No. 27

National science policy and organization of scientific research in India

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The Unesco series "Science policy studies and documents" forms part of a programme "to collect, analyse and disseminate information concerning the organization of scientific research in Member States and the policies of Member States in this respect", authorized by resolution 2.1131 b, adopted by the General Conference of Unesco at its eleventh session in 1960 and confirmed by similar resolutions at each subsequent session.

This series aims at making available to those responsible for scientific research and development throughout the world factual information concerning the science policies of various Member States of the Organization as well as normative studies of a general character.

The country studies are carried out by the governmental authorities responsible for policy making in the field of science in the Member States concerned.

The selection of the countries in which studies on the national scientific policy are undertaken is made in accordance with the following criteria: the originality of the methods used in the planning and execution of the national science policy, the extent of the practical experience acquired in such fields and the level of economic and social development attained. The geographical coverage of the studies published in the series is also taken into account.

The normative studies cover planning of science policy, organization and administration of scientific and technological research and other questions relating to science policy.

This same series also includes reports of international meetings on science policy convened by Unesco.

As a general rule, the country studies are published in one language only, either English or French, whereas the normative studies and the reports of meetings are published in both languages.

The present study on the national science policy and the organization of research in India was prepared under a contract with Unesco by the Council of Scientific and Industrial Research of India. Overall supervision of the study was carried out under the responsibility of the Committee on Science and Technology, Cabinet Secretariat, by Dr. B.D. Nag Chaudhuri Chairman, and Dr. V. Ranganathan, Secretary. The study reflects the situation of research as of October 1970, with statistical data relating to 1969 and previous years.

The general plan is as follows:

Part I gives the historical background of scientific development in India.

Part II deals with the organization of scientific and technical research in the Republic and States, both in the public and private sectors, together with institutional structures and operational links.

Part III contains information on financing of scientific and technical research.

Part IV is concerned with human resources in science and technology, their main qualifications and status.

Part V describes the principal aims of national science policy, drawing attention especially to the scientific policy resolution adopted by the Government in 1958.

Part VI relates to political structure and provides basic socio-economic data.

Annexes give the lists of higher education establishments, scientific and learned institutions, research organization, etc... Tables, diagrams and figures at the end of the publication illustrate and supplement information given in the different chapters of the study.

Responsibility for the facts presented and opinions expressed rests with the authors.

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NOTE: In this study, the following units are sometimes used: 1 crore : 10,000,000 1 lakh : 100,000
PART I

HISTORICAL BACKGROUND OF SCIENTIFIC DEVELOPMENT
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India’s contributions in the field of science during the earlier part of her history are well known. The contributions of Aryabhata, Susruta, Varahamihira, and Bhaskara are important landmarks in the history of science. However, there was a sudden break in scientific achievements after the twelfth century due to various historical factors; although in certain areas, such as astronomy, the tradition continued and resulted in the setting up of observatories at Jaipur and Delhi.

Science in the modern sense took root in India in the eighteenth century. The establishment of the Asiatic Society of Bengal by Sir William Jones in 1784 was an outcome of the interest created at that time in scientific research. The Society has since then played a prominent part in the development of scientific activities in India.

During the nineteenth century a number of organizations were set up for encouraging scientific work in various disciplines such as zoology, botany, anthropology, mathematics, physics, chemistry, meteorology, geology, medical science, etc. The Trigonometrical Survey (1800), the Geological Survey (1851), the Archaeological Department (1862), the Indian Museum (1866), the Indian Coastal Survey (1875), India Meteorological Department (1875), the Botanical Survey (1890) and the other periodical surveys opened up vast and previously almost untouched fields for investigation. Medical colleges were started in Madras and Calcutta in 1835 and in Bombay in 1845. Scientific work was also carried out by medical men, engineers and civilians working in defence establishments, in their spare time. A number of basic monographs on various scientific subjects were published.

Medical research was placed on an organized basis in 1859 when Dr. Lewis and Dr. Cunningham initiated a systematic research on cholera, malaria, beri-beri and kala-azar. The Haffkine Institute was started in 1899 as the Plague Research Laboratory, and gradually expanded its activities to include antirabic, pharmacological and biochemical research.

