TECHNOLOGICAL EDUCATION IN INDIA

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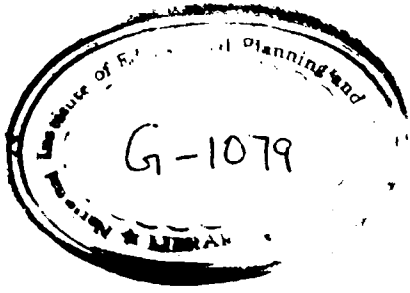

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With the attainment of independence, India was faced with the task of effecting an all-round reconstruction of her national life. It was realized that some basic welfare services previously denied to the people, could be provided to them only by building up the economic strength of the country ; that the successful implementation of a developmental programme for this purpose depended largely upon the availability of scientists, engineers and technicians of the right type. The improvement and expansion of facilities for technical education, therefore, received the close attention of the National Government immediately after its assumption of power.

The need to expand the provision of Technical education had been keenly felt during the Second World War. The difficulties experienced during this period to meet various requirements that in peace time were largely met by imports from other countries, led to the formulation of post-war plans in almost every field. The fulfilment of these plans required, in turn, scientific and technical personnel. Provision was, therefore, made in the post-war plans for the training of such personnel. The programme in this field was not however based upon any survey or assessment of the requirements of technical manpower. It merely followed the general appreciation of the situation, namely, that technical manpower was in short supply and that improvements in training arrangements were necessary to make the products of various institutions more useful.

Before 1947

In 1944, the Central Advisory Board of Education had submitted to the Government a report on " Post-war Educational Development in India", popularly known as the Sargent Report after Sir John Sargent, the then Educational Adviser to the Government of India. This report contained a blue-print of a national system of education and a plan for its introduction. The schemes included in the post-war plans for Technical education referred to earlier, conformed generally to the pattern suggested in the Sargent Report.

In this report, the Central Advisory Board of Education gave reasons why, under modern conditions, Technical education could not be effectively organised on a provincial basis. The Board recommended that a Central body, representative of the various interests concerned, be established to control policy in Technical education generally and to deal with all technical institutions above the High school stage except the Technological Departments of Universities.

The Government accepted this recommendation, and in November, 1945, the All-India Council for Technical Education

came into being as an advisory body only. Although the Council was not endowed with the controlling powers visualised by the Central Advisory Board of Education, undoubtedly the coordinated expansion and improvement in Technical education achieved during the last ten years is due solely to the good work of this body.

Earlier, in 1945, the Central Government had appointed a high-powered committee under the Chairmanship of the late Shri N.R. Sarkar to make recommendations on the question of the development of Higher Technical Institutions in India, with a view to ensuring an adequate supply of technical personnel required for post-war industrial development in the country. The Committee submitted its report in 1946.

Another noteworthy development prior to Independence was the establishment of the Council of Scientific and Industrial Research. This Council had drawn up a programme for the establishment of a number of National Laboratories and Central Research Institutions and had set up Planning Committees for some of them.

Recognising the importance of scientific manpower in any scheme of economic development, the Central Government appointed early in 1947, a Scientific Manpower Committee to assess the requirements at various levels during the next five to ten years. The Committee submitted its interim report in August, 1947. As a result of this report certain programmes were initiated even before the completion of the work of assessment by the Committee.

INDEPENDENCE AND AFTER

The position at the time of the transfer of power, therefore, was that much spade work had been done by bodies such as the Council of Scientific and Industrial Research, the All-India Council for Technical Education and various *ad hoc* committees appointed by the Government for specific purposes. Collection of precise data, its collation and interpretation had yet to be undertaken to formulate concrete schemes and secure their implementation. One thing was, however, evident, namely, that there were large gaps to be filled, not quantitatively only but qualitatively.

Although certain plans had been formulated before Independence, the National Laboratories and the Central Research Institutes were established with great vigour under the able and energetic leadership of the late Dr. Shanti Swarup Bhatnagar, only in the years that followed. The first in the chain of Laboratories was the National Chemical Laboratory opened at Poona in January, 1950. It was soon followed by the National Physical Laboratory at Delhi and today there are as many as 14 National Laboratories and Central Research Institutes covering the following fields : Physics, Chemistry, Roads, Buildings, Food Technology,

Drugs, Leather, Electro-Chemical, Fuels, Glass and Ceramics, Salt, Electronics and Botany.

Besides the promotion of research in general, testing and standardization of new products and provision of such products, these laboratories and institutes offer facilities and advice to scientists, Universities, industries and others who may not be in a position to carry out or complete investigations on their own. They also play an important part in the dissemination of scientific knowledge, and there is increasing collaboration between them on the one hand, and the Universities and the training institutions on the other.

AICTE—Scope and Functions

The All-India Council for Technical Education is the main advisory body of the Central and the State Governments on matters relating to the organisation and development of Technical education above the High school stage. It consists of representatives drawn from all interests concerned such as Parliament, Central Ministries, State Governments, Private Industry and Commerce, Labour, Professional Bodies, Inter-University Board and so on. As it has representatives of so many interests, it is a rather large body of 60 members but it has made excellent arrangements for the performance of its functions with the assistance of

(i) seven Boards of Technical Studies in specified fields,

(ii) four Regional Committees, one each for the North, South, East and West zones into which the country is divided for this purpose, and

(iii) a Coordinating Committee, that coordinates the work of the various Committees and Boards and has the power to take decisions on behalf of the Council when it cannot meet.

The Council meets once a year or so to discuss broad policies, problems and programmes, whereas the Regional Committees and the Coordinating Committee meet much more often.

The All-India Boards of Technical Studies advise the Council on all technical matters pertaining to their respective fields. They lay down the standards and frame courses in a variety of subjects, that serve as a guide to the institutions in the country and qualify students for the award of National Diplomas and Certificates. The seven Boards cover the fields of (1) Engineering and Metallurgy (2) Chemical Engineering and Chemical Technology (3) Architecture and Regional Planning (4) Textile Technology (5) Applied Art (6) Commerce (7) Management Studies.

The Regional Committees are the backbone of the Council for all development at the first degree and diploma level. It is the function of these committees to survey the facilities within their

respective regions, to determine the needs and to suggest programmes of expansion or improvement for consideration by the Coordinating Committee of the Council. The Committees are advised by panels of experts, who visit the institutions concerned and make recommendations.

For development at the post-graduate level and in specialized fields, the Council has appointed special committees to assist it. The Council ensures that there is no unnecessary duplication and that resources in men, money and material are used to the best national advantage.

Vital Recommendation Implemented

At its first meeting held in April-May, 1946, the Council recognised that the provision of facilities at the post-graduate level had been sadly neglected and they were, therefore, extremely limited both in the range of subjects covered and the number of institutions. It, therefore, endorsed the recommendation of the Sarkar Committee that four higher technological institutions should be established, one in each region, to meet the needs of high-grade technical personnel required for the implementation of the various economic development schemes. Further, that each one of these institutions should make provision for post-graduate courses and advanced work and research in a variety of subjects for a large number of students. It was suggested that the total enrolment in each institution should be of the order of 3,000 (2,000 for the first degree courses and 1,000 for the post-graduate courses and advanced work and research). Since, however, owing to difficulties of obtaining requisite staff and equipment, all the institutions could not be started simultaneously, the Eastern Institute, it suggested, should be established first. The Western Institute could be taken in hand concurrently with the Eastern Institute, or failing that as soon after as possible.

