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A SHORT NOTE ON THE STATUS OF ENGINEERING
DESIGN CAPABILITIES IN INDIA
AND A
PROPOSAL FOR A DESIGN CENTRE FOR
DEVELOPING COUNTRIES ^{1/}

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I N D E X

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A. Short Note on the Status of Engineering
Design Capabilities in India

1. Indian engineering industry today.

1.1 The mechanical engineering industry in India has registered considerable expansion during the last two decades. While all the machinery and equipment required to support the programmes of industrial development during the First Five Year Plan (1951-56) were imported, machine building and engineering industries were given high priority in the Second and the Third Plans with a view to establish a sound base for the production of a wide range of capital goods and intermediates.

1.2 To start with, India had no other alternative, but to start a licence based industry. This has led to a very rapid growth of industries in general, unseen in India before, with thousands of units of small and medium industries set up both in the private and public sectors. A number of heavy engineering industries were also established. But being licensed industries basically, the expansion of the medium and the heavy industries were mostly at the cost of their increasing dependence of foreign know-how, design drawings, equipment and spares and to a certain extent on import of materials.

1.3 It is a recognised strategy that the efforts towards achieving a measure of self-reliance in industries, particularly in basic industrial items and capital goods require to be supplemented by a parallel progress towards developing indigenous design engineering skills, development of production technology, production and substitution of basic materials, besides testing techniques and facilities. While

considerable progress has been made in regard to the later items, action for generation of creative design skill have been comparatively inadequate.

1.4 No doubt, a limited number design and consulting organisations for heavy industries both in the public and private sectors, such as in the field of iron and steel, mining, fertilizers and railways have been set up. Recently a Machine Tool Institute has also started to design indigenously metal cutting machine tools. But the total design and development man-power and skill generated so far is grossly inadequate. And again the Central Sector Design Organisations being attached to particular industries are not approachable by other industries in general. Neither it can be expected that the medium and small scale industries can create design and development cells for their own in foreseeable future as they have not enough capital or management resources to organise them.

2. Existing design potentialities.

2.1 Besides the 79 universities existent in India, research activities are also organised in about 900 establishments as a concerted effort. While 43 universities and institutions are engaged in education and research in various fields of engineering, 120 organisations are engaged in research only. Also there are 5 Institutes of Technology where research is conducted beside imparting education to graduate and post graduate students.

2.2 Before the initiation of the First Five Year Plan in 1951, the existing institutions were producing roughly 300 mechanical engineers per year. Subsequently the annual requirement of engineering graduates to meet the needs of the expanded industries in the country was assessed as 25,000 per year, with

roughly 30 per cent in the mechanical group. Presently about 6,000 graduate mechanical engineers are being turned out annually. About a dozen engineering institutes and technical colleges are conducting post graduate courses of two years duration leading to the Masters degree in Machine Design/Design Engineering. On an average 75 students are being trained on this speciality and six persons are getting their doctorates in some aspects of machine design, mechanism and vibrations every year.

2.3 With the existing research facilities in India, and with the output of 6,000 graduate mechanical engineers and 75 masters degree holders and 6 doctorates per year, proper feeding to more design and development organisations in this country is assured. This is particularly important to note that in an industrial economy dependent on foreign know-how, designs, equipments and materials, the output of 6,000 mechanical engineers becomes a curse and causes regretful wastage of highly productive brain and man power.

3. The requirements of India.

3.1 The need for creative design facilities being so urgent for India in view of its expanding engineering industries now reliant on foreign design and know-how, and the country having ensured generation of engineering know-how and availability of creative engineers, it is necessary to locate the fields where creative design facilities promise immediate prospects.

3.2 The Planning Commission, the Technical Development Organisation, the Institution of Applied Economic Research, and Market Survey Institutions in India have from time to time analysed the economic progress, areas of deficiency with feasible forecasts for future growth.

3.3 It has been estimated by the Planning Commission that out of the new investment of rupees 61930 Million in the Fourth Five Year Plan, plant, machinery and engineering industry will concern rupees 7970 Million. or about 13 per cent of the total plan requirement.

3.4 Considering the importance of the various branches of the engineering industry and the priorities given in the Fourth Five Year Plan, the following fields are identified which require to be urgently developed:

- i) Farm machinery and equipment,
- ii) Machinery and Machine Building Industries including
 - a. Foot-wear machinery,
 - b. Road making machines,
 - c. Materials handling and building construction equipments,
 - d. Special purpose machine tools and metal forming machines,
- iii) Pumps, blowers and compressors,
- iv) Fertilizer and food processing equipment,
- v) Consumer product development.