Research work in agriculture and veterinary science was mostly done in the various provincial departments of agriculture. Agricultural departments were set up in Bombay (1885), Madras (1889), Shillong (1894), Allahabad and Nagpur (1895), and Bengal (1896). The Imperial Bacteriological Laboratory was established in Poona in 1889 for veterinary research and was moved to Mukteswar in 1893, where it later became the Indian Veterinary Research Institute.

The Indian Association for the Cultivation of Science was the first research centre to be established through private munificence. It was founded in 1876 by Dr. Mahendra Lal Sircar for the propagation of science through public lectures, and later became an important centre for physical research, culminating in the discovery of the Raman Effect.

Early in the twentieth century the Government of India established a number of important research institutes. The Imperial Agricultural Research Institute (1905) was set up in Pusa, Bihar. The Central Research Institute for Medical Research (1905) in Kasauli, the Forest Research Institute (1906) in Dehra Dun, the King Institute of Preventive Medicine (1903) in Madras, and the Pasteur Institute (1907) in Coonoor were some of the important institutes established for carrying out applied research in various fields. For the prosecution and assistance of research relating to the causes and prevention of diseases, the Government of India in 1911 established the Indian Research Fund Association which later became the Indian Council of Medical Research.

The Indian Science Congress was inaugurated in 1914, with Sir Asutosh Mookerjee as its first President; the Asiatic Society of Bengal was asked to undertake the management of this new organization. The Congress has played a prominent role since then in providing a forum for Indian scientists to meet and discuss every year the results of their research work.

The Zoological Survey of India was set up in Calcutta in 1916.

The Bose Institute was established in Calcutta in 1917 by Sir Jagdish Chandra Bose. It is famous for its pioneering work in biophysical research.

Other applied research institutes established during this period included the Cotton Technological Research Laboratory (1924) in Bombay, the Institute of Plant Industry (1924) in Indore, the Indian Lac Research Institute (1925) in Ranchi, the Toklai Experimental Station in Assam for Research on Tea (1911), and the Dairy Research Institute at Bangalore (1923). As a result of the recommendations of the Linlithgow Commission, the Imperial Council of Agricultural Research, which later became the Indian Council of Agricultural Research,

The British Government set up the Royal Commission on Agriculture in India under the Chairmanship of Lord Linlithgow in 1926, to examine the condition of agriculture and rural economy and to make recommendations for the improvement of agriculture and the promotion of the welfare and prosperity of the rural population, including the promotion of: agricultural and veterinary research, experiments, demonstrations and education; compilation of agricultural statistics; introduction of new and better crops; and improvement in agricultural practice, during farming and breeding of stock. The final report was submitted in 1928.
were established between 1921 and 1947 with pro-
British to Indian control. Nine more universities
universities within each province.

The first Academy of Sciences, then known
as the United Provinces Academy of Sciences, was
set up at Allahabad in 1930; it later became the
National Academy of Sciences, The Indian Academy
of Sciences was started at Bangalore in 1934. To
meet the still-felt desire for a central academy of
sciences on the pattern of the Royal Society of
London, the National Institute of Sciences of
India was inaugurated in Calcutta in 1935. In 1945, the
Government of India declared the National Institute
of Sciences to be the premier scientific society in
the country, and the headquarters was shifted to
Delhi in 1947. It was renamed as the Indian Nation-

Indian science began to make an impact on the
international scene; the outstanding contributions
of S. Ramanujan, P. C. Ray, C. V. Raman, Jagdish
Chandra Bose, M. N. Saha, Birbal Sahni, K. S.
Krishnan, H. J. Bhabha, S. S. Bhatnagar, P. C.
Mahalanobis, Satyen Bose, S. Chandrasekhar,
P. Maheshwari, D. N. Wadia, S. K. Mitra, T. R.
Seshadri, C. R. Rao, M. G. K. Menon, J. V. Narlikar,
H. G. Khurana, brought laurels to the scientists
and international recognition to scientific work in
India.

Ancient India had well-known universities such as
Nalanda and Vallabhi, which attracted famous
scholars from all over the country. As a result of
various historical developments, the traditions es-
tablished by these universities did not survive.
Modern universities were established in 1857 at
Bombay, Calcutta and Madras, as institutions pat-
terned on London University. They started purely
as examining bodies and continued to be so until
the beginning of the twentieth century. They were
followed by two more universities, one at Lahore
in 1882 and the other at Allahabad in 1887.