Indian Institute Of Technology Is Born

The programme of establishing two higher technological institutions was approved in 1947 but practical difficulties caused delay and the first Institute known as the Indian Institute of Technology, Kharagpur (West Bengal), admitted the first batch of students only in 1951. The Institute has now on its rolls 1,400 students undergoing various courses and doing advanced work and research in 15 Departments.

The fields covered by First Degree courses are (i) Civil Engineering (ii) Mechanical Engineering (iii) Electrical Engineering (iv) Metallurgical Engineering (v) Mining Engineering (vi) Agricultural Engineering (vii) Naval Architecture and Marine Engineering (viii) Geology and Geophysics (ix) Architecture.

The fields covered by Post-graduate courses are (i) Structural Engineering (ii) Hydraulics and Water Power Engineering (iii) Transportation Engineering (iv) Soil Mechanics and Foundation Engineering (v) Design of Electrical Machinery (vi) Mechanical Handling of Materials (vii) Production Technology (viii) Mechanisms and Vibrations (ix) Combustion Engineering and Fuel Economy (x) Advanced Broadcasting Engineering (xi) Technical Gas Reaction and High Pressure Technology (xii) Industrial Physics (xiii) Applied Geology (xiv) Exploration Geophysics (xv) Regional Planning.

A limited number of research scholars and members of the teaching staff are engaged in carrying out investigations in a number of fields in the various Departments of the Institute.

In addition to the normal course, the Institute organises short-term residential study courses for the benefit of personnel already engaged in Government or Industry. So far, such courses have been arranged in Management subjects such as Management Practice, Production Management, Productivity in Industry and Works Management. The courses have proved extremely popular and fruitful.

The Institute also runs a short-term course of three months' duration in Modern Foundry Practice for foundrymen from Government Departments and Industries.

Having regard to the financial provision made for the Institute in the First Five-Year Plan and also the expansion of facilities at the First Degree level in other institutions in the country, the Board of Governors of the Institute decided to restrict the development in the first phase to a total student body of 1,800 as against the original plan of 3,000. Even for the fulfilment of this target, the original financial provision of Rs. 31.4 million for buildings (instructional buildings, staff quarters and students' hostels) and equipment proved inadequate. Up to the end of the financial year 1955-56, a sum of Rs. 33. 4 million had been spent and a further sum of Rs. 20 million has been provided in the Second Five-Year Plan for the same purpose.

The annual budget on items other than buildings and equipment has reached a figure of Rs. 4.7 million and this is expected to increase to approximately Rs. 7.5 million in 1960-61.

International Aid

The international technical cooperation secured for this project deserves special mention. Services of some professors were made available by Unesco under the U.N. Expanded Programme of Technical Assistance and by the United States under the Point Four Programme. Specialized equipment was also received under the above programmes as also from the United Kingdom and Australia under the Colombo Plan. In financial terms, the total assistance received was only a small part of the total expenditure incurred by

the Government itself. It was, however, a significant part and vital for the success of the project as it provided the personnel for organising high level work in subjects for which Indian personnel was not available.

Provision has been made in the Second Five-Year Plan for the establishment of the remaining three higher technological institutions. Unesco has agreed to assist in the establishment of the Western Institute with 18 experts and a substantial amount of equipment from the U.S.S.R. Facilities for advanced work for 20 teachers in institutions of higher learning in the U.S.S.R. will also be provided under this programme. It is expected that further assistance by way of experts and equipment from other countries will be available for this project through Unesco and other agencies and the Institute will start functioning in 1958.

Indian Institute Of Science, Bangalore

The Indian Institute of Science, Bangalore, which was started in 1911 as a centre of pure scientific research has in the last nine years not only improved the Science Departments but has added new Departments in Applied Science and Technology.

The initial establishment of the Institute was due to the foresight and magnanimity of Jamshedjee Tata, who endowed certain properties in Bombay, the income from which went to meet the expenditure on the Institute. Until 1946, the Central Government participated in the running of the Institute with comparatively small grants, when a scheme for the all-round development of the Institute at a cost of Rs. 4 million was sanctioned by the Central Government. This was followed by three more schemes, all financed by the Central Government bringing the total cost to approximately Rs. 17.6 million. The programme included

(a) the improvement and expansion of the Departments of Physics, Chemistry, Chemical Engineering and Technology Electrical Technology and Electrical Communication Engineering ;

(b) the establishment of Metallurgy Department, Internal Combustion Engineering Department, Power Engineering Department, High Voltage Engineering Laboratory and the Department of Economics and Sociology ; and

(c) the development of the Internal Combustion Engineering Department to provide for research in gas turbines and of the Aeronautical Engineering Department to provide for advanced training and research.

The Power Engineering Department of the Institute is the only one of its kind in the country and provides facilities for training and research in the various aspects of electrical power generation, trans-

mission and distribution. This is a provision of great significance in the context of the country's requirements for specialist engineers for power projects. Similarly, the Aeronautical Engineering Department is also the only centre for advanced work and research in Aeronautics and related fields. The facilities in this department have been found to be of great value to the Hindustan Aircraft Factory, which is located at Bangalore. This has been particularly so with the construction of the wind tunnels of various types completed recently. The Internal Combustion Engineering Department has undertaken a number of research schemes sponsored by the Council of Scientific and Industrial Research and has already made significant contributions towards the development of different types of engines.

Nearly 400 post-graduate students and research workers are engaged at present in important work in the various Departments of the Institute.

More recently, on the recommendations of the All-India Council for Technical Education, further development of the Institute to provide the following post-graduate courses and facilities for research have been approved. The Institute is making arrangements for starting these courses soon :

(*i*) *Post-graduate Courses in* (a) Soil Mechanics and Foundation Engineering (b) Automobile Engineering (c) Foundry Engineering (d) Electrical Engineering (e) Electrical Communication Engineering (f) Industrial and Production Engineering and Industrial Administration;

(*ii*) *Research Training in* (a) Internal Combustion Engineering (b) Hydraulic Machines (c) Technical Gas Reactions (d) Physical Metallurgy (e) Radio and Electrical Communication Engineering.

Government Implements Three Schemes

On the recommendation of the Scientific Manpower Committee made in its interim report, the Government of India undertook three important schemes in 1949 which are :

(*i*) the provision of Practical Training Stipends for graduates and diploma holders in Engineering and Technology;

(*ii*) the provision of Research Training Scholarships at Universities and other institutions of equivalent standard; and

(*iii*) the improvement and strengthening of Post-graduate Science Departments in Universities for the provision of research facilities.