3.5 While the above fields are of immediate interest, it may be mentioned that with further progress of industries, newer fields requiring design and development may have to be attended to.

3.6 It is also important that design work should not be undertaken for all the fields at a time. Instead, 3 or 4 fields may be covered initially, and work in other fields started successively and only after the impact of the design centre on manufacturing industries has been rightly assessed.

3.7 The Institution pioneer in the field of mechanical engineering research in India is the Central Mechanical Engineering Research Institute at Durgapur which is presently the seat of the largest concentration of

industries in India, with over 7000 Million rupees invested. The Institute has about 100 design personnels in its Design and Product Development Section who already possess considerable design experience earned through efforts in certain fields in the past. The experience and expertise of these personnel may also be very effectively utilized in assisting other developing countries to reinforce their design capabilities and also in establishing the necessary centres.

APPENDIX A

Preliminary Outline for an 'Engineering Design Centre' for
Developing Countries.

- (a) Objective of the Engineering Design Centre. (NEDC)
- a.1 The proposed design centre may be established to fill the specific gaps in the spectrum of industrialization and product design. Strong design groups have to be created in the areas as may be identified as important from time to time to undertake design for the manufacturing industries.
- a.2 Knowing the needs of the country the primary objectives of the NEDC may be to perform the following functions satisfactorily:
- (i) Design of commercially feasible new engineering products
 - (ii) Development of new products and improvements of existing ones:
 - (iii) Technical development of existing product lines.
 - (iv) Design of equipment, plant and machinery for manufacture of products
 - (v) Technical evaluation of proposed programmes:
 - (vi) Development of technical data covering products, plants, equipment, and manufacturing processes and phases:
 - (vii) Fusion of technical information into product and process development:
 - (viii) Liaison with Industry and other Research and Development Institutes:
 - (ix) Assistance to Industrial-Technical Service
 - (x) Assistance to the Government in formulating Industrial Development Policies:
 - (xi) Creation of Design Consciousness in Educational Institutes, Industry and Research Institutes;
 - (xii) Train Engineers to form a basic core of national design potential through creative and rational policy.

a.3 The Centre will cater to the many sided design and other related technical problems faced by both organised industries as well as by new entrepreneurs, particularly in the fields where there are no adequate design and development facilities and where proper design skills are non-existent.

a.4 Besides the actual design work it is also important to establish "Technological Search", "Review" and "Documentation" services at this Centre so that the reports relating to design and development status and needs for the engineering industry can be obtained readily.

(b) Structure of the Organisation for the Design Centre

b.11.5 A request for new design either in plant machinery or product usually brings with it a series of problems, some major which must be tackled at the outset, others of detail which will be solved as the design takes shape. The designer will begin by making sure that it is clearly and precisely stated. He will analyse all the various factors inherent in the problem.

b.2 These solutions will be examined and re-examined to establish if in fact they do meet all the requirements. The design process is of analysis and synthesis. The design will then be translated into manufacturing instructions which consist of engineering drawing supported by additional information relating to materials and heat treatment, surface finish, parts list and so on. The instructions should ensure that the product finally manufactured is exactly in accord with the designer's concept or it and they must therefore be correct and complete in every detail.

b.3 The organisation for design and the structure, therefore, will be evolved over the years in order to suit the peculiarities

be production, management or design.

d. Need for Appropriate Design Staff

d.1 To train the design engineers of the Centre, therefore, a suitable programme has to be organised as laid out in the Appendix. This has been shown for two categories of staff, viz. the design officer and the supporting staff. The design officers in particular groups will be trained in a few selected areas abroad (item 2). In return, the centre expects to obtain the UNIQ expertise (item 1) to work in the same fields who would also train up the supporting staff at the centre.

d.2 In India, personnel with vast design and testing experience in general engineering products are available. With people trained in a few selected areas and with UNIQ help, strong groups can be built up easily to confront any technical problems independently without going to foreign countries for designing the equipment and machinery.

e. National Importance.

e.1 It is hoped, the establishment of the National Engineering Design Centre will provide a very useful component to reinforce the developing countries' endeavour to build up a self-sustaining industrial economy.



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