaison should be established between the Research Laboratories, Equipment and product manufacturers, Consultancy and Process Design Organisations. This will help to quicken the implementation and commercial use of the results of indigenous research, design and development.

Overall guarantees

5.17. The normal practice is that the suppliers of each item of plant and machinery support it with the necessary guarantee for satisfactory performance while the consulting engineer

guarantees satisfaction of flow-sheet and adequacy of equipment. In effect, these two agencies cover the guarantee for the satisfactory performance of the entire plant. Often, foreign consultants and/or suppliers due to their unfamiliarity and lack of experience with indigenous equipment, apart from their keenness to import from their own country, decline to accept guarantees offered by indigenous suppliers, and, in turn, do not take overall responsibility for the entire plant. When foreign consultants or suppliers are reluctant to accept such performance guarantees, the project authorities themselves should come forward and accept guarantees of satisfactory performance of indigenous sections of equipment.

5.18. With a view to save time and effecting economy in the cost of indigenous equipment, the consultancy organisation/contractor might be given licence for import of raw-materials needed for fabricating equipment indigenously. The consulting engineer contractually and morally should not make profit in procurement of such materials.

Indian Consultancy Organisations with Foreign Collaborations

5.19. The broad policy framework within which Consultancy Organisations with foreign collaboration are permitted to be set up in India has already been laid down. Briefly, it requires:

(a) Preference for minority foreign share holding;

(b) A minimum of two whole time technically highly qualified Indian Directors;

(c) Prior approval of Government to such portions of the work which would be got done abroad;

(d) Progressive reduction in dependence on foreign technical resources and programmed build-up of indigenous talent; and

(e) A review of the position 3 years after start of initial operations.

5.20. Within this broad framework, a number of consulting engineering firms have started functioning in the country which have a tie-up with foreign organisations. It was stated before the Committee that these firms have an edge over purely Indian firms. Consultants with foreign collaboration were said to inspire greater confidence. They are often able to help in arranging foreign collaboration and foreign equity participation.

5.21. The aspect of foreign collaboration in the field of consultancy services was carefully considered by the Committee and they came to the conclusion that such collaborations need not be discouraged. The guidelines provided by Government and the powers already enjoyed by it can be suitably used for ensuring that the country is progressively enabled to take up consultancy work for its own development, that knowledge and experience accumulates and that as little work as possible is contracted out of the country. The Committee is also of the view that the scope of the guidelines already provided for could be enlarged as to take advantage of them on the basis of the following:

(a) Collaboration between Indian consultancy firms and foreign consultancy firms may be encouraged on the basis of specific projects in preference to foreign consultancy firms opening branches here;

(b) Where Indian consultancy organisations or those with foreign collaboration already exist and do not have sufficient work load, new units in the same field with foreign collaboration should not be allowed except when they perform work on jobs to be put up outside India;

(c) Foreign exchange should not generally be spent for feasibility studies; and

(d) The main work of compilation of data and designing of the plant and equipment must be done within the country, if necessary, by inducting assistance from foreign experts. The work to be done outside the

country by foreign collaborators should be, as far as possible, confined to checking up the work done within the country.

5.22. If these aspects of foreign collaboration are kept in view, sufficient safeguard would be available to ensure that the legitimate interests of Indian consultancy organisations do not suffer and that at the same time, the country is not deprived of the expertise and accumulated experience that is made available through consultancy organisations with foreign collaborations.

Financial Incentives

5.23. It was argued before the Committee that the Corporate tax structure applied equally to manufacturers and consultants, although concessions, such as, development rebate, tax rebate for key industries etc. which are available to manufacturing units could not be availed of by Consulting Organisations. In that case, the Committee is of the view that the tax structure is particularly harsh on Consultancy Organisations and is not conducive to the proper growth of consultancy in the country. Even more than manufacturing plant, a consultancy organisation is extremely sensitive to work load variations. Apart from drop in revenues, reduced work-load creates a feeling of insecurity amongst such highly specialised personnel who, afterall, are in the main the "capital assets" of such an Organisation.

5.24 From recent reliefs announced, it would appear that Government are already cognisant of the need for reforms and concessions in this regard. However, in the view of the Committee, the following additional measures will go a long way towards ameliorating the financial hardships at times, faced by Consultancy Organisations: —

(i) The Banks should grant loans on easier terms to enable engineering organisations to meet their working capital needs. Consultancy and process engineering should be treated on par with other industries for purposes of bank loans;

(ii) The rate of income-tax for consultancy work should be lower than that applicable to other corporate bodies;

(iii) Income-tax should be levied on the average income of the past three years;

(iv) Indian Consultancy Organisations should be permitted to create special tax free reserve funds (like development reserves) from earnings during good periods to help them tide over occasional lean periods.

VI. *REQUIREMENTS OF CONSULTANCY AND ENGINEERING SERVICES*

The success of modern industry depends to a large extent on the competence and experience of the consultancy and design organisations which are employed to prepare the detailed feasibility reports, supervise the construction and execute the projects. The cost of design and engineering is sometimes indicated separately in the overall project costs; very often this is a covert item included in the price of the plant and equipment—specially in the case of turn-key jobs executed by foreigners; it is for this reason that it is not always possible to assess or calculate even roughly the charges for design and engineering services being paid to the foreigners. A recommendations has earlier been made that in all collaboration agreements and imports of machinery and equipment, consultancy and engineering charges should be separately shown.

6.2. The consultancy charges vary widely according to the size and complexity of the plants, experience of the consultants, the area of specialisation involved, pattern of guarantees and liabilities required by clients, stipulations regarding period of completion, total cost of the project and the responsibilities given to the consultants. Moreover, if the technology has been recently evolved, particularly, in a fast developing field, consultancy is likely to cost more. According to the "Guide for encouragement of engineering services" issued by the American Society of Civil Engineers, for projects of 'above average' complexity, the charges may vary from about 14 per cent for a project costing U.S. $ 30,000 (Rs. 2.2 lakhs) to about 5.5 per cent for a project costing U.S. $ 100 million (Rs. 75 crores). In the case of projects of average complexity, the consultancy charges may vary from about 4 per cent to 10 per cent.

6.3. In India, charges and conditions for engagement of consultants have yet to be standardised. Some of the items which formed basis for contracts in the past and the charges levied

thereon, on the cases of power project, petroleum refineries and fertilisers are given below to serve as only typical cases: —

Power projects	*Percentage of project cost*
Feasibility/project report etc.	1.5 to 3.0
Equipment procurement	1.0 to 1.5
Engg. and detailed design	1.5 to 2.0
Supervision of construction and erection of equipment.	1.25 to 1.75
Commissioning	0.5
Initial operation and preparation of operating instructions	0.5 to 0.75
Petroleum Refineries	
Feasibility report	0.3 to 0.5
Process know-how	1.0 to 2.0
Process Design	1.0 to 3.0
Detailed Engineering	6.0 to 8.0
Procurement services	2.0 to 3.0
Fertilizer and Chemical Plants	
Process Engineering	6.0 to 8.0
Detailed Engineering	10.0 to 16.0

(The above percentages are applicable to individual items of work. When complete work including all the items is entrusted to a single consultant, the percetanges may be lower).

6.4. Although the consultancy charges are bound to vary with the types of projects, specialisation involved and other conditions and it would not be possible to draw up a common format of scales of fees, for the various types of jobs involved, it would be reasonable to place the consultancy and detailed design engineering costs at about 10 per cent of the project

costs. According to the views expressed by the different consultancy organisations, project owners, contractors and design engineers, the charges may vary from about 5 per cent to 15 per cent in the case of different projects; an average of 10% for the Indian conditions may not be off the mark. The consultancy and engineering charges would, therefore, be of a substantial magnitude considering the investments during the Fourth Plan period. The Fourth Plan investments in the various sectors where consultancy and engineering services would generally be needed are placed at about Rs. 14,000 crores as per details given below: —

	Sector	*Outlay* Rs. crores
1.	Power	2523
2.	Irrigation & Flood Control	1073
3.	Railways	1050
4.	Transport and Communications other than Railways	3067
5.	Water Supply	404
6.	Housing Construction	2410
7.	Small Industry	5555
8.	Continuing Public Sector Projects	1677
9.	Organised Industry and Mining other than continuing projects.	1166
	TOTAL	18925

Many of the above investments may not require the services of outside professional engineers and consultancy organisations. Firstly, these may relate to departments/organisations which possess resources to do this work through their own expertise having past experience or through their in-built professional organisations, such as, railways, road transport, power, irrigation, Fertilizer Corporation of India, Hindustan Steel, Post and

Telegraph etc. Secondly there are many continuing projects for which consultancy arrangements would already have been made and existing projects undertaking expansions may not need the services of outside professional engineers/consultancy organisations. Thirdly, there would be projects which need very sophisticated and new processes of manufacture for which know-how and engineering are not available in India and the same will have to be imported. In spite of these exceptions, there would still be substantial number of projects which will require outside consultancy services of varied types which can be offered by the indigenous Consultancy Organisations. The Committee, therefore, feels that with the increase in investments in the respective Plans and Developments of indigenous know-how, the demand for Indian Consultants will increase in the years to come.

6.5. During the discussions which the Committee held with the representatives of consultancy organisations, it was brought out that within reasonable time, they had been able to recruit highly experienced and skilled personnel from within the country and abroad and that a very large number of Indians who were still working abroad in responsible positions, could be attracted back to the country if there was adequate demand for their services. It was pointed out to the Committee that the migration of trained personnel from India and the difficulty of inducing highly skilled and technical personnel working abroad to come back hinged more on job satisfaction than on comparable emoluments. Such highly qualified technical personnel did not appear to be keen to return and work for projects set up with foreign credits, foreign technical know-how, imported equipment, erected and commissioned by foreign personnel and run by them in the initial years. In this set up, Indian personnel did not have sufficient scope for initiative and did not derive satisfaction out of subordinate jobs. In the Committee's view, the technical consultancy organisations could provide the creative challenge which such technical personnel would more readily accept. At lower levels, the consultancy assignments could provide maximum employment to

inspection and testing where necessary. In special cases where the process know-how has been obtained from abroad for the first time, the help of a few foreign personnel for supervision would suffice.

(vi) *Start-up and performance guarantees*

Before actual production could commence, it is necessary to prepare manufacturing drawings, flow sheets, indicating in detail the actual process flow involved and establish the manner of material movement and inter-relationship of various departments.

In most cases, the start-up and performance tests are usually carried out either by the suppliers of the constituent units or by operating staff who have to take over and run the plants. Local consultants who may have taken part in plant design may be capable of supervising the start-up and help in achieving the performance guarantee. Wherever necessary, services of personnel from similar plants in operation or of foreign experts could be availed of.

(vii) *Product and Equipment Design*

There are considerable gaps in this respect in the case of a large number of industries. The economics of a seller's market and excessive dependence on foreign collaborators have mainly influenced plant managements in avoiding effort and expenditure in this regard. For these reasons, one sees today the unhappy situation of idle production capacity on the one hand and continuing imports of machinery and equipment which could otherwise be produced indigenously, if designs were available. While this is not essentially a part of normal consultancy engineering activity, the Committee would urge upon Indian Consultants to lend a helping hand in setting right the imbalance between product design and production capacities. No doubt, the main effort in this regard must come from the Plant manufacturers themselves, the Committee cannot help but remark here that the large organisations—including those in the public sector—have had much to contribute to this rather sorry

state of affairs. They would do well, both in their own interests as well as from a national point of view, if the large design offices created along with such plants were used more fully for product design and development. This would simultaneously call for a reduction in their pre-occupation with project design work, which is essentially the function of consulting Engineers.