Scheme No. 1

It was recognised that practical training should form an integral part of the education of an engineer or a technologist. It was, however, found that the majority of industrial concerns and the Government Technical Departments did not offer adequate opportunities for such training and very few offered stipends during the training period. The young graduate was naturally attracted towards a paid job, however small, and he missed the opportunity of broad-based practical training.

The Government, therefore, decided to institute Practical Stipends for graduates and diploma holders respectively of the value of Rs. 150/- p.m., and Rs. 75/- p.m. A start was made with 250 senior stipends for graduates and 200 junior stipends for diploma holders. The industry does not merely provide the training facilities but contributes towards the expenditure on the payment of stipends. There has been increasing interest in the scheme and with the cooperation of the Industry and the Government Technical Departments, it has been possible to make more or less standing arrangements for the training of 645 graduates and 227 diploma holders at a time.

Scheme No. 2

The Research Training Scholarships were instituted with the twin object of promoting scientific and technological research in the Universities etc. and building up a scientific force for feeding the various National Laboratories, Central Research Institutions, institutions of higher learning, industrial establishments etc. In this case also, a beginning was made with 53 senior scholarships each of the value of Rs. 200/- p. m., and 142 junior scholarships each of the value of Rs. 100/- p.m., the former being available only for post-M.Sc. research. The scholarships were tenable for a period of three years. Subsequently, having regard to the recommendations of the Universities Education Commission regarding the award of M.Sc. degree, it was decided to withdraw the junior scholarships gradually as they fall vacant and to institute in their place, a suitable number of senior scholarships for post-M.Sc. research. Allocations of the available scholarships numbering approximately 600 have been made to the various Universities and comparable institutions, having regard to their capacity to provide the necessary facilities. At the end of the Second Five-Year Plan, it is expected that there will be about 800 scholars working in various Universities and institutions of higher learning in the country under this scheme.

With a view to encouraging brilliant young scholars to engage themselves in research of a high standard, 30 National Research Fellowships were instituted last year for post-doctoral work. The value of each fellowship is Rs. 400/- p.m., and a grant of Rs. 1000/-

per annum is given for any special apparatus or equipment required to carry on research. The plan is to increase the number of National Fellowships to 80 at the end of the Second Five-Year Plan.

Scheme No. 3

It was realized that the grant of Research Scholarships to young students would prove infructuous if the equipment in the laboratories where they were to carry on their research was not simultaneously improved. Selected institutions and Departments of Universities were given the necessary funds to bring about the required improvement. In some cases, new departments were also established. In the formulation of the First Five-Year Plan, the usefulness of this scheme was recognised and a provision of Rs. 12.7 million was made to supplement Rs. 3.7 million spent prior to the Plan. With the establishment of the University Grants Commission in 1953, the tempo of work in this field increased greatly. A total sum of Rs. 22.51 million has been given to the various institutions since the inception of the scheme in 1949.

Non-Governmental Institutions

The post-war development plans for Technical education were ambitious and yet not enough attention had been paid to the requirements of non-Governmental institutions in the various States. The All-India Council for Technical Education saw the danger of such a situation and immediately took up the question of improvement and strengthening of 15 selected non-Government colleges situated in different parts of the country. The Council recommended that these institutions be strengthened at a cost of Rs. 16.2 million and the entire responsibility for this development be taken over by the Central Government. In addition, loans for the construction of hostels for students and maintenance grants for improving salary scales of teachers were also recommended. The scheme deserves special mention as it was the first of its kind relating to development of Engineering and Technological education in the States, for which the Central Government agreed to give *direct* grants in a big way. It laid more or less the foundation for greater activity in the field by the Central Government later during the period of the First Five-Year Plan. Apart from bringing about qualitative improvement in the institutions concerned, it enabled their intake to be increased by nearly 50 per cent.

The following institutions received grants under the scheme: (1) College of Engineering and Technology, Jadavpur; (2) Victoria Jubilee Technical Institute, Bombay; (3) College of Engineering, Banaras Hindu University, Banaras; (4) College of Mining and Metallurgy, Banaras Hindu University, Banaras; (5) College of Technology, Banaras Hindu University, Banaras; (6) Department of Applied Physics, Calcutta University, Calcutta; (7) Department

of Radio-Physics and Electronics, Calcutta University, Calcutta; (8) Department of Applied Chemistry, Calcutta University, Calcutta ; (9) Alagappa Chettiar College of Technology, Madras University; (10) Jeypore Vikram Deo College of Science and Technology, Andhra University ; (11) Luxminarayan Institute of Technology, Nagpur University ; (12) Dayalbagh Engineering College, Agra ; (13) College of Engineering and Technology, Muslim University, Aligarh; (14) Department of Chemical Technology, Bombay University ; (15) Engineering College, Annamalai University.

DEVELOPMENT UNDER THE FIVE-YEAR PLANS

The problem of food shortage loomed large in the country, when the First Five-Year Plan was being formulated and the industrial development programme drawn up after the war had to be slowed down to meet this problem. Despite this fact, the Plan made substantial provision for the improvement and expansion of Technical education.