In 1902, the Indian Universities Commission
was appointed and the Indian Universities Act was
passed in 1904. The Government of India Resolu-
tion on Educational Policy (1913) recommended a
separate university for each of the leading pro-
vinces and the creation of teaching and residential
universities within each province. Six new univer-
sities were established between 1913 and 1921 -
Banaras and Mysore (1916), Patna (1917), Osmania
(1918), Aligarn (1920) and Lucknow (1921). Lucknow
University was established as a teaching, unitary
and largely residential university.

After 1921, education was transferred from
British to Indian control. Nine more universities
were established between 1921 and 1947 with pro-
vision for teaching and research, following the
recommendations of the Sadler Commission Report
on Calcutta University published in 1913. They
were mostly of a unitary type. The older universi-
ties introduced teaching and research by establishing
chairs in physics, chemistry, botany and zoology.
Some of the universities, including Calcutta,Banaras,
Bombay, also established chairs in applied sciences.

The entire field of university education was re-
viewed soon after Independence (1947) by an Edu-
cation Commission headed by Dr. S. Radhakrishnan;
its recommendations, which have since been im-
plemented, had considerable impact on the growth
of the universities. A later Education Commission,
appointed by the Government of India in 1964 under
the chairmanship of Dr. D. S. Kothari, submitted
its report on 29 June 1966 which has provided the
basis for widespread discussion at all levels, re-
garding the educational reconstruction of the country.

The establishment of a University Grants Com-
mission in 1953, on the lines of the United Kingdom
University Grants Committee, had considerable
effect on the expansion of facilities for teaching
and research in universities through its research
projects, fellowship programmes, proposals for
advanced centres for research and grants for equip-
ment. The Commission is generally responsible
for the co-ordination and maintenance of standards
in higher education. It meets the entire expendi-
ture of the central universities, such as the Aligarh
Muslim University, Banaras Hindu University,
Delhi University, Nehru University and the Visva
Bharati University. It also provides financial sup-
port to universities and colleges for development
programmes and improving the quality and stand-
ards of teaching, examinations and research.

Grants are paid not only to statutory universities
but also to institutions deemed to be universities
under Section 3 of the University Grants Commis-
sion Act, 1956, for maintenance and development.
The total number of universities is now 83 and the
number of institutions deemed to be universities
is 10 (see Annex I).
The Commission has started a number of "Centres of Advanced Study" in Indian universities, in special fields of astronomy, botany, chemistry, geology, mathematics, physics, zoology, etc. At present there are seventeen Centres of Advanced Study in Science (see Annex I). These centres which are intended to encourage the "pursuit of excellence" and to raise standards at the postgraduate and research levels, function on an all-India basis and provide conditions and facilities attractive to scientists of outstanding ability and qualifications. Summer schools and seminars are held periodically at these centres to enable teachers and research workers to acquaint themselves with the latest developments in their respective fields of work.

Technical education

The All-India Council for Technical Education was established by the Government of India in 1946 to advise on all aspects relating to the improvement and co-ordinated development of technical education. The Scientific Manpower Committee was constituted in 1947 to assess the requirements for various categories of scientific and technical personnel and to recommend appropriate measures.

The All-India Council, after carrying out a comprehensive survey of technical institutions in the country, formulated a scheme for their immediate improvement and development, to be financed by the Central Government. It also set up Boards of Technical Studies in various fields to prepare courses for various levels of training which could serve as a guide for the institutions and facilitate reorganization of technical education in the country. Four regional committees were set up to survey the needs on a regional basis, to formulate and implement development programmes in a co-ordinated manner and to help in the establishment of liaison between industry and technical institutions. A certain awareness of the importance of technical education to national development had already been established by the time India attained independence in 1947.

Institutes of technology

An important step taken by the Central Government to develop facilities within the country for advanced technological training and research was to establish five higher technological institutions. The concept behind the institutions is to make provision for training the highest possible grades of technologists in a fairly large number. The Indian Institute of Technology, Kharagpur, the first of the five, started functioning in 1951. The Indian Institutes of Technology at Bombay, Madras, and Kanpur admitted their first batches of students in 1958, 1959 and 1960 respectively. The College of Engineering and Technology established in Delhi