Gaps in specific fields:

6.7. In addition to consideration of gaps in respect of functions as discussed in the preceding paragraphs, it is necessary to analyse the gaps in regard to specific industries. During the course of its deliberations, the Committee decided to limit its investigations to the following industries: —

(i) Power

(ii) Communications

(iii) Railways

(iv) Development of Ports

(v) Iron and Steel

(vi) Aluminium

(vii) Other non-ferrous metals, particularly copper

(viii) Mining and material handling

(ix) Fertilizers

(x) Petroleum refining

(xi) Heavy inorganic chemicals, such as, caustic soda, soda ash, sulphuric acid

(xii) Sugar

(xiii) Cement

(xiv) Paper

6.8. Based on a Report prepared by the NIDC at the end of 1965, a Study Group comprising representatives of DGTD, NIDC and the erstwhile Ministry of Industry made a detailed

examination of industries in which foreign technical assistance was no longer considered necessary. Though not fully exhaustive, this Study did cover a fairly wide spectrum based on an industry-wise analysis.

6.9. The Committee reviewed the work of this Study Group and based on their observations generally agreed with the recommendations that, as a first step, use of foreign consultancy services with regard to the listed industries (Appendix II) need not be allowed and further, the Government may periodically review the list in order to keep it up-to-date. It was also noted that where foreign collaboration had run out for the period that was originally agreed upon, the units invariably came up for renewal of agreements generally on the plea of expansion and taking up the production of a new model or product, and such extensions were normally given. This created a psychology in which the manufacturing units generally neglected their own efforts towards improved product design and process know-how. The Committee would strongly urge that extensions of collaboration agreements should be the exception rather than the rule.

Power

6.10. *Hydro-stations*:—The Central Water and Power Commission and State Electricity Boards are well equipped to carry out all the work including the functions covered by the consultancy services with regard to the hydro-generating sets. So far as design engineering for the turbines, generators and other auxiliaries is concerned, manufacturing facilities have been set up with the Heavy Electricals units at Bhopal and Hardwar in technical collaboration with the U.K. and U.S.S.R. respectively. Heavy Electricals units for the time being are dependent upon their collaborators for securing design engineering for the equipment. Their design organisations will have to be built up in order to take up progressively such design work within the country.

6.11. *Thermal Stations.*—Of the five firms established with foreign collaborations for thermal power station designing, two are now fairly well established in the country and have already

been given several important assignments. Although initially, they demanded a substantial portion of their fees in foreign exchange, this demand has steadily decreased; and the bulk of their work is now carried out within the country.

The Committee felt that the existing consultancy organisations in this field within the country would be adequate to take up the work load involved in the setting up of thermal power stations in future. Given adequate work load, they have flexibility enough for expanding themselves and will not constitute a bottleneck in the implementation of the power programme.

The Committee would suggest that the CW&PC, for the time being, could give greater attention among other things, to the following: —

(a) Studies of fuel and resources characteristics;

(b) Studies of cooling water, transport and transmission lines facilities;

(c) Studies of meteorological and ground conditions at site;

(d) Pattern of future operation, basic single line mechanical and electrical diagrams;

(e) Keeping in view available range of equipment in the country, phased development and ultimate capacity of different power projects;

(f) Determination of the unit rating, steam parameters, heat balance and economic vacuum;

(g) Number of boilers per unit, rating of boilers, method of firing and fixing of design fuel determination of boiler auxiliary rating; and

(h) Developing schemes for control; instrumentation and protection.

6.12. The Ministry of Irrigation and Power has set up in 1969 a new independent consultancy organisation known as

Water and Power Development Consultancy Services (India) Ltd. It is an important step in making India's expertise in the field of irrigation and power available to the States in India and other developing countries. The constituents of this Organisation are:

(a) Central Water and Power Commission

(b) Geological Survey of India

(c) India Meteorological Department

(d) The Survey of India

This organisation is to provide engineering and related technical consultancy services for development of water resources, irrigation and drainage, electrical power, flood control and water supply projects, and procurement, installation, management of construction and related services for projects like dams, barrages, canals, hydro and thermal power stations and transmission and distribution systems. The organisation will also undertake aerial photography and pre-investment surveys such as, hydrological, meteorological, geological, material, soil, foundation investigations, and land classification.

6.13. The Government of India has set up the Research and Development Organisation for Electrical Industry (RDOEI). RDOEI is required to undertake R&D in the electricals field and to standardize the equipment made by the Indian electrical industry. It also provides technical consultancy services for establishment of new ventures or extending/improving the existing enterprises. For the present, it can help the prospective manufacturers of the following:

1. Power, Distribution and Instrument Transformers.
2. Induction Motors—Squirrel Cake and Slip Ring.
3. The Electric Drive Systems (primarily engineering and development of new circuits).
4. Switches, Isolators, Control/Relay Panels, Control Desks, Alarm Systems and Visual Indications in Electric Circuits.

RDOEI renders the following consultancy and engineering services: —

1. Preparation of Project Reports covering the plans and programmes of manufacture, requirements of building equipment and raw materials, requirement of funds and the operational data of the factory all of which help the prospective clients to assess the viability of the proposed projects.

2. Plans of the factory and the layout of the different departments and their plant and equipment which will enable the company's architects and engineers to prepare estimates and the detailed drawings for the construction of the factory.

3. Schemes for the internal services of the factory, such as, power, lighting, heating, air-conditioning and other similar items which are required for the manufacture of electrical equipments.

4. Specifications of the plant, machinery and equipment and materials which are required for the factory, in such details as will enable the company to invite quotations.

5. Provides: —

   (a) Design data, manufacturing drawings, drawings of jigs and fixtures and testing procedures for electrical equipments.

   (b) Details of the manufacturing process.

   (c) Specifications of the raw materials required, their quantitative estimates and approximate costs.

   (d) The likely sources of supply will also be indicated. The above shall be provided with such details that will enable the company to manufacture the electrical equipments.

6. Advises and assists in the preparation of the factory paper work system, technical literature and commercial quotations.

7. Advises and assists in establishing a design engineering department in the factory, which will handle as soon as possible all variations form and application of standardised equipments.

8. Advises in posting of experts.

Tele-communications

6.14. P&T Development of the Government of India provides inland tele-communication services to the public. It also provides certain tele-communication facilities to other organisations like Defence, Railways etc. The Tele-communication Research Centre undertakes design of Tele-communication equipment and systems required by the P&T. The designs are released to Indian Telephone Industries for indigenous manufacture. All the designs evolved by the TRC during the last 15 years of its existence are without any foreign collaboration for know-how.

The Department procures the equipment mainly from Indian Telephone Industries, Hindustan Cables, Hindustan Teleprinters, Departmental Tele-Communication factories and from the general trade wherever such items are available. P&T resorts to import of equipment only when the same is not available indigenously or when indigenous production capacity is not adequate to meet the requirements.

Against this background, the information regarding technical know-how and consultancy services is briefly indicated below: —

Planning and detailed engineering of Projects

All the projects are planned and engineered by the P&T for which there is adequate know-how and technical compe-

tence. This is done by the Planning Wing of the P&T Directorate or by the Circles depending on the type and size of the project.

Installation and Testing

P&T has adequate know-how and a well-established organisation to carry out this work.

Telephone Equipment

Indian Telephone Industries Ltd., has been producing the entire range of electronic transmission equipment for the P&T, Defence, Railways, Electricity Boards, etc. No foreign collaboration was arranged in this field. In respect of equipment required by the P&T, ranging from 3/12 channel carrier equipment for open wire lines to 1380 channel co-axial equipment and microwave equipment, development has been in collaboration with the Tele-communication Research Centre at Delhi, while for specialised equipment for the Defence, Railways and other users, design and development have been carried out by the Research & Development Department of this project. Currently, the design and development of electronic exchanges, pulse code modulator equipment, error correcting equipment for the Defence is in progress. No consultancy service in respect of transmission equipment has hitherto been required by this organisation which has developed its own Research & Development Department which is able to design and develop electronic transmission equipment to the performance standards of the advanced countries of the world. The production of switching and Strowger equipment is through foreign collaboration. The Research & Development Department in this project does not, however, possess know-how for the manufacture of various electronic components which still continue to be imported. The know-how for these items will be required to be obtained by those who are granted licences for their manufacture. Consultancy service for items such as, permalloy laminations, mylar capacitors, integrated circuits (digital and linear) and of

advanced construction practices for achieving higher productivity and cost reduction, will be necessary.

Railways

6.15. The Railway Board has a Research Design and Standards Organisation (RDSO) which is one of the oldest consultancy and design institutions in India. The RDSO has expanded according to the needs and it is now a well-equipped and well-knit organisation undertaking consultancy services, import substitution, technical liaison and inspection services, engineering services, research, preparation of designs and standards. It covers now almost all the important lines of work related to the laying down of the tracks, signalling, tele-communications and controlling systems and operation of the railways. It has been conducting studies on impact of high speed on bridges under different hydrological conditions, formation engineering, improvements in speeds, and track tolerances for different categories of engines, and metallurgical and chemical products. Assistance is also rendered for preparation of designs and standards for architectural projects and structures tracks, carriages, different types of locomotives, electrical systems and fittings, signalling and tele-communications, traction, installation, wagons, different types of parts, components, fittings and replacements. The RDSO is of late not only working for India but it is rendering valuable advice regarding exports of railway wagons and other equipment to other countries and for railway installations in some of the under-developed countries.

Ports

6.16. The Development Adviser and the Technical staff under him in the Ministry of Shipping and Transport, look after the working and development of ports in India. The Development Adviser is currently supervising the development of Kandla, Marmugao, Paradeep, Mangalore, Tuticorin and other ports. The country has no doubt made good progress in this field but is not self-sufficient. In the case of bigger ports and special problems, foreign consultants and engineers are employed.

A few examples are given below along with cases where Indian Consultants are also employed:

(a) M/s. Rendel, Palmer & Tritton, London, are the Standing Consulting Engineers for the *Calcutta* Port Commisioners. They were engaged specially for the preparation of a Master Plan and a project report for the development of a satellite port at Haldia. M/s. Rendel, Palmer and Tritton will continue to function as the special Consultants to the Port Commissioners till the Haldia Project is complete.

(b) M/s. Bertlin & Partners are functioning as the Standing Consultants for the *Bombay* Port Trust since March, 1960. They are being paid a fixed retainer fee for the agency work they carry out on behalf of the Trust and also for general technical advice and services. This arrangement does not cover any special Consultancy service for major projects. M/s. Bertlin & Partners have also been engaged as Special Consultants on the basis of a specific agreement for the Dock Expansion and Ballard Pier Extension schemes and for the preparation of a Master Plan for the future development of Bombay Port which are covered by a loan from the International Development Association, an affiliate of the World Bank.

(c) M/s. Rendel, Palmer & Tritton, London are the Standing Consultants to the *Madras* Port. They are at present doing the work of inspection of plant and equipment ordered in U.K. M/s. Howe (India) Private Ltd., an Indian firm, has been engaged as the general Consultants of the Port for one year. M/s. Howe (India) Private Ltd., have also been engaged as special Consultants for the Madras Iron Ore Handling Project.

(d) M/s. Engineers India Ltd., were engaged as Consultants for investigating the question of providing facilities for handling deep-drafted oil tankers at *Cochin*. They will continue as the Consultants to the Port until the Oil Dock Project is completed. As regards projects other than Oil Dock, the Port authorities are depending on their own technical know-how and seek the advice of the Development Adviser in the Ministry

of Shipping & Transport for advice on problems beyond their competence.