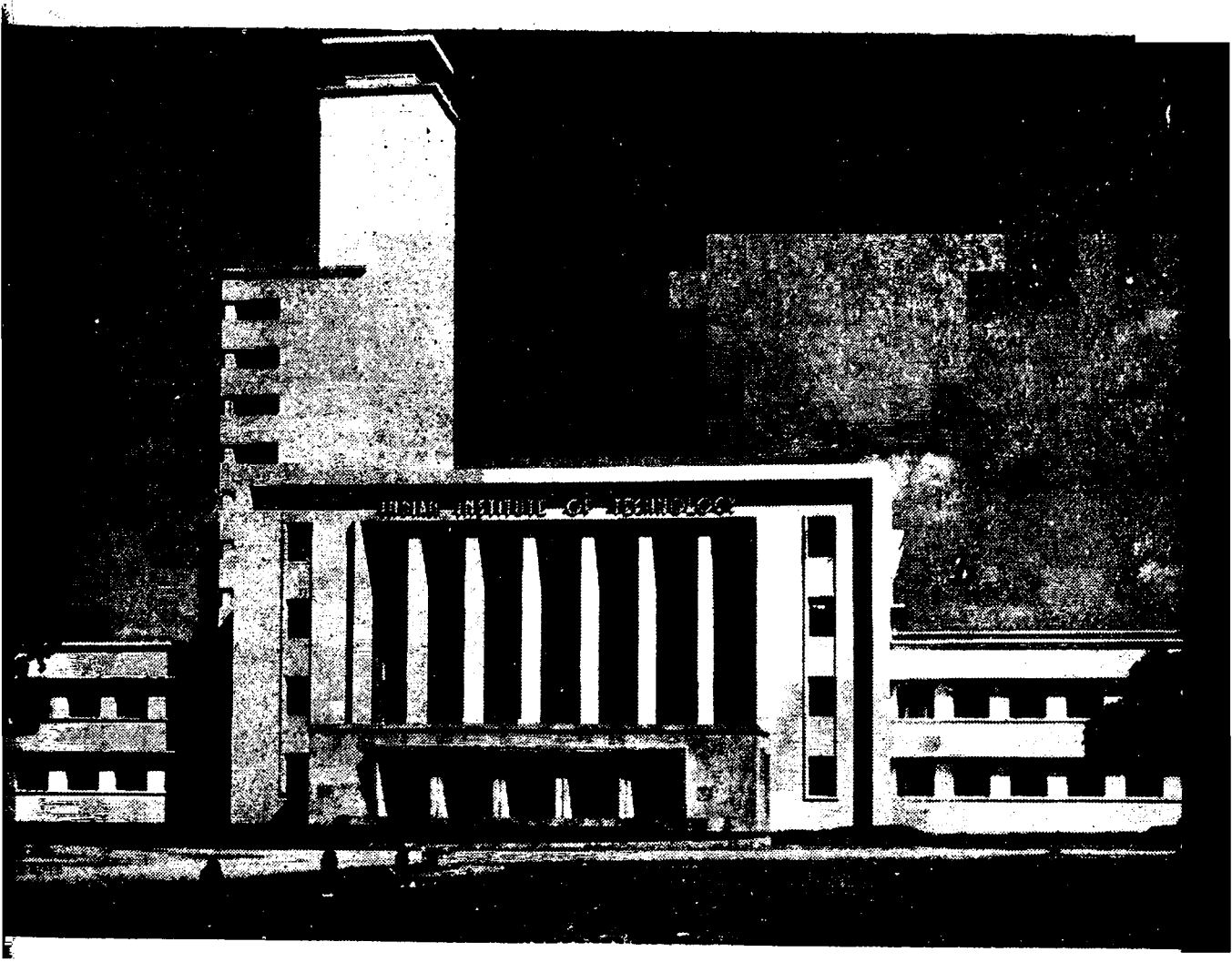
Faced with the situation, namely that of a large number of institutions set up in the post-war period and the intake of others greatly increased without a corresponding increase in building space, equipment and staff, the All-India Council for Technical Education suggested that generally the policy at the first degree and the diploma levels should be to make proper provision of facilities—both physical and instructional—rather than to carry out any further expansion in numbers. The Council, however, recognised that at the post-graduate level and in the provision of courses in specialized subjects, a great deal would require to be done as available facilities were extremely limited and in certain subjects non-existent. The Council also recommended an extensive programme of loans to various institutions for the construction of students' hostels.

The Five-Year Plan, therefore, provided for the completion of the developmental programmes already undertaken, continuance of schemes initiated on the recommendations of the Scientific Manpower Committee and the new schemes recommended by the All-India Council for Technical Education as enumerated above.

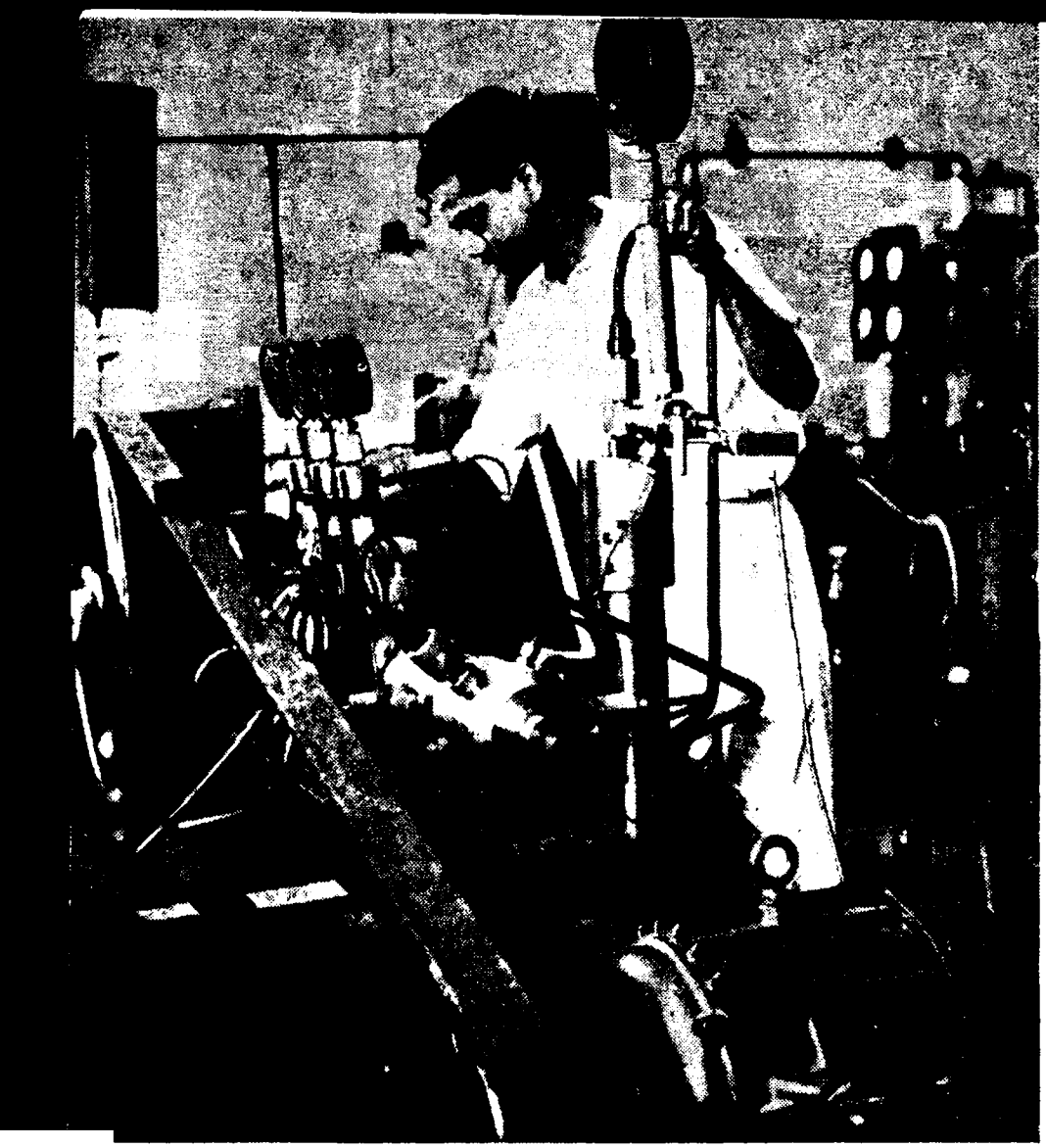
Provision of More Post-Graduate Courses

At the post-graduate level, a Special Committee of the All-India Council for Technical Education surveyed the existing facilities, and after taking into account the developmental programmes of the country necessitating training at the advanced level, made its recommendations for further provision of such courses. In doing so, the Committee considered the condition of each institution and particularly the staff position.