(e) M/s. Howe (India) Private Ltd. have been engaged as special Consultants for the Visakhapatnam Outer Harbour Project.

Iron & Steel Plants

6.17. The country has more or less gained self-sufficiency in the planning and setting up of steel plants. The main gap that existed related to the detailed designing and development of shop drawings of individual equipments. These fields can now be covered by the indigenous know-how. There are some organisations with experience in this line, such as, the C.E.D.B. of Hindustan Steel Limited and M/s. Dastur & Co. There are also agencies like M/s. Kuljian Corporation, Simon Carves, Lurgi etc. who have specialised experience in different sections, of an integrated plant. For the actual construction and erection, Indian contractors and construction organisations of the steel plants have themselves acquired considerable experience. Manufacture proper consists of preparation of shop drawings, planning and manufacture of equipment. Facilities are now available for manufacture of equipment provided the equipment manufacturers get the necessary detailed engineering on the basis of which equipment can be developed.

6.18. It is in the matter of detailed design and engineering for the main equipment that some foreign assistance might be required. In order to make full use of indigenous manufacturing capacity and to achieve the objective of self-reliance, it is necessary to develop fully these abilities as speedily as possible. It would be necessary for the heavy engineering firms and other allied organisations to enter into licence agreements in selected fields. The Heavy Engineering Corporation has entered into such collaborations with regard to the manufacture of blast furnaces, coke ovens and continuous casting plants. Similar collaboration agreements for L.D. converters would be necessary. C.E.D.B. has also entered into collaboration for design

of rolling mill equipment with M/s. United Engineering of U.S.A. The Heavy Engineering Corporation had put forward a proposal for the setting up of a separate project design institute for steel plants in India, on lines similar to Gipromex in the U.S.S.R. At several meetings of the Committee, views were expressed in favour of creating such an Institute which would, among other things, combine all the functions including those of consultants and design engineers for the setting up of steel plants.

6.19. The consultancy organisations, including the C.E.D.B., held the view that it was not for them to undertake detailed designing and engineering of individual equipments for the purpose of developing shop (fabrication) drawings of equipment required in a steel plant. The consultants having intimate knowledge of the details of different designs, only select the major equipment and approve the major drawings prepared by the suppliers.

6.20. As regards the question of the development of ability to prepare engineering designs and detailed drawings, the C.E.D.B. held the view that for standard items of plant and equipment, where there are already specialised equipment manufacturers in the country, it was not necessary for the steel plant designers to develop similar capacity for designs. It was in the field of metallurgical plants and equipments, such as, coke ovens, blast furnaces, steel melting and rolling mills that the capacity for designs had not still developed fully in any organisation in the country. It is mainly in this field, therefore, that necessary steps should be taken to fill the gaps for achieving self-reliance.

6.21. As regards the proposal of the H.E.C. for setting up an Institute in India on the lines of Gipromex Design Institute of U.S.S.R., it might be pointed out that the Gipromex came into effective functioning over a long period of nearly two decades. This Institute in U.S.S.R. was more or less a development parallel to the practice in the West where the specific manufacturers of equipment were also specialising in

the design of the equipment manufactured by them. The setting up of such an Institute in India would involve considerable time, effort and money. It would also entail a variety of other problems such as, coordination with other Institutes, limited availability of talent, etc. The growth of the steel industry could not, however, be allowed to slow down or to wait till such a Design Institute in India grows in maturity.

6.22. The Committee could not also agree with the suggestion that only a design institute could select the equipment and demand modifications in the context of only one major producer of specialised metallurgical equipment in the country and the accepted need of standardising of a few sizes and parameters of the main equipment from the production point of view. Selection of equipment in these circumstances is rendered much simpler and easier if it were done by consultants. Similarly, close touch with overseas practices and use of more sophisticated and improved steel products can bring to bear a constant pressure on the manufacturing unit to correspondingly improve on its equipment through technical collaboration with specialised manufacturers abroad. The setting up of a separate Institute is likely to disrupt the existing consultancy organisations and the design and engineering firms which have already developed and which have acquired good reputation for their work. Such an Institute will hardly be of any practical value for the short-term development of the steel industry in the country. A better course would be to strengthen the C.E.D.B. so that it could undertake work in fields in which India is still not self-reliant. This conclusion was corroborated by the Russian Team of Experts headed by the Director of Gipromex who undertook a study to identify gaps in consultancy and design engineering of equipment required for the setting up of new steel plants in India. Accordingly, an agreement has already been reached with the U.S.S.R. for strengthening the work of the C.E.D.B.

6.23. The Committee carefully considered these aspects and came to the conclusion that the best course would be for the

major equipment manufacturers to enter into licence agreements in selected fields with proper agencies in developed countries. The existing consultants should perform the normal consultancy functions and, at the same time, supply the design drawings of the plant to their clients mainly on the basis of suppliers' equipment. The best manner in which the deficiency can be made up would be:—

(a) Through quite liberal arrangements for taking up process know-how from abroad;

(b) The existing heavy engineering firms or consultants should enter into technical collaboration with their counterpart specialised manufacturing units abroad to obtain their research and development and designs for specialised and sophisticated equipment;

(c) The strengthening of the heavy engineering units particularly units like the H.E.C. by having design cells attached to them for designing specialised equipment for steel plants; and

(d) Strengthening of C.E.D.B. which could in the course of time, undertake work on lines in which India is still not self-reliant.

Aluminium

6.24. As in the case of steel, the setting up of an integrated aluminium plant involves planning, detailed plant design and engineering including working drawings, equipment design and manufacture construction and installation.

6.25. With several large aluminium plants already operating in the country, there should be no dearth of talent in respect of process know-how. However, facilities for pilot plant testing and for upscaling from such tests are still lacking. Such development facilities are essential to examine the bauxite characteristics, digestion of bauxite, setting of redmud composition of anode paste, electrolytic cell proportions etc. The Committee

is satisfied that once such facilities are made available, there would be little need for external dependence in regard to this industry.

6.26. The National Industrial Development Corporation are already involved in an extensive and intensive way with the engineering of the Korba Aluminium Plant. NIDC have already been appointed as the consultants for the Koyna Aluminium project also. Already their association with the Korba Plant design work has resulted in very substantial reduction in the foreign exchange needs of the plant. They have been instrumental in getting the foreign collaboraters to accept indigenously produced equipment of a very large and complex variety, which would otherwise, perhaps not have been possible. With this experience, the NIDC have emerged as a fully equipped consultancy organisation in this field.

6.27. The Government had appointed a Panel of Experts from the industry, concerned Ministries and the NIDC to report on how to develop facilities for process know-how etc., in regard to this industry. The Committee understand that the Panel has come to the conclusion that an Organisation in the nature of Aluminium Research Institute needs to be developed for this purpose commencing with the existing facilities in the National Metallurgical Laboratory as the nucleus. The Report of the Panel is under consideration of the Department of Mines and Metals. The Committee would urge that steps be taken early to fill this gap which would ensure near self-sufficiency in the field of aluminium.

Coal Mining

6.28. It was reported to the Committee that at present there is no single indigenous organisation which can completely cover the technical consultancy services for the coal mining projects. Organisations like NCDC, Sofre Mines (India) Ltd., and Civil and Mining Engineering Consultants could, however, undertake the bulk of the consultancy work, although for very deep mines they may have to draw on foreign assistance

to some extent. In addition, there are a few other organisations which have developed sufficient design competency in selected fields, such as:

(a) Garden Reach Workshop Limited; design and manufacture of pontoon mounted suction type sand dredgers and associated equipment;

(b) Mining and Allied Machinery Corporation for the whole range of mining equipment including cutters, loaders, shunters, props, shaft sinking equipment including winders and haulages, conveyer belt equipment for coal handling etc.;

(c) Heavy Engineering Corporation and some other units in the private sector for jaw crushers, rotary crushers and drum crushers etc.;

(d) Heatly & Gresham Ltd., Calcutta, for design and manufacture of venture type pontoon mounted sand dredgers. At present, their equipment is suited for medium capacity mines; but the design can also be developed for large mining projects.

6.29. The Planning and Development Division of the NCDC has already built up a nucleus of design sections comprising electrical, mechanical, civil, structural and water supply engineers. The NCDC geological and drilling section is fully capable of proving and interpretation of the geology of the coal deposits. They are also capable of preparing feasibility reports for open cast and shallow underground mines. Even for deep mines, where they have been depending on foreign assistance, sufficient know-how and experience has been built up so that for future mines, feasibility and project reports can be prepared by them. Only occasionally, would it be necessary for them to secure the services of foreign experts.

6.30. The Planning Section of NCDC is also capable of preparing detailed engineering drawings, including construction drawings, coal face mechanisation, underground and surface

transport, coal handling equipment, railway sidings, open cast mining, power plants, water supply, electrification etc. With regard to some other aspects like ventilation, specialised coal face mechanisation, automation, hydraulic stowing, shaft sinking and winding, and fast tunnel driving, the Planning and Development section may have to be further strengthened, if necessary, through procuring the services of foreign experts; however, it should be possible for them to become self-reliant even in this respect in a short time.

6.31. The Committee was of the view that with closer liaison with the Mining and Allied Machinery Corporation, Durgapur, detailed project reports can be drawn up entirely around indigenous equipment. In fact, some of the deficiencies of the design and development cell of the NCDC can well be supplemented and covered by greater association with MAMC, Durgapur.

6.32. Having regard to these factors, the Committee felt that consultancy services required in the field of coal mining can be fully covered by the Planning and Development Cell of the NCDC, Sofre Mines (India) Ltd., and Civil and Mining Engineering Consultants Ltd., with the following assistance:

(a) they have to be supplemented in the design engineering field by indigenous manufactures of mining equipment particularly MAMC; and

(b) in specialised fields, such as, new ventilation standards, hydraulic and pneumatic stowing, introduction of new coal faced mechanisation and support, development of very deep mines, etc., they may require the service of foreign experts which should be allowed for a few years, where necessary, till expertise in these fields is built up. The foreign experts should not be connected, however, with suppliers of equipment.

6.33. Although the Central Mining Research Station (CMRS) is undertaking problems regarding ventilation, roof control etc., it will be necessary to take up detailed research on

these subjects to improve the working and efficiency of coal mines. It will be useful if a detailed study is undertaken regarding the suitability of available designs and proto-types and thereafter proper equipment is manufactured for this coal-mining industry.

6.34. Adequate facilities exist with the Central Fuel Research Institute which can furnish necessary data on the characteristics of the coal to be washed and the type of equipment to be used. The necessary parameters for coal washeries can be fixed by them.

6.35. The important units which are licensed to manufacture and supply complete coal washery equipment are MAMC, Durgapur and McNally Bird, Calcutta. MAMC has finalised its collaboration agreement with Poland for setting up an organisation for the design, fabrication and supply of washery equipment; likewise McNally Bird have also similar arrangement.

6.36. A main gap in the equipment till now has been the D.S.M. cyclone, an essential and vital part of the washery Plant. MAMC has secured the necessary collaboration agreement for the manufacture of this item. McNally Bird is also stated to be in a position to manufacture equipment cyclones of comparable performance.

Mining—Other than Coal

6.37. *Geology and exploration*:—While expertise and facilities exist in the country for ground geo-physical and geo-chemical surveys, mapping, surface and underground drilling, exploratory mining and ore appraisal, neither the National Mineral Development Corporation nor Geological Survey of India are at the moment equipped to carry out air-borne geo-physical surveys. Such work has been taken up through contracts placed with competent firms abroad. It would be desirable to build up technical competency to carry out such studies on our own in future. For this purpose, officials of the NMDC should be actively associated with this work so that they could familiarise themselves with the technique.

6.38. Comprehensive geological investigations and appraisals of copper, lead, zinc and iron ore deposits and development of large mines can now be carried out by GSI or NMDC. Allied with this work is the question of efficient and speedy surface and underground core drilling. This work can be carried out by Indian organisations which have the necessary technique and expertise. The requisite equipment is also available in the country. Know-how and consultancy are available indigenously on off-shore under-water drilling and oceanography also. It may, however, be useful if, in specific cases, services of expert drilling contractors from abroad are utilised, who could help in setting up standards in ore drilling as also in building up supporting organisations which can sustain a high rate of drilling and core recovery. The NMDC and GSI should obviously work in collaboration with such contractors.

Mining

6.39. A fair amount of expertise has been built up by the NMDC in regard to preparation of feasibility studies, choice of mining systems, mines layout development and operational know-how. NIDC have been appointed as the prime consultants for Bailadilla Iron Ore Project Deposit No. 5 and have undertaken complete detailed design and engineering for iron ore dressing, handling and transport. Recently, Mining and Allied Machinery Corporation, Heavy Engineering Corporation, McNally Bird and Dorr Oliver have developed design capacity for specific items of plant and machinery for such projects. Chemical and Metallurgical Design Company (CMDC) has been providing know-how and consultancy in hydro-metallurgical operations. It should, therefore, be possible for the NMDC, in consultation with manufacturing units for equipment and NIDC for detailed engineering to undertake such work fully in the future. It may be necessary in a few cases to obtain specialist advice from abroad.

6.40. So far as open cast mining of the metalliferous type is concerned, there has been built up adequate technical know-how and experience in the country particularly in the NMDC

to enable complete mine planning to be done. This would include preparation of the detailed project report, assessment of the equipment required and estimates for the same. In some cases, outside help for detailed engineering is still necessary.

6.41. With regard to the high speed shaft sinking and tunnelling, rapid progress is understood to have been made in different parts of the world. In India, very deep shafts exist but what has been lacking so far is speed in execution of the job. In view of the necessity for speeding up mineral development in the country, it would be worthwhile to induct up-to-date shaft sinking and tunnelling techniques from abroad. Assistance in this respect may, therefore, be specifically limited to the technique. Our engineers could be specially sent for training abroad.

6.42. *Beneficiation.*—Necessary expertise in respect of process design and feasibility study preparation already exists in the country with organisations, such as, NMDC, NML, M. N. Dastur & Co., Lurgi (India), Dorr Oliver etc. As regards the processing of iron ore for crushing, scruning, sizing, beneficiation by simple washing, so far there has not been adequate experience and it has been necessary to engage foreign consultants for the same. NMDC have utilised the services of foreign consultants for the project concept, lay out etc. of its ore crushing, scruning, washing and loading plants at Bailadilla. The NMDC is, however, trying to take up this work on its own in future, but would still depend for detailed engineering on outside help.

With the process of simple mining, crushing, scruning, washing etc., a complicated beneficiation process for iron ore, particularly fines, gets involved. The know-how in the country for the beneficiation of iron ore fines by jigging or other methods is limited and in many cases it becomes necessary to seek the advice of foreign consultants. Facilities for beneficiation of fines etc., particularly for setting up large scale plants are limited and it is necessary to have large scale tests

outside the country on the basis of which our plants could be designed.

6.43. With regard to detailed engineering for the plant, although there was general lack of experience in the country so far, with the establishment of the manufacturing capacity (for copper and zinc in the public sector), some of the consultancy firms have a good record of work in this field and this gap can be progressively filled by them. It was also noted by the Committee that the NMDC has prepared the detailed project report and detailed engineering for the plant for Rakha which, in a similar way, could also be applied to other projects, such as Daribe and Agnigundala. In the discharge of this work, they can be substantially assisted and their functions can be supplemented by the fabricating units.

Metallurgy

6.44. The position in this regard is virtually the same as stated above except that process know-how is required in a few cases like flash smelting of copper concentrates or some hydro-metallurgical techniques. Where such processes are to be used, patents can be obtained instead of taking them on the basis of tied credits and associated foreign consultancy which does not often permit the repetitive use and accumulation of knowledge.

6.45. In the field of procurement services and construction work, Indian know-how is sufficiently developed and use of consultants from abroad should not be necessary. Apart from the National Mineral Development Corporation, as a major operator in the field of mining, other organisations in the country are: National Coal Development Corporation (already covered under coal mining), Atomic Energy Commission, Pyrite and Chemicals Development Corporation and various State Mining Corporations. NMDC can render services, where necessary, to other organisations particularly for core drilling etc. Other consultancy organisations could also be given such work.

Fertilizers

6.46. Considerable progress has been achieved in the development of indigenous consulting engineering services relating to Fertilizer Plants since the days when the Sindri Unit of FCI was set up on a completely turn-key basis. Today, organisations, such as, the Planning and Development Division of the Fertilizer Corporation of India (FCI) and the FACT Engineering and Design Organisation (FEDO) of Fertilizers and Chemicals Travancore Ltd. (FACT) are capable of providing the complete consultancy services relating to the setting up of a new fertilizer plant. They have supplemented their own knowledge and experience by purchasing—on a licence basis—the know-how needed by them in specific areas. Thus, FCI has obtained the know-how licence for ammonia and urea from Montecatini Edison of Italy and FACT has obtained the know-how for the I.C.I. steam reforming process from the Power Gas Corporation of U.K. and the know-how for the Pravon Phospheric Acid Process and also for the Central Prayon Hemi Hyderate Phosphoric Acid Process.

6.47. The PEDO jointly with the P&D Division of the FCI can take up a new project almost every year, along with several smaller jobs. In the fertilisers field, therefore, the necessary capacity and working force are available in the country, except for providing the know-how for some of the vital processes. The practice now being followed is to buy only particular information regarding the process and do the entire supplementary engineering in the country. To avoid buying this process know-how, a great deal of research and pilot plant studies will have to be conducted to develop our own know-how. Technology is advancing very rapidly and it will be more advantageous to direct our efforts in developing more advanced technologies.

Petroleum Refining and Petro-chemical Industries

6.48. The technical consultancy services in this field include, process know-how, process design basis and detailed che-

mical and mechanical engineering. Fabrication of shop drawings is generally the responsibility of equipment fabricators, though it may be necessary for technical consultancy organisations to offer assistance in this area particularly in regard to special items.

6.49. Engineers India Ltd., a public sector consultancy organisation was set up about five years ago to provide the necessary consultancy services in this field. Since then, Engineers India Ltd. have rendered major consultancy services for two refineries and are engaged in performing consultancy work for another refinery and a petro-chemical plant. Other private consultancy organisations are also building up expertise in this field. In order that indigenous organisations could speedily build up the necessary expertise and capacity, the Committee was of the view that they should be engaged as prime consultants for all future refineries. Secondly, there should be an arrangement whereby they fully share the actual experience gained in the refineries and with problems covered by the Indian Institute of Petroleum, Dehradun.

6.50. *Process know-how.*—It would be desirable either for the IOC, Refinery Division, or indigenous Consultants to buy process know-how wherever required from abroad, as was done in the case of the fertiliser industry with regard to ammonia and urea process etc. It may be pointed out that there are several licensed processes in the petroleum refining field; e.g. catalytic cracking, hydrocracking, hydrotreating, alkylation, isomerisation and polymerisation. Licensed processes figure to an even greater extent in the area of petro-chemicals, *e.g.* for the manufacture of ascetaldehyde, acetylene, ethylene, acrylonitrile, aniline, chloromethane, cyclohexane, hexamine, urea, etc. and these have to be initially purchased preferably with no restriction for repetitive use.

6.51. *Process Design.*—Process designs are developed from process design basis supplied as part of the know-how. These would involve the preparation of process and utilities, flow sheets for the plant, piping and instrumentation diagrams, heat

and material balances, sizing major process equipment etc. Once the process know-how has been obtained, most of the process design work should be taken up by indigenous design engineers. They may, at times, have to secure the services of foreign experts which should be permitted to them in this highly specialized field.

6.52. *Detailed Engineering.*—Process designs are employed for performing detailed engineering for the plant. This work can readily be executed on the same lines as mentioned above. However, special assistance from abroad may be required in the following areas: —

(a) Design of thermally rated heat-exchangers;

(b) Design of distillation trays and columns; and

(c) Refinery heaters and furnaces.

Such designs are available for purchase from established engineering design organisations.

6.53. *Shop drawings.*—These drawings are prepared from detailed mechanical designs supplied by technical consultancy organisations for manufacture or fabrication of the necessary equipment. Although normally such drawings are prepared by the manufacturers themselves, in India assistance may have to be rendered by the Consultancy Organisations also due to inadequate drawing office facilities with some of the manufacturers.

6.54. With regard to the other services, such as, procurement services, construction, commissioning etc., these can be carried out by Indian consultancy organisations.

6.55. *Existing Facilities and Gaps.*—In the field of Petrochemicals, very little progress has been made to build up the necessary facilities for process design development in India. This is a serious matter and needs urgent attention of Government. Government may consider the question of incentives to those who develop such facilities on desired lines.

Other Industries

6.56. With respect to the remaining industries mentioned under para 6.7, namely, heavy inorganic chemicals, sugar, cement and paper, the consultancy services available in the country were, more or less, adequate. To a limited extent, process know-how might be required to be obtained from abroad. Such know-how can be secured either by the consultancy organisations or by the entrepreneurs on a non-exclusive basis. The Committee, therefore did not consider it necessary to go into these industries in further detail.

General

6.57. The Committee tried to identify areas where India had gained self-sufficiency and where imports of process know-how, shop designs, detailed engineering and consultancy services where necessary on the basis of data furnished by the different projects, consultancy organisations, design engineers, contractors and their Associations. This does not, however, purport to be a static situation. Fields in which presently there is self-sufficiency, may require import of process know-how and consultancy services in view of new technological developments having taken place in foreign countries. On the contrary, fields in which presently there is need for import, India may acquire self-sufficiency with the researches and technological developments being accomplished in the country.

6.58. The proposed All India Association/Institution of Consulting Engineers suggested earlier should compile annually authentic data regarding gaps in India in the consultancy/process design and other fields of engineering. Imports of know-how and consultancy services may be permitted in these fields. It will be useful if this information is widely published, so that the projects can easily know the fields where import may be necessary. A suggestion has been made that this should be included in the Red Book which lays down the import policy of the country.

6.59. It will be useful if on the basis of the Five Year Plans, the proposed Association/Institution of the Consulting Engineers prepares a programme for developing consultancy, process and design engineering services that would be needed for the projects and development programmes included in the Plan. This will gradually make the country self-sufficient in technical consultancy services and at the same time, avoid to a large extent unemployment amongst the consulting engineers.

6.60. In order to determine in details the services needed by each important and major industry developing in the country, a dialogue between the project owners/promoters, C.S.I.R., D.G.T.D., and other research organisations and the proposed Association(s)/Institution(s) of Engineers would be necessary. This would enable the industry to introduce and utilise to the maximum the services available in the country.

6.61. In order to streamline the working of engineering services, the proposed Association(s)/Institution(s) may attempt to prepare Model Schedule of Rates and Terms of Contract for consultancy, design and other engineering services. This would be only indicative, the actual terms, conditions and rates depending on the negotiations between the consultancy firms and the project owners.