On the recommendations of this Special Committee, the Council has so far approved the introduction of courses in 30 subjects



The first of higher technological institutes: The Indian Institute of Technology, Kharagpur

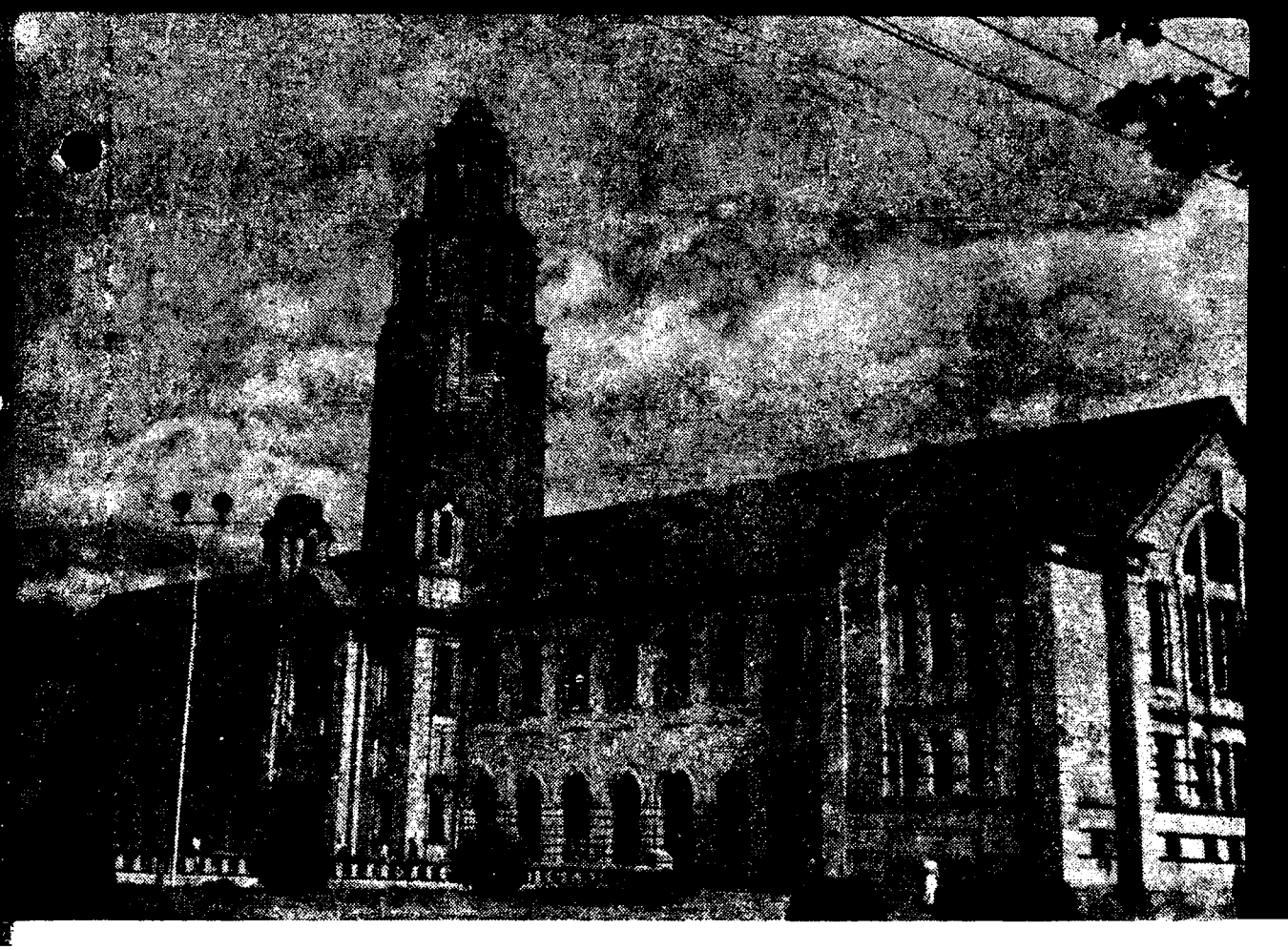


RESEARCH

in the laboratory

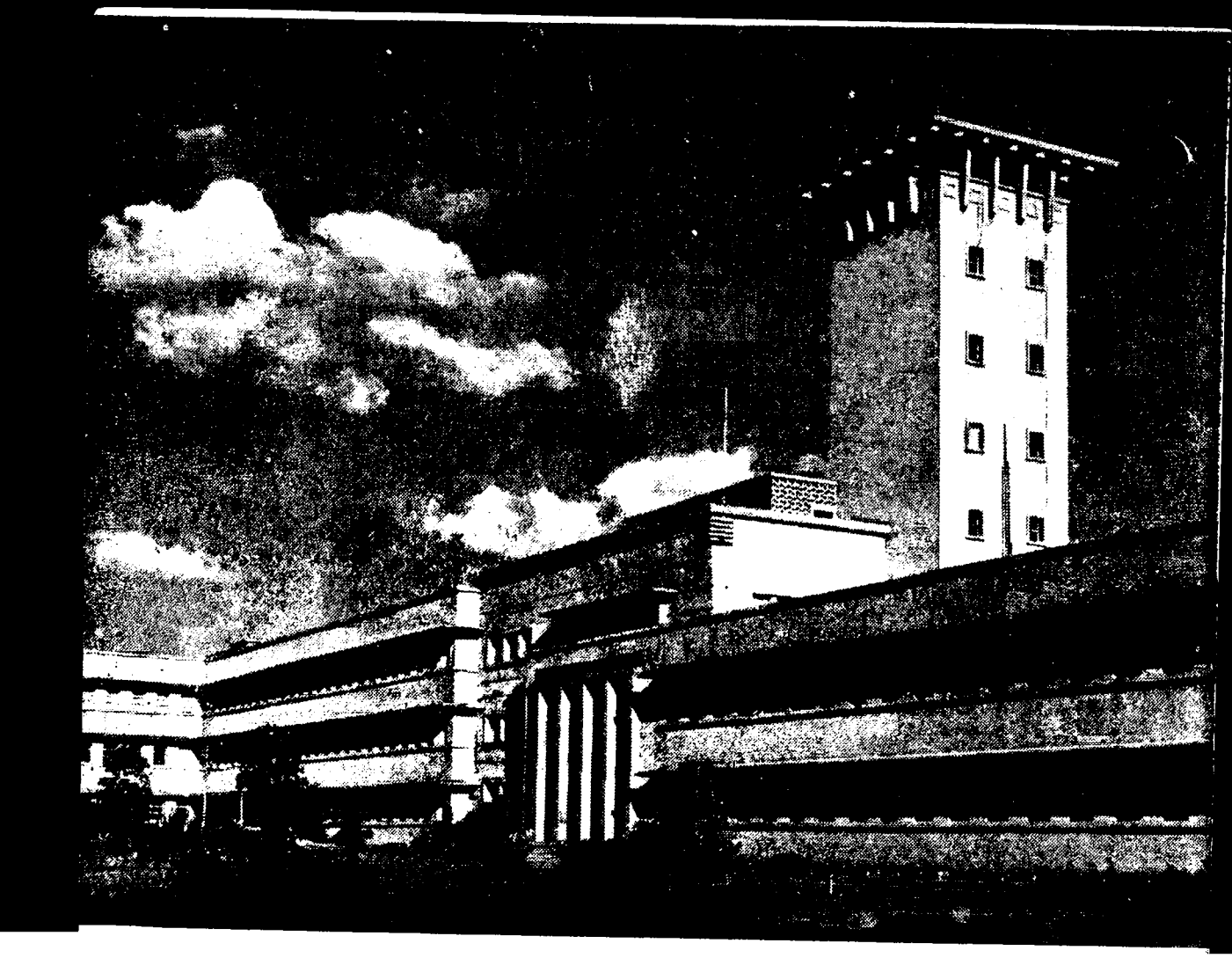
and

in the field (Kharagpur Institute)



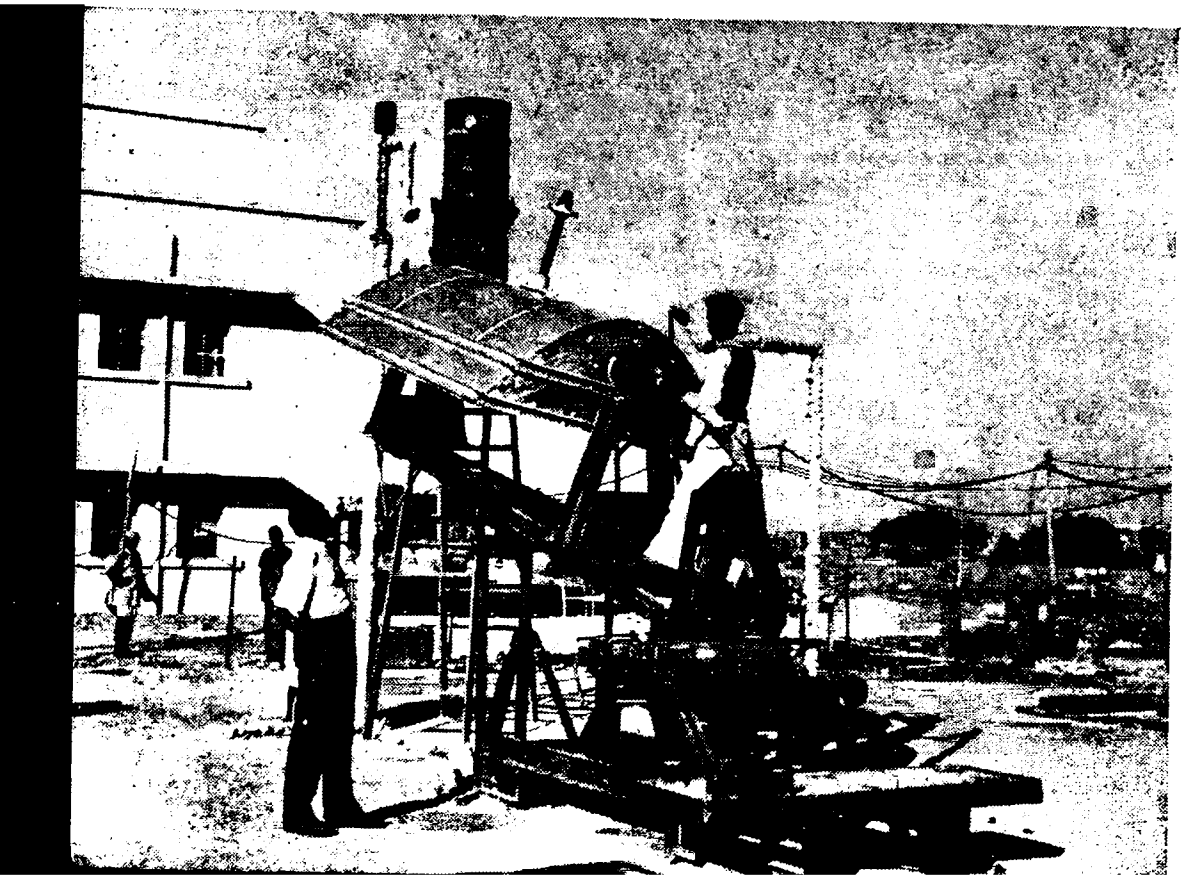
'The Indian Institute of Science, Bangalore, was first started in 1911 as a centre of pure scientific research....'

A research scholar



The National Physical Laboratory (NPL), Delhi—one of the 14 laboratories established in the country since Independence

Harnessing solar energy



at 15 selected institutions. A list of the subjects and the names of the institutions where courses are being organised is given below:—

Subject	Institution
1. Highway Engineering	1. Punjab Engineering College, Chandigarh. 2. Indian Institute of Technology, Kharagpur.
2. Dam Construction, Irrigation Engineering and Hydraulics	1. Indian Institute of Technology, Kharagpur. 2. Roorkee University, Roorkee. 3. College of Engineering, Poona, in association with CWPC Research Station, Poona. 4. College of Engineering, Guindy, Madras.
3. Foundation Engineering and Soil Mechanics	1. Indian Institute of Technology, Kharagpur. 2. College of Engineering, Guindy, Madras. 3. University of Roorkee, Roorkee. 4. Bengal Engineering College, Sibpur. 5. College of Engineering, Poona. 6. Indian Institute of Science, Bangalore.
4. Structural Engineering including Concrete Technology	1. College of Engineering, Guindy, Madras. 2. College of Engineering, Poona. 3. Bengal Engineering College, Sibpur. 4. University of Roorkee in association with the Building Research Institute.
5. Agricultural Engineering: (*a*) Soil & Water Conservation (*b*) Farm Power & Machinery	1. Indian Institute of Technology, Kharagpur.

	Subject	Institution
6.	Public Health Engineering	1. College of Engineering, Guindy, Madras. 2. University of Roorkee, Roorkee.
7.	Advanced Ship Hydro-dynamics	1. Indian Institute of Technology, Kharagpur.
8.	Automobile Engineering	1. Victoria Jubilee Technical Institute, Bombay. 2. Indian Institute of Science, Bangalore.
9.	Mechanical Handling of Materials	1. Indian Institute of Technology, Kharagpur.
10.	Prime Movers	1. Bengal Engineering College, Sibpur.
11.	Applied Thermodynamics	1. University of Roorkee, Roorkee.
12.	High Voltage Engineering	1. Indian Institute of Science, Bangalore.
13.	Electrical Measurements and Measuring Instruments	—do—
14.	Transmission, Distribution and Network Practice	—do—
15.	Electrical Machines Design	1. Bengal Engineering College, Sibpur. 2. L.D. College of Engineering, Amedabad. 3. College of Engineering, Guindy, Madras. 4. Engineering College, Banaras Hindu University, Banaras. 5. University of Roorkee, Roorkee.
16.	Advanced Electronics	1. College of Engineering, Poona. 2. Birla Engineering College, Pilani in association with the National Electronics Research Laboratory. 3. Indian Institute of Science, Bangalore. 4. Institution of Radio Physics and Electronics, Calcutta University.