VII *EXPORT OF CONSULTANCY SERVICES*

The development of consultancy and engineering services in this country is of recent origin. But within a short span of time, it has made rapid progress. The emphasis in the initial years of the growth of consultancy services was primarily related to the scope it provided for import substitution. The consultancy services were largely geared to meet the domestic needs both directly by way of replacing foreign technical consultants, and indirectly in terms of providing a larger proportion of capital equipment from within the country by undertaking designs suited to the local conditions. This reflected the first phase of development. Though we are by no means self-sufficient in all the technical services that we need, there is no denying the fact that in a variety of fields, capacities created and experience gained are such that the country is in a position to render these services, in a large measure, to meet the needs of international clients.

7.2. There is a close linkage between the direction and volume of our future exports and the export of consultancy services. If India is to achieve a break-through in the export of non-traditional items, it will be necessary to have, as a prerequisite, well organised consultancy services capable of undertaking jobs in other countries. The hope for the fulfilment of export targets in future will depend largely on our ability to export sophisticated products and capital equipment. The export of engineering goods, particularly, in the realm of capital goods and machinery are not achieved merely in terms of the price and competitiveness—though no doubt these are very important—but primarily on the basis of the allied services that go with them and the reputation of the technological competence a country is able to build for itself. It is in this field of setting the high standards on technical sophistication that the export of consultancy services has to play a vital role and along with it ensures a growing export trade not only in the

service that we provide but also in the manufactured goods that we are able to offer.

7.3. With the expertise and technical competence that has already developed, there is a wide field in which our country can provide consultancy services and turn-key contracts to other countries. In some of these fields, we have an advantage over the more developed countries in competing in our neighbouring countries, such as, West Asia, South-East Asia and Africa on account of similarities of the local conditions. The technologies that we can provide would be better suited to these countries than the more advanced ones from the developed nations. Some of the fields in which we seem to possess this advantage are in building up the infra-structural facilities, namely, roads, bridges, high-ways, inland transport system, ports, harbours, water resources, water supply and drainage, irrigation and reclamation, civil engineering works, buildings, sheds and other architectural services, rail transport system, power generation, transmission and distribution and tele-communications. Development of these facilities in any country is a 'must' before undertaking development of modern agriculture or industries. India has long years of experience in building up such facilities under widely differing conditions of topography, soils and climate. This experience will be valuable to any developing country. An added advantage is that India manufactures all the equipment needed for the construction of the above infra-structural facilities and is in a position to offer turn-key projects with guarantee of performance. India has made notable progress in reaching self-sufficiency in rail transport. The Railway Research and Design Centre is one of the oldest professional cells in India. India manufactures railway lines, structures needed for bridges, signalling equipment, railway wagons and bogies, locomotives of all types. India can, therefore, undertake services for rail transport, lay railway lines, instal latest signalling apparatus, supply locomotives and rolling stock. It can construct railway systems based on the utilisation of coal, diesel or electricity as may be necessary to suit local conditions.

7.4. Development of irrigation system is the first step in giving fillip to agriculture. India has constructed large dams, irrigation canals, a network of tubewells and tanks and adopted multifarious types of major and minor irrigation works. This experience can be useful to any developing country for harnessing its agricultural resources. Indian consultants are today in a position to undertake full responsibility for establishing power generation, distribution and transmission projects, whether hydel or thermal, starting from the pre-feasibility reports to actual operation and working of the projects. India also manufactures the equipment and machinery needed for the power projects and it can offer full projects to the developing countries. The field of tele-communications and telephone equipment is well developed and these services can as well be offered to other countries. India can, therefore, offer consultancy services and equipment and undertake contracts for building infra-structural facilities in other countries.

7.5. Development of consumer industries is another step in the industrialisation programme of any developing country. India now possesses vast capabilities in this field and can cover all major items like textiles, sugar, cement, paper, oil, food products, soap, cosmetics, leather, wool, beverages, drinks, alcoholic preparations and similar products. For this sector too, all types of equipment and machinery are manufactured indigenously and India can offer complete projects. An added advantage is that India has passed through various stages in the development of these industries and Indian engineers can set up projects with varying capacities based on the local demand for the products thus avoiding wastage of capital and resources.

7.6. India has gained proficiency in the construction and operation of many types of mechanical and chemical industries like re-rolling mills, foundries, machine-shops, cycles, water mains and fittings, refrigeration equipment, caustic soda, soda ash, oil refineries, petro-chemical complexes, fertilisers, sulphuric acid, and drugs and pharmaceuticals. Many developing countries, particularly in West Asia, possess extensive resources for

the development of such industries and services of Indian engineer can be of immense value to these countries.

7.7. In the metallurgical industries, India has gained experience of setting up iron and steel mills, aluminium plants and of manufacturing other ferrous and non-ferrous metals and their alloys. In mining also, enough Indian expertise has developed and has covered wide fields like coal, iron ore, manganese, lime-stone, and many other items. India has thus developed enough know-how necessary for other developing countries in a variety of fields. However, for some specific projects requiring more sophisticated technologies and equipment, recourse can be taken to joint ventures with other developed countries.

7.8. Another important field for offering consultancy services to developing countries is the development of sophisticated and well-equipped small scale industries. Most of the developing countries suffer from limited indigenous demand for their manufactures and they cannot for this reason establish big projects. India has achieved enviable success in developing small scale industries, industrial estates etc. and this experience can be made available for establishing similar industrial complexes in other countries.

7.9. In exploring the field for exports of consultancy services, cognisence must be taken of the fact that India has to compete with the highly developed countries of the world which have, on the one hand, built up a goodwill and reputation and, on the other, have resources for offering financial and other inducements. In order to successfully compete under such conditions, the Indian services must be efficient, competitive and well-organised. The lower cost of engineering services in India compared to those in Europe and U.S., can go a long way in making Indian offers highly attractive.

7.10. In the competitive international market, the techniques of exports have become increasingly subtle and complex. The consultancy and contracting services in the country should

adjust themselves to meet these requirements and competition from the developed countries. The Committee feels that action on the following lines would be useful:—

(1) Following the thesis that the customer has often to be educated as to what he needs, many exporting countries have developed the technique of providing, free of cost, reports in the nature of preliminary feasibility studies. These reports then generally form the basis for developing new projects or programmes and, as such, a market for consultancy services and equipment. To the extent a particular country is able to enter initially with pre-investment surveys and pre-feasibility reports of this character, it gains an advantage in securing contracts for the establishment of such projects. It will be worthwhile for the Government of India to offer these services to the neighbouring countries and help them in the preparation of projects and programmes in which India can later on participate.

(2) Many developing countries have now embarked on National Plans which provide fair indications of the projects selected for execution during the Plan periods. An advance knowledge of such projects and of tenders and enquiries floated by the country for the execution of such projects can considerably assist our own consultancy organisations and equipment manufacturers to be ready with their bids to compete.

(3) The Government may organise collection of advance information about the projects being considered in different countries and consider publishing them in any monthly economic or export journal for the benefit of Indian consultancy and contracting organisations.

(4) In order to meet the demand of developing countries for package-deals, turn-key jobs with guarantees of performance, joint ventures or Consortia of consultants, process engineers and suppliers of equipment and sometimes with reputed firms/organisations in 'foreign'

countries become necessary. Measures may be taken to establish proper organisations for meeting these requirements.

(5) Indian consultancy, engineering and contracting firms should accept sub-contracts from international firms. India should maintain proper relationship with these international organisations which will on the one hand enable the country to bring its technology up-to-date and on the other, get opportunities for sub contracts for work in other developing countries.

(6) The proposed Association(s)/Institution(s) of consulting engineers should prepare a Directory giving the names of all consulting, design engineering and contracting firms in India and fields in which they can render services. This Directory should be circulated to all the Embassies so that they can suggest proper names to the foreign Governments as and when opportunities for consultancy and contracting work arise.

(7) The Indian consultancy, engineering and contracting firms should get their names registered with the international organisations like IDBRD, United Nations, UNIDO, FAO, WHO, ILO etc. so that their particulars are available to these organisations for consideration when they allot jobs.

(8) The developing countries are short of foreign exchange and suffer from lack of financial and other resources for the fulfilment of their development programmes. Many of these countries have, therefore, to tie their developmental programmes with the foreign aids. India may also have to extend credits in the interests of long-term exports from the country. Such credits will facilitate the export of technical services and industrial equipment.

(9) The proposed Association(s)/Institution(s) of the Consulting and Contracting Organisations may create a

foreign Projects Development Fund. Assistance from this Fund may be made available for undertaking studies in foreign countries and for establishing close contacts in the fields of consultancy and project engineering.

7.11. The export of consultancy and engineering services from India is to encourage 'invisible exports'. There appears to be immense scope for such exports and for exploiting this new field. It should, however, be remembered that for obtaining orders from a foreign country under conditions of international competition, the Indian engineers must keep their knowledge and know-how abreast of the time. They should have up-to-date information on the developments taking place in other countries and must be able to convince the parties of the relative merits of the designs and processes offered by them.

MAIN CONCLUSIONS AND RECOMMENDATIONS

Technical Services

1. The services rendered by technical consultants can be classified into (1) Project Planning, (2) Project Designing, (3) Project Implementation, and (4) Project Evaluation. The professional engineers undertaking technical services can be broadly categorised as (a) consulting engineers, (b) process engineers, and (c) contracting engineers.

2. *Consulting Engineers.*—Consulting engineers primarily undertake the planning and implementation of the projects. The process employed and the basic data for the process are generally obtained from the process engineers. Divergent views were expressed before the Committee regarding the definition of a consulting engineer. One view was that the consulting engineers should be 'independent' with no financial or commercial interests in manufacturing or contracting unit. The 'independent' consulting engineer could generally evaluate the comparative merits and select best of the available processes and equipment for his client. His judgement was not likely to get influenced so that the client stood to gain. Another view was that consulting engineers could be part of or 'associates' of equipment/product manufacturers, contractors or process suppliers. A consulting organisation 'associated' with a manufacturer could offer turn-key projects with guarantees of construction, time, costs, and performance and, therefore, was more appropriate to the present stage of our development.

3. *Process Engineers.*—These firms are sellers of the basic process and know-how and render an important service to the projects. They specialise in particular processes and cater, by and large, to the requirements of a section of a plant and have a complementary role. Their services can be obtained directly by the client or through the overall consultant, except in those rare cases where it is possible to engage the process

suppliers and plant designers wholly to the exclusion of the other groups.

4. *Contracting Engineers.*—They undertake the construction and erection of plants, based on the design and engineering done by the consulting/process engineers. It was suggested to the Committee that the role of contracting engineers should be recognised in view of their overall responsibility and the 'turn-key' project concept.

5. After taking into account the various views, the Committee has come to the following conclusions: —

(i) Consulting engineers may be grouped into two categories—(a) 'independent consultants' and (b) 'associated consultants'. Both types of consulting engineers have developed in India. They are helping in construction of indigenous projects, exports of consultancy services and turn-key projects. There appears to be need to disturb the existing pattern, although with the growth of a larger number of competing equipment and product manufacturers, the independent consulting engineers will grow and gain in importance.

(ii) The consulting engineers who form part of or are associated with any contracting organisation or manufacturer of product or equipment, should specify their status clearly so that the client knows their interests beforehand.

(iii) There is wide scope for the growth of process and equipment design organisations whose efforts are complementary to those of consulting engineers.

(iv) The manufacturers of equipment should strengthen their research and design cells and concentrate their efforts more on product design and development.

(v) The consulting as well as the contracting engineers are essential for setting up of projects and both should be given due recognition.

Regulation of the Profession

6. Engineering services have taken roots in this country during the last ten-fifteen years and time is now opportune to place them on sound footing. There was general agreement that in order to develop this profession on healthy lines and to avoid undesirable elements/practices, there should be an All-India Institution(s)/Association(s) on the lines of the Indian Institute of Chartered Accountants to lay down proper standards of education, experience, capability, capacity etc. There could be one All-India Institution/Association to represent both the 'independent' and 'associated' consultants; or else, there might be two such institutions/associations to represent the two types of consultants separately.