	Subject		Institution
		5.	Government Engineering College, Jabalpur.
17.	Carrier & V.F. Telephone Engineering	1.	Government Engineering College, Jabalpur (in extension of the course in Advanced Electronics)
18.	Advance Line Communication.	1.	Indian Institute of Science, Bangalore.
		2.	Indian Institute of Technology, Kharagpur.
19.	Advanced Broadcasting Engineering.	1.	Indian Institute of Science, Bangalore.
		2.	Indian Institute of Technology, Kharagpur.
20.	Ultra-short and Micro-Wave Engineering	1.	Indian Institute of Science, Bangalore.
		2.	Indian Institute of Technology, Kharagpur.
21.	Advanced Electro-Accoustical Engineering.	1.	Indian Institute of Science, Bangalore.
		2.	Indian Institute of Technology, Kharagpur.
22.	Mining Engineering	1.	College of Mining and Metallurgy, Banaras Hindu University.
		2.	Indian School of Mines and Applied Geology, Dhanbad.
23.	Advanced Metallurgy (with emphasis on Engineering aspects)	1.	Bengal Engineering College, Sibpur.
		2.	College of Mining and Metallurgy, Banaras Hindu University.
		3.	College of Engineering, Poona.
24.	Foundry Engineering	1.	Indian Institute of Technology, Kharagpur.
		2.	Indian Isntitute of Science, Bangalore, in association with the Hindustan Aircraft Ltd.

Subject	Institution
25. Advanced Textile Technology	1 Victoria Jubilee Technical Institute, Bombay.
26. Harbour Engineering	1. Indian Institute of Technology, Kharagpur.
27. High Polymers and Rubber Technology	—do—
28. Paper Technology	—do—
29. Advanced Naval Architecture	—do—
30. Industrial Physics	—do—

Detailed schemes formulated by the institutions for 35 courses out of the above have been sanctioned at a cost of Rs. 7.17 million non-recurring and Rs. 1.04 million ultimate annual recurring. Apart from financial assistance, the Government is assisting in securing under the Technical Aid Programmes, the services of professors of high calibre to organise and run the courses for some time. It is expected that within the next two years, all the courses planned will have been started at the selected institutions.

Management Studies

A Board of Management Studies was set up under the aegis of the All-India Council for Technical Education for bringing about coordinated development of Management Studies on an all-India basis. On the recommendations of the Board, seven centres selected on a regional basis are being specially developed for courses in the different branches, viz., Industrial Engineering, Industrial Administration and Business Management.

The centres concerned and the courses are as follows :—

Course	*Duration*	*Admission requirements*	*Centres*
National Diploma in Business Management	1 year full-time or 3 years part-time.	Degree in Arts and Commerce with at least two years experience in Business (Academic requirements could be relaxed for the part-time course).	1. All-India Institute of Social Welfare and Business Management, Calcutta. 2. Delhi School of Economics, Delhi University. 3. School of Economics and Sociology, Bombay University. 4. Department of Economics, Madras University.

Course	*Duration*	*Admission requirements*	*Centres*
National Diploma in Industrial Engineering	1 year full-time or 3 years part-time.	Degree in Engineering, Technology or equivalent qualifications with at least two years' experience.	1. Indian Institute of Technology, Kharagpur. 2. Victoria Jubilee Technical Institute, Bombay. 3. Indian Institute of Science, Bangalore.
National Diploma in Industrial Administration	—do—	—do—	—do—

While the provision of both part-time and full-time courses will be the ultimate aim, the institutions with the exception of the Indian Institute of Technology, Kharagpur, will, in the first instance, organise only part-time courses and after gaining sufficient experience and ensuring necessary staff, they will later organise full-time courses. The Indian Institute of Technology will offer full-time courses for which it has organised the necessary facilities.

Grants totalling Rs. 9,50,000 non-recurring and Rs. 3,00,000 have been approved for the above purpose. The Delhi School of Economics, the All-India Institute of Social Welfare and Business Management, Calcutta, the Madras University and the Bombay University have started course in Business Management in close collaboration with industry and commerce. The Kharagpur Institute has organised a course in Industrial Engineering and Industrial Administration. The Indian Institute of Science, Bangalore, and the Victoria Jubilee Technical Institute, Bombay, are making necessary arrangements and are expected to start the course in the near future.

The Board of Management Studies has drawn up a scheme for training in Foremanship and Supervision in the form of a network covering all the important industrial centres.

A Planning Committee under the Chairmanship of the Union Minister for Commerce and Industry submitted a plan for the establishment of (*i*) an Administrative Staff College, and (*ii*) a National Management Association. The former will be on the lines of the Administrative Staff College at Henley in U.K., and will provide three months' courses in the principles and techniques of organization, administration and leadership. It will also provide opportunities to young administrators in the different walks of national life to meet and exchange ideas to their mutual advantage. The National Management Association on the other hand will be the professional body in the field. It is hoped that the two organisations will start functioning soon.

Printing Schools

Regional Schools of Printing are being established in Madras, Calcutta, Allahabad and Bombay in association with the State Governments concerned and the printing industry. Each School is being designed to cater for a total student strength of 200 for the National Certificate and Advanced Certificate Course in the different branches of Printing Technology, in accordance with a scheme prepared by the All-India Board of Technical Studies in Applied Art. An important feature of the scheme is that persons employed in the industry can take the courses on a part-time basis. The Madras School has begun the course and has admitted 78 candidates, from the different States which comprise the Southern region. The Calcutta School has made good progress in respect of buildings and equipment and the courses are expected to start this year. Arrangements are being made for starting the Allahabad and Bombay Schools.

Each School is estimated to cost Rs. 9,00,000 for buildings and equipment and Rs. 1,40,000 recurring. The Central Government has agreed to bear up to 50% of the above cost and the balance will be provided by the State Governments concerned in conjunction with the printing industry. Each School will cater for the students of the States within its area. Admission for the course will be on the basis of 50 per cent of the seats for the students of the State in which the School is located and the balance for the students of the rest of the States.

In view of the fact that the printing industry is developing fast and that there is an acute shortage of technical personnel, it has been decided to establish a fifth school at Delhi, which will form a part of the Delhi Polytechnic.

It is proposed that after all the Regional Schools have been fully established, they should be developed for courses at a higher level, *viz.*, National Diploma in Printing Technology for the training of the executive cadre of personnel for the printing industry.

School of Town and Regional Planning

A Central School of Town and Regional Planning has been established at Delhi in association with the Institute of Town Planners, which has agreed to provide free services of it members to work as teachers, thus reducing the recurring charges for the working of the School. The first course was started in the premises of the Delhi Polytechnic in August, 1956.

Prior to the First Five-Year Plan, only a small number of selected institutions at the first degree level had been assisted for their improvement. The All-India Council for Technical Education suggested that during the Plan period, all the institutions in the country providing courses not only at the first degree level but at

the diploma level also, should be covered and their improvement brought about in collaboration with the State Governments. In process of making proper provision of buildings, equipment and staff so as to maintain the standards, it became necessary to reduce the intake into some of the existing institutions, there should be no hesitation in bringing about this reduction. With the aid of expert committees, the Council laid down the standards of accommodation, equipment and staff to which the various institutions should be brought up.

Assessment Conducted

The Regional Committees of the All-India Council for Technical Education carried out an assessment of the requirements of 93 institutions out of a total of 156 providing courses for degree and diploma courses. Schemes involving a total expenditure of approximately Rs. 75 million non-recurring and Rs. 4.6 million recurring were recommended by the Council.

By holding out a promise of substantial grants, the Central Government was able to bring about the improvement of 25 insti tutions at the degree level and 48 at the diploma level during the First Five-Year Plan period.

Schemes of hostels costing Rs. 20 million were also approved. Loans were promised by the Central Government for this purpose. The loans were interest-free and returnable over a period of 33 years. When the hostels are completed, they will provide accommodation for over 7,000 additional students in different parts of the country.

Industry and Education Work Together

The Industry and the Education authorities were never so close to each other as during the post-independence period, which witnessed a phenomenal growth in Technical education. The Education authorities recognised the necessity of having representatives of the Industry on their Governing Bodies and Advisory Committees so as to get a clear idea of the needs of the employers of their products, which would enable them to orientate their courses and make them useful. Industry, on the other hand, took an increasing interest in the education and training of the young engineer, gave valuable advice on the curriculum contents and provided more and more practical training facilities within the workshops and factories.

The need to find a place for liberal education in technical studies was also recognised more than ever before. In the curricula for Engineering Studies, Humanities were introduced in a number of institutions, with a view to ensuring that those who are to occupy responsible positions in Industry and Government Technical

Departments emerge from their education with a broad outlook. It was recognised that Technical education goes for beyond the study of materials and mechanics; that a wider understanding of how the economy of a country works is necessary. Subjects such as Economics, Business Management and Human Relations were, therefore, duly emphasised.

General Assessment

The following tables indicate the rate, at which facilities for Technical education have grown in the country over the period 1947-55:

A. Engineering Studies

	1947	1950	1951	1952	1953	1954	*1955
(i) Degree level							
Number of institutions ..	28	37	41	42	42	42	43
Output (i.e., number passing out final examination)	950	1,700	2,163	2,426	2,286	2,602	3,000
Intake (i.e., number joining 1st year class) ..	2,520	3,337	3,893	4,209	4,436	4,457	5,000

*Estimated

	1947	1950	1951	1952	1953	1954	*1955
(ii) Diploma level							
Number of institutions ..	41	61	64	65	66	70	83
Output ..	1,150	2,146	2,257	2,332	2,505	2,982	3,472
Intake ..	3,150	5,350	5,485	5,786	6,550	7,619	8,000

*Estimated

B. Other Technologies

	1947	1950	1951	1952	1953	1954	*1955
(i) Degree level							
Number of institutions ..	16	24	25	25	25	25	25
Output ..	320	498	530	530	594	605	700
Intake ..	420	782	895	975	1,014	1,011	1,050

*Estimated

	1947	1950	1951	1952	1953	1954	*1955
(ii) **Diploma level**							
Number of institutions ..	20	31	36	36	36	36	36
Output ..	290	332	369	323	242	415	428
Intake ..	520	553	731	713	663	694	700

*Estimated

It will be observed from the above that the annual output of Engineering graduates and diploma holders increased during the period 1947-55 to three times what it was in 1947. The annual intake increased by approximately 100 % in the degree courses and by 150 % in the diploma courses.

In other technologies, the increase has not been as great and yet considerable. While the annual output at the degree level increased by about 120 %, the intake increased by about 150 %. The corresponding figures for the diploma courses were only 47% and 35 % respectively.

Phenomenal Expansion

The expansion during these years has been phenomenal. Yet for a vast country with a fast developing industrial economy, a great deal remains to be done.

The position in respect of the large demand for technical personnel that will arise in the years ahead for the execution of the Second Five-Year Plan is indeed a difficult one. It has been rendered difficult by the lack of advance planning of manpower. Increasing attention is being paid to this problem and it is hoped that by measures calculated to provide quick and effective results, the situation will be met. Care has, however, to be taken to see that there is no falling off in standards at the full-fledged degree or diploma courses. Nothing can be more disastrous than that inadequately trained and ill-equipped engineers and technicians should be produced by technical institutions.

The Second Five-Year Plan provides for an outlay of Rs. 487 million on development of Technical education as against approximately Rs. 230 million in the First Plan. Apart from the establishment of three higher technological institutions and further development of the Indian Institute of Science, Bangalore, the other important schemes include the expansion of training facilities at the Delhi Polytechnic, establishment of six new Engineering Colleges and 21 new institutions at the diploma level. Provision has also been made for a larger number of Practical Training Stipends and Research Training Scholarships, refresher courses for technical teachers, establishment of Junior Technical Schools for the age group 14-17 and Schools of Industry for instruction of apprentices and workers of

industry. As a result of these developments, the output of graduates and diploma holders from the various institutions is expected to reach a figure of 5,700 and 6,800 respectively per year in 1960-61.

Engineering Personnel Committee

In September 1955, the Planning Commission appointed an Engineering Personnel Committee to make a general assessment of the shortages of supervisory and higher grades of engineering personnel anticipated at the end of the First Five-Year Plan and to estimate the probable requirements in these grades for implementing the Second Five-Year Plan in the principal fields of national development.

After taking into account the programme formulated by the various States and the Central Government for the Second Plan, the Personnel Committee has come to the conclusion that it will be necessary to establish 18 more Engineering Degree Colleges and 62 institutions at the diploma level. Establishment of new institutions naturally takes time. The Personnel Committee, therefore, recommended that the intake into the existing institutions should be increased by 20 to 25 per cent. All-India Council for Technical Education is working out a plan for increased admissions as also for the location of new institutions in the different parts of the country. It is estimated that an additional outlay of approximately Rs. 160 million will be necessary on this account.

With all these developments, that have occurred and are contemplated in the near future, the question is: "Have we done and planned for enough in this important field of training of technical personnel ?"

The answer to this question is not easy. Faced with the rapid technological advances taking place in different parts of the world and the swiftly developing economy of this country, it is almost impossible to be precise quantitatively or qualitatively in the matter of requirements of personnel. The need for a permanent machinery that will review from time to time the requirements of trained personnel has been emphasised by the Engineering Personnel Committee and it is hoped that very soon such a machinery will come into existence. As the Prime Minister has said, the approach to this problem has to be comprehensive, integrated and dynamic. Training of personnel takes time and therefore forward planning is more necessary in this than in any other field. A comparison of figures of engineers trained in the more progressive countries of the world like the U.S.A., U.S.S.R. and U.K. clearly indicates the efforts that India must yet make to lay the foundations of an industrial economy.