7. The proposed Institution(s)/Association(s) should prepare a Code of Conduct which should be followed by all practising consulting engineers. After examining the different standards/codes of conduct followed in other countries, the Committee was of the view that it was not advisable to adopt in entirety the U.K., U.S., Japan or any other foreign model. After taking due account of the developments in India, the objective of the proposed Code should be to encourage growth of consultancy services on sound lines, to make the services efficient, reliable and internationally competitive. The Code should also promote good relations between the consultants, contractors and project owners.

8. The proposed All India Institution(s)/Association(s) will be useful particularly in respect of following: —

(i) Being an All India Organisation(s) with Government recognition, it will be able to lay high standards of discipline for the members.

(ii) Its standing will inspire confidence of the clients in its members.

(iii) It would more effectively represent the interests of the profession before Government and the public.

(iv) The unhealthy and self-defeating spectacle of rival claims by different bodies claiming to represent the same interests would be avoided.

(v) It would undertake, on behalf of its members, an examination of major projects planned for the future in order to identify the extent to which work could be assigned to its members.

(vi) It would provide an effective forum through which its members could advantageously consult each other on matters of common interest.

(vii) It would serve as the centre for documentation of information on consultancy and projects and thus it will be the store-house of latest techniques and processes known to Indian consultants.

9. It is too early to establish such an Institution(s)/Association(s) by an Act of Parliament and to enforce its regulations through law. A start should be made initially by organising the proposed Institution(s)/Association(s) on voluntary basis and the Government recgonising the Institution(s)/Association(s). After a few years of its working and in the light of experience gained, legislation could be undertaken to make it a legal entity parallel to the Institute of Chartered Accountants.

10. In order to expedite the formation of the proposed Institution(s)/Association(s) and to deal with other related problems, the Government should set up a broad-based "Panel of Experts" headed by a senior official of the Government of India with representatives of consultancy organisations of both categories (independent and associated), process and design engineers, contracting engineers, product and equipment manufacturers in the private and public sectors and Government Departments dealing with consultancy services and projects in one form or the other, with the following terms of reference: —

(i) To decide whether there should be only one All-India Institution/Association to represent all types of Con-

sultancy Organisations or there should be two—one to represent 'independent' consulting engineers and the other for 'associated' consulting organisations.

(ii) To decide whether any one of the existing All-India Institution(s)/Association(s) should be recognised for this purpose or else a new organisation(s) set up.

(iii) To prepare the Constitution of the proposed Institution(s)/Association(s).

(iv) To set up and arrange registration of the proposed Association(s)/Institution(s) under the Societies Act of 1886 and recognition by the Government.

(v) To prepare guidelines for the appointment of consultants and fixation of their fees and other terms and conditions of their contract.

Conditions of Engagement

11. The Committee agreed with the view that engagement of consultants and fixing of their fees should be in accordance with the international practices adjusted to the Indian conditions. Price cutting and competitive bids should be avoided. Contracts should be awarded to the consultants based on their capability and experience and reasonableness of the bids. The consultants should follow the same standards and practices as are observed by the medical practitioners and Chartered Accountants. The method of calling tenders for appointment of consultants should be used only sparingly. Negotiations for striking a proper bargain cannot be ruled out. The quality of performance of a job would depend more on the competence and reputation of the consultant.

12. The proposed Institution(s)/Association(s) of the Consulting Engineers when set up could undertake to introduce guidelines and standards—(as drafted by the Experts Panel) amongst the consulting engineers. The Institution(s)/Association(s) should also prepare model contract forms for consultancy

and contract jobs to safeguard the interests of clients on the one hand and consulting engineers on the other, and thus introduce high professional standards.

Promotion of Indigenous Consultancy Services

13. Foreign consultants have been often employed for the purpose of obtaining project reports, process designs and detailed engineering in preference to Indian organisations. The foreign consultants are, on the one hand, not familiar with the Indian equipment, raw materials and industrial conditions and on the other, they have a bias for the equipment used and processes followed in their own country. This results in their recommending foreign processes and equipments. Sometimes this is done under pressure from the aid giving countries. On the whole, this not only entails foreign exchange losses, the country also misses the opportunity for gaining the necessary knowledge and experience in the setting up of new projects. The Committee, therefore, recommends that the Government should lay down policies which would ensure:

(i) The utilisation of the best and most up-to-date techniques of production suitable for Indian conditions;

(ii) Maximum utilisation of the consultancy and engineering services available in the country and providing opportunities for their further development; and

(iii) Allowing import of foreign know-how and consultancy services only where absolutely necessary for the development and improvement of the industrial structure of the country.

14. Proper goodwill should be created for the facilities which are now indigenously available. Effective steps (as suggested below) are necessary for removing the bias in favour of foreign consultants and equipment:—

(i) The proposed All-India Institution(s)/Association(s) should prepare annually a monograph of know-how, processes, technologies, and equipment which are avail-

able in the country on the basis of information collected from consultants, process enginers, contractors and manufacturers. This will on the one hand publicise the facilities available in the country and on the other permit proper discretion regarding imports.

(ii) All cases of engagement of foreign consultants whether for public or private sector must require prior approval of Government.

(iii) Frequently, in the case of private sector projects, consultancy charges are a covert element in the price of imported equipment. This element must be clearly spelt out.

(iv) In all foreign collaboration agreements, a condition should generally be included to the effect that Indian consultancy organisations will be associated for preparing feasibility study reports, lay out designs and for planning the engineering work. This will pave the way for building and improving the technological base of Indian consultants and process engineers.

(v) Even where foreign consultants have otherwise to be appointed, it should be made conditional that as far as possible and keeping in view the technology of production suitable for India, designs shall be developed on the basis of indigenously available equipment.

(vi) Where foreign consultants and/or suppliers of equipment refuse to take overall responsibilities for the entire plant if indigenous equipment is partly used, the project owners should accept guarantees of satisfactory performance offered by the indigenous equipment manufacturers and contractors.

15. Divergent views were expressed before the Committee regarding the import of know-how and consultancy services.

Keeping all the factors in view, the Committee arrived at the following conclusions: —

(i) Import of process know-how and equipment design should preferably be through consulting/process engineers. This would avoid the need to import the same know-how repeatedly, ensure quicker implementation and lower expenditure of foreign exchange.

(ii) This should not, however, tie the consultants and process engineers to a particular know-how, technology or process in a permanent or static way. The consultants and process engineers should keep themselves up-to-date and give up their interest in technologies and processes in which they hold rights in favour of latest and most up-to-date know-how. Client's interest in avoiding obsolescence has to be safeguarded.

(iii) In order to broad-base the industrial structure of the country and introduce latest know-how, import of new and improved processes and technologies for manufacture of the same product should be permitted when there is a demonstrable advantage in doing so.

(iv) Import of know-how and process designs should be as far as possible on non-exclusive basis.

(v) Import of package deals and turn-key jobs should not ordinarily be permitted.

(vi) Product and equipment manufacturers may not be precluded from acquiring the know-how and process designs from foreign countries to keep themselves up-to-date subject to the conditions that it is not on exclusive basis and it does not involve expenditure on machinery and equipment which can be fabricated within the country.

(vii) Facilities of foreign exchange for import of literature and for studies and re-orientation in foreign countries should be given to the Indian consultancy and process

design organisations to enable them to acquire up-to-date knowledge.

(viii) The banks in India should regard consultancy and process design work as a regular business and offer advances on merits for meeting working capital requirements.

(ix) Proper liaison should be established between the Research Laboratories, Equipment and product manufacturers, Consultancy and Process Design Organisations. This will help to quicken the implementation and commercial use of the results of indigenous research, design and development.

16. The Committee noted the latest policy framework within which consultancy organisations with foreign collaboration are permitted to be set up in India. While such collaborations need not be discouraged, the guidelines provided and the powers already enjoyed by Government can be suitably used for ensuring that the country is progressively enabled to take up consultancy work for its own development, that knowledge and experience accumulates and that as little work as possible is contracted to outsiders. The guidelines could be enlarged to advantage on the basis of the following: —

(i) Collaboration between Indian Consultancy firms and foreign consultancy firms may be encouraged on the basis of specific projects in preference to foreign consultancy firms opening branches here.

(ii) Where Indian consultancy organisations or those with foreign collaboration already exist and do not have sufficient work load, new units in the same field with foreign collaboration should not be allowed except when they perform work on jobs to be put up outside India.

(iii) Foreign exchange should not generally be spent for feasibility studies.

(iv) The main work of compilation of data and designing of the plant and equipment must be done within the country, if necessary, by inducting assistance from foreign experts.

17. The Committee feels that in order to encourage the development of indigenous consultancy services, some fiscal reliefs are necessary. The following measures would go a long way in ameliorating the financial hardships faced by the consultancy organisations and would help their steady growth: —

(i) The banks should grant loans on easier terms to enable engineering organisations to meet their working capital needs. Consultancy and process engineering should be treated on par with other industries for purposes of bank loans.

(ii) The rate of income-tax for consultancy work should be lower than that applicable to other corporate bodies.

(iii) Income-tax should be levied on the average income of the past three years.

(iv) Indian Consultancy Organisations should be permitted to create special tax free reserve funds (like development reserves) from earnings during good periods to help them tide over occasional lean periods.

(v) Tax rebates should be permitted on fees received by indigenous organisations for passing on the available know-how.

Requirements of Consultancy Services

18. The consultancy charges vary from 5 to 15 per cent depending on the type of projects, specialisation involved etc. and on an average, such costs could be placed at 10 per cent of the project costs. The investments during the Fourth and subsequent Plans will provide ample work to indigenous consulting/process engineers.

19. The Committee feels that given suitable opportunities, Indian consultancy organisations would not be hindered by inadequacy of personnel. Apart from recruiting highly experienced and skilled personnel from within the country, efforts have to be made to get back the migrated Indian personnel working abroad by offering suitable assignments and conditions for work.

20. The Committee recognises that there are some gaps in consultancy and engineering services to be covered. The position in this respect is as follows: —

(i) *Process know-how.*—Where there are restrictions to pass on the know-how to others in collaboration agreements, difficulties arise in dispersing the know-how and import from competitive sources for new projects becomes necessary. For some sophisticated industries not yet established in India, there are gaps in indigeneously available process know-how. In such cases, foreign assistance has to be obtained which should preferably be on non-restrictive basis.

(ii) *Detailed engineering*: —Once know-how details become available, the detailed designing and engineering of a plant could be satisfactorily undertaken by Indian consultancy organisations. With the increase in indigenous content of projects made possible, there is need for utilising indigenous capacity for detailed engineering, except in the case of most sophisticated engineering designs for which the use of foreign consultants as supervisors may still be necessary.

(iii) *Procurement and Inspection*: —In special cases where the process know-how has to be obtained from abroad for the first time, the help of a few foreign personnel for supervision, may be necessary.

(iv) *Start-up and performance guarantees*: —Local consultants who have taken part in plant design may be capable of supervising the start-up and helping to

achieve the performance guarantee. Wherever necessary, services of personnel from similar plants in operation or of foreign experts could be availed of.

(v) *Product and equipment design*:—There is an imbalance between product design and production capacities in a large number of industries. The Committee feels that the main efforts required for correcting this imbalance should come from the plant manufacturers themselves. It would be better if the large design offices created along with various plants in both public and private sectors, are used more for product design and development. This would also result in reduction in their preoccupation with project design work which is mainly the function of consulting engineers.

21. The Committee reviewed the observations and recommendations made by a Study Group on industries in which foreign technical assistance was no longer considered necessary and suggests that, as a first step, use of foreign consultancy services with regard to the listed industries need not be allowed. This list should be periodically reviewed. Renewal of foreign collaboration agreements are resorted to on the plea of expansion and taking up the production of a new model or product. This often results in neglect of own effort to improve product design and process know-how. Extensions of collaboration agreements should be permitted in exceptional cases only.

22. Apart from the gaps in respect of functions, the gaps in certain specific sectors have also been studied which are summarised in the following paragraphs.

Power

23. *Hydro Stations*:—The Central Water & Power Commission and the State Electricity Boards are well equipped to carry out all the work needed for planning and setting up of hydro electricity stations. A number of consultancy organisations both in the public and private sectors render engineering services in this field.

24. *Thermal Stations*:—The Committee found that the existing consultancy organisations within the country would be adequate to take up the work involved in the setting up of thermal power stations in future.

25. Water & Power Development Consultancy Services (India) Limited has been set up in 1969 to provide engineering and related technical consultancy services for development of water resources, irrigation and drainage, electricity, flood control, etc.

26. Heavy Electricals Units at Bhopal and Hardwar are producing various types of equipment needed for electricity projects but depend upon their collaborators for securing design engineering for the equipment. The Research & Development Organisation for Electrical Industry (RDOEI) has been set up to prepare project reports, and to undertake consultancy and design work in electrical fields.

Telecommunications

27. The Telecommunications Research Centre undertakes design of telecommunication equipment and systems required by the P&T. All the designs evolved so far are without any foreign collaboration for know-how. The Research & Development Department of the P&T is also carrying out design and development work for specialised equipment for defence, railways and other users. Telephone equipment of different types and grades are now being manufactured in India without foreign collaboration. There are, however, various electronic components, such as, parmalloy laminations, mylar capacitors, integrated circuits, etc. for which India will have to import the necessary know-how.

Railways

28. The Research, Designs & Standards Organisation under the Railway Board is well equipped to undertake consultancy services, import substitution, engineering services, preparation of designs and standards. RDSO is also rendering services for

export of railway equipment as also for railway installations in some of the underdeveloped countries. India is more or less self-sufficient in all railway projects.

Ports

29. The country is not self-sufficient in providing consultancy services for the working and development of ports in India. In case of bigger ports and special problems, foreign consultants and engineers are employed.

Iron & Steel Plants

30. Some foreign assistance might be required in the detailed design and engineering for the main equipment. Steps have to be taken to develop these capacities quickly. Collaboration agreements would be necessary for L.D. Converters, similar to the ones now entered into by the Heavy Engineering Corporation for blast furnaces, coke ovens and concast plants. The CEDB should be strengthened to undertake work in fields in which India is not self-sufficient.

31. The Committee feels that the major equipment manufacturers could enter into licence agreements in selected fields with proper agencies in developed countries. The deficiency could be filled by: —

(i) Liberal arrangements for taking up process know-how from abroad.

(ii) The existing heavy engineering firms or consultants should enter into technical collaboration with their counterparts abroad to obtain their research, development and designs for specialised and sophisticated equipment.

(iii) Strengthening of the heavy engineering units particularly, the H.E.C. by having design cells attached to them for designing specialised equipment for steel plant.

(iv) Strengthening of the CEDB which could in course of time undertake to work on lines in which India is still not self-reliant.

Aluminium

32. The NIDC has emerged as a fully equipped consultancy organisation in this field, with their taking up the Korba and Koyna Aluminium projects. The Committee understands that for the development of facilities for process know-how, an organisation in the nature of Aluminium Research Institute is proposed to be developed with the existing facilities in the National Metallurgical Laboratory as the nucleus. The Committee would urge that steps be taken early to fill this gap, to ensure near self-sufficiency.

Coal Mining

33. There is no single indigenous organisation which can completely cover the technical consultancy services for the coal mining projects through organisations like NCDC, Sofra Mines (India) Ltd., and Civil and Mining Engineering Consultants can undertake the bulk of the consultancy work. In addition a few organisations like the Garden-reach Workshop, Mining & Allied Machinery Corporation, Heavy Engineering Corporation and Heatly & Gresham have developed sufficient design competency in selected fields.

34. The Planning & Development Division of the National Coal Development Corporation has now gained sufficient know-how and experience even for deep mines, and can undertake preparation of feasibility and project reports for future mines. Some of the deficiencies of the design and development cell of the NCDC could be supplemented by the MAMC. The consultancy services in the field of coal mining covered by the indigenous organisations need the following assistance: —

(i) They have to be supplemented in the design engineering field by indigenous manufacturers of mining equipment, particularly MAMC.

(ii) In specialised fields, such as, new ventilation standards, hydraulic pneumatic stowing, introduction of new coal face mechanisation and support, development of very deep mines etc., the services of foreign experts should be allowed for a few years till expertise in these fields is built up.

35. Adequate facilities exist for working out the design parameters of coal washeries. Similarly, all the equipment required for coal-washeries can be procured from within the country.

Mining-other than Coal

36. *Geology and exploration.*—The Committee noted that expertise and facilities exist in the country for ground geo-physical and geo-chemical surveys, mapping, surface and underground drilling, exploratory mining and ore appraisal. There are, however, no facilities to carry out air-borne geo-physical surveys. It is desirable to build up technical competence in the field.

37. Comprehensive geological investigations and appraisals of copper, lead, zinc, and iron ore deposits and development of large mines can now be carried out by Geological Survey of India and NMDC. In specific cases, however, if the services of expert drilling contractors from abroad are utilised, proper standards in ore drilling and sustained high rate of ore recovery could be built-up.

Mining

38. NMDC has built up considerable expertise for preparation of feasibility studies, choice of mining systems, mine layout development and operational know-how. The area in which foreign assistance would be required is in respect of up-to-date shaft sinking and tunnelling technique. Our engineers could be sent abroad for training.

Beneficiation

39. NMDC have so far utilised the services of foreign consultants for the project concept, lay out etc. of ore crushing, scruning, washing and loading plants for the Bailadila iron ore project. The know-how in the country for the beneficiation of iron ore fines by jigging or other methods is limited and it is necessary to have large scale tests *outside the country* and our plants designed accordingly. In the area of detailed engineering, good progress has been made by the Indian consultancy firms but there are gaps which have to be filled early.

Metallurgy

40. Process know-how is required in cases like flash smelting of copper concentrates, hydro-metallurgical techniques. In such cases, patents could preferably be obtained instead of taking them on the basis of tied credits and associated foreign consultancy with restrictive uses. In the field of procurement series and construction work, India know-how is sufficiently developed and use of foreign consultants should not be necessary.

Fertilisers

41. Complete consultancy services for the setting up of a fertiliser plant are now available indigenously. With the acquisition of know-how for ammonia, urea, ICI steam reforming process, Prayon phosphoric acid process and central Prayon hemi hydrate phospheric acid process, the Planning & Development Division of the Fertiliser Corporation of India and the FACT Engineering and Design Organisation (FEDO) of the Fertilisers and Chemicals Travancore Ltd. can take up new projects on 'turn-key' basis. In order to keep pace with the advanced technology, a good deal of research and pilot plant studies will be necessary.

Petroleum Refining and Petro-Chemical Industries

42. Apart from Engineers India Ltd., a public sector organisation set up to provide the necessary consultancy services in this field, other private consultancy organisations are also

building up expertise for speedy and fuller development of indigenous know-how. The Committee is of the view that Indian organisations should be engaged as the prime consultant for all future refineries. Arrangements may also have to be made for close link-up of the experience gained by such organisations and problems covered by the Indian Institute of Petroleum.

(i) *Process know-how*:—Initial purchases of process know-how with no restriction on repetitive use is desirable in petroleum refining and petro-chemicals. This could be done by either IOC or indigenous consultancy organisations.

(ii) *Process Design*:—Once the process know-how is obtained, the process design work should be taken up by indigenous design engineers. The services of foreign experts should be permitted where necessary.

Very little progress has been made to build up the necessary facilities for process design in the field of petro-chemicals. This needs urgent attention. Incentives for development of such facilities on desired lines may be considered.

(iii) *Detailed Engineering*:—The detailed engineering can all be done in the country on the basis of process designs. Specialist assistance may be required in areas like (a) Design of thermally rated heat-exchanges; (b) Design of distillation trays and columns; and (c) Refinery heaters and furnaces.

(iv) *Shop Drawings*:—Normally such drawings are prepared by the manufacturers of equipments themselves. Assistance may, however, have to be rendered by the consultancy organisations in view of inadequate drawing office facilities with some of the manufacturers.

43. The Committee studied the remaining industries, like heavy inorganic chemicals, sugar, cement and paper and found

that the consultancy services in the country were more or less adequate.

44. The Committee has tried to identify areas where India has gained self-sufficiency and where the imports of consultancy services, process know-how, shop designs, detailed engineering were necessary. This does not, however, purport to be true for all times. Fields in which presently there is self-sufficiency may require imports of process know-how and consultancy services in view of new technological developments in foreign countries. On the contrary, fields in which presently there is need for import, India may acquire self-sufficiency with the research and technological developments being accomplished in the country. The proposed All-India Institution(s)/Association(s) of Consulting Engineers should prepare annually an authentic document indicating fields in which the country has gained self-sufficiency and gaps that still exist where imports are necessary.

45. On the basis of the Five Year Plans, the proposed Institution(s)/Association(s) may prepare a programme for developing consultancy and process engineering services needed for projects included in the Plan.

46. For effective utilisation of the consultancy services available in the country, the proposed Institution(s)/Association(s) should arrange from time to time meetings of consulting/process engineers, contractors, equipment manufacturers, project owners/promoters, D.G.T.D., C.S.I.R. and other Research Organisations.

Exports

47. The development of consultancy and engineering services in this country is of recent origin, and primarily directed to import substitution. In several fields, India has built up capacities and gained experience which can be utilised to render engineering services to other developing countries.

48. India has an advantage over the more developed countries in providing consultancy services and undertaking 'turn-key' contracts in the neighbouring countries either for building up infra-structural facilities or for establishing industrial projects by virtue of her experience under similar conditions. India has reached self-sufficiency stage in respect of buildings, structurals, roads, bridges, rail transport, irrigation, power and telecommunication. She can establish complete projects of consumer industries like textiles, sugar, cement, paper, oil, food products, soap, cosmetics, leather, wool, beverages, alcoholic preparations and similar products, as also many types of mechanical, chemical, metallurgical and mining industries. Projects could be set up with varying capacities to suit local demand. Further, the comparatively low cost of Indian engineering services is an advantage over the advanced countries.

49. India can render technical and organisational assistance to all developing countries in establishing small-scale industries with latest industrial technology and to undertake manufacture of various sophisticated items like radios, T.V. sets, automobile parts, colours, pigments etc.

50. In order to build up the exports of consultancy and engineering services from India, the Committee recommends the following lines of action: —

(i) Conducting pre-investment surveys and preparation of pre-feasibility reports would be a distinct advantage for securing consultancy contracts in foreign countries.

(ii) Advance knowledge and information of the National Plans and the projects selected for execution will make consultancy organisations and equipment manufacturers ready with their bids to compete.

(iii) For meeting the requirements of package deals for turn-key jobs, Consortia of Consultants, process and design engineers and suppliers of equipment should be organised.

(iv) It may become necessary for the Indian consultancy organisations to go in for partnerships with reputed organisations in other countries and/or to accept sub-contracts from international firms.

(v) The proposed Institution(s)/Association(s) may bring out a Directory giving the names and fields of service of all consulting/process engineers, equipment manufacturers and contracting organisations in India and forward its copies to the Embassies in foreign countries.

(vi) Registration with the International Organisations like World Bank, UNIDO, Asian Bank etc. would enable Indian consultancy firms to obtain consultancy jobs allotted on global basis.

(vii) In the interests of export of technical services and industrial equipment, credit facilities may have to be extended to developing countries which are short of foreign exchange and lack financial and other resources.

(viii) The banks may undertake to finance complete projects involving turn-key jobs and payments for contracts over long periods.

(ix) A Foreign Projects Development Fund may be created by the proposed Institution(s)/Association(s) for undertaking studies and establishing close contacts in foreign countries.

APPENDICES

APPENDIX I

COMMITTEE ON TECHNICAL CONSULTANCY SERVICES

Questionnaire issued to the existing Technical Consultancy Organisations

PART I

1. Name of Organisation

2. Date of establishment

3. Type of organisation and capital structure

   (Proprietory, Partnership concern or Joint Stock Company—name of proprietors, partners etc. with their share in equity etc., may be mentioned)

4. Are you a member of any consultancy Association ?

5. Organisational Structure :

   (i) Brief description of the set up of the organisation with organisation chart

   (ii) Personnel :

   (a) Technical staff :

Category :	Number Senior level salary above Rs. 1000
Mech. engineers	
Electrical engineers	
Civil engineers	
Chemical engineers	
Metallurgical engineers	
Industrial engineers	
Architects	
Draftsmen	

(b) Do you have any technical advisers or associates ?

(c) Do you get your work evaluated before submission ? If so, the nature of the organisation which evaluates your work

(d) Administrative & Accounts staff :

(i) Managerial

(ii) Clerical

Note : If any foreign personnel are employed, their numbers, categories etc. may also be given.

6. Foreign Collaboration :

(If the firm is in collaboration or association with any foreign consulting engineering organisation/individual, then please give the names of these foreign parties ; the nature and extent of association may also be indicated)

7. Scope of services offered :

(Plase indicate which of the following types of consultancy services are offered by your organisation and for which particular industries each of these services is offered)

(a) Supply of process know-how

Please indicate the particular processes for which :

(i) You have developed your own know-how :

(ii) You have been licensed by other parties to supply the process know-how developed by them)

(b) General Tech. Consultancy services :

(i) Demand assessment surveys;

(ii) Preparation of techno-economic assessment; feasibility studies and preparation of Detailed Project Report;

(iii) Process evaluation reports for the techno-economic assessment of various alternative manufacturing processes available for any particular production ;

(iv) Site surveying including assessment of load bearing capacity of the soil ;

(v) Preparation of detailed specifications for plant and machinery;

(vi) Preparation of tender documents for plant and machinery requirements;

(vii) Supervision during and/or after the fabrication of plant and machinery equipment ;

(viii) Supply of detailed designs for all the services and utilities, requirements and the general engineering coordination of the various production and ancillary departments in industrial projects;

(ix) Supply of detailed designs for the civil engineering work in industrial projects;

(x) Inspection and/or erection of plant and machinery;

(xi) Commissioning of the plant ;

(xii) Acceptance of turn-key assignment for putting up complete industrial projects;

(c) Supply of detailed engineering designs for plant and machinery (which could enable the manufacturers to fabricate the plant and machinery. This is to be considered as distinct from the shop manufacturing drawings)

8. Capacity of your Organisation :

(Here indicate the amount of work under each of the categories (under (i) to (xii) of Qn 7(b) for which you are equipped to handle per year. This may be given in value in rupees of the project/projects.

9. Assignments already executed :

(Please indicate specific assignments of consultancy work which has been undertaken and executed by you since the inception of your company to date. Here, please indicate for each project the total value and time taken in completing the assignment)

10. Are the fees quoted by you as :

(i) percentage of the cost of the project

(ii) fixed fees

(iii) cost basis

(iv) any other basis and if so, explain

(v) is any advance payment required by you.

PART II

11. What are the various difficulties which you have experienced :

(a) in securing adequate orders for the type of services which you are in a position to offer

(b) in executing the assignments which you have been commissioned.

12. What is your estimate of the scope and demand for the type of consultancy services which you are in a position to offer, during the course of the next 5 years ? (State your estimate of addl. staff, finance etc., needed in this respect)

13. What, in your opinion, are the principal gaps to be filled up in the field of engineering designs (as referred to under item 7) and consultancy services to meet the requirements of your industrial development during the 4th plan period and subsequent years ?

14. What are the measures which you consider necessary for filling up these gaps and building up engineering design and consultancy services to the extent required ?

15. What are the specific sectors of industrial development, in which you consider that :

    (a) foreign technical consultancy organisations ;

    (b) process know-how; and/or

    (c) engineering designs

    are necessary at the present time ? What are your proposals for building up indigenous talent in these fields ?

16. Where foreign know-how is to be secured, wherever indigenous know-how is not available, either for process technology or engineering designs, what are the general lines which you would like to suggest for obtaining the foreign technical know-how ? (With a view to minimise the outgo of foreign exchange and multiplicity of collaboration for the same product)

17. What are the incentives and provisions which you consider necessary for the rapid development of the technical consultancy services of each of the categories mentioned under question 7 above, to the extent required in our present conditions ?

PART III

18. Are you in favour of compulsory registration of consultancy organisations, as for instance in the case of chartered accountants ?

19. Do you favour a professional code of conduct ? If so, what, in your opinion are the dos' and don'ts of the profession of consultancy engineers ?

20. Do you favour the idea that a consultancy engineer should not directly or indirectly have any commercial manufacturing or contracting interest ?

21. Are you in favour of clients issuing tenders for consultancy services and deciding mainly on the basis of fees quoted ?

APPENDIX II

ILLUSTRATIVE LIST OF INDUSTRIES WHERE FOREIGN CONSULTANCY SERVICES MAY NOT BE REQUIRED

1. *Paper, Pulp and Allied Industries:*

Common grades of printing, writing, packing and wrapping paper and boards e.g., white printing papers, azure, cream laid and woven papers ; art paper and board ; litho, offset paper ; drawing and cartridge paper ; M.G. poster ; bank and bond paper ; airmail paper ; cheque paper ; kraft paper ; match paper ; greaseproof and glassine paper ; ordinary M.G. tissue papers ; blotting paper ; straw boards ; mill boards ; grey boards ; pulp board ; duplex board ; ticket board ; carbon paper; typewriter ribbons; VP I paper.

2. *Rubber Goods:*

Bicycle tyres and tubes; tyre retreading material; rubber and canvass footwear ; conveyor belting ; industrial and agricultural hoses; automobile rubber components; rubberised fabrics; latex foam; industrial and surgical gloves; medicinal rubber goods such as vaccine and other injectible bottlevials ice cups and hot water bottles and reclaim rubber.

3. *Chemical Industries :*

Formaldehyede, acetic acid ; esters of acetic acid like ethyl acetate, butyle acetate, formic acid ; monochloroacetic acid; ethyl chloride ; methyl bromide; chloroform; methylene chloride ; chlorobenze plasticisers (phthalates—Batch process) ; oxalic Acid ; chlorinated paraffins ; bear ; Ethenol ; Pentaorythritol, Aniline.

4. *Leather and Leather Goods Industries :*

Glue/Technical gelatine; vegetable tanning extracts ; pickers ; picking bands ; leather belting ; cotton and hair finished leather ; leather footwear ; synthetic tanning materials.

5. *Rayon and Synthetic Fibres Industries :*

Viscose filament yarn/staple fibre ; viscose tyre yarn ;

6. *Asbestos and Carbon Products :*

Asbestos cement products ; pencils

7. *Timber Based Industries :*

Teachest plywood, commercial plywood, matches

8. *Glass Industry :*

Sheet glass, table and pressed ware ; vacuum flasks ; enamelware ; containerware

9. *Cement and Cement Products :*

Cement, RCC pipes, Prestressed and pre-tension cement products ; building bricks and roof tiles

10. *Ceramics Industry :*

Sanitary-ware ; glazed tiles ; crockery

11. *Castings :*

Grey casting, steel casting

12. *Electrical Engineering Industries :*

Distribution transformers
Power transformers 1000 KVA and below ;
AC motors below 30 HP ;
Electronic Components (Ferrite, transformer coils, telescopic aerials, ceramic capacitors) cables (except power cables above 11 KV) ;

Iron Clad Switches ;
Winding wires and strips ;
Hospital wares ;
Electric fans ;
Domestic refrigerators ;
Domestic air-conditioners ;
Commercial radio receivers ;
House service meters ;
Ammeters and vol-meters other than sub-standard ;
Multimeters ;
Storage battery

13. *Industrial Machinery* :

Sugar Machinery ;
Cement Machinery ;
Conveyors ;
L.P. Gas cylinders
Coal mining machinery (except hydraulic props & electric drills)
Coal washery plant ;
Building and constructional machinery—except specialised items
Poultry equipment ;
Pesticides application equipment (other than special type equipment)
Milk and dairy machinery except specialised items
Cooling towers ;
Tea processing machinery ;
Oil Mill Machinery ;
Water treatment plant ;
Solvent Extraction Plant ;
Rice Mill Machinery of conventional type ;
Weighing machinery except specialised items ;
Cold formed sections and slotted angles ;
Tubular structurals ;
Railway wagons ;
Railway mechanical and signalling equipment ;
Railway points and crossing ;
Steel doors ;

Windows and rolling shutters ;
Wire ropes ; (other than bicable ropeways)
Lifts ;
Welding Electrodes (other than special types)
Bright bars ;
Welded G.I. steel pipes and tubes ;
Conduit pipes ;
Electric Hoist block and chain pulley block ;
Transmission line towers ;
Rail and road bridges ;
Structurals (light, medium and heavy) ;

14. *Machine Tools and Small Tools :*

Forged hand tools (Spanners, Pliers etc.) Steel Files (except export oriented) ;
Twist Drills, General purpose machine tools (simple types)

15. *Other Industries :*

Drums and barrels ;
Collapsible tubes ;
Crown corks ;
Pilfer proof seals and closures ;
Hurricane lanterns ;
Chaf-cutter knives ;
Buckets,
Domestic utensils and cutlery ;
Agricultural implements and machinery (manual and animal drawn)
Clocks ;
Time pieces (conventional)
Franking machines ;
Duplicators (other than special types
Oil pressure stoves ;
Belt fastners ;
Steel belt lacing ;
Spectacle frames ;
Oil pressure lamps ;
Hand sewing and gramophone needles;
Addressing machines ;
Pressure cookers ;

Domestic sewing machines ;
Air rifles ;
Cigarette lighters ;
Bicycle and bicycle parts ;
Ball bearings (only)
Steel Balls ;
Leaf springs ;
Zip fastners ;
Grinding media ;
Coil springs excluding hair and other delicate and complicated springs ;
Snap fastners ;
Toys,
Bolts, nuts, rivets, dogspikes of all types excluding specialised types of rivets ;
Wood screws other than with special recessed Heads ;
Mild steel welded link chains other than ship chains and alloy steel chains ;
Machine screws other than specialised types ;
Pipe fittings other than specialised types ;
Locks ;
Valves and cocks (other than specialised)
Shoe grindery ;
Builders hardware ;
Welded wire mesh ;
Wire gauze and netting ;
Oil milling ;
Solvent extraction of oil cakes ;
Soap ;
Synthetic detergents (formulations)
Fatty acids ;
Textile auxiliaries ;
Paints and allied products.

MGIPCBE—S2—1 PC/ND/70—9-3-71—3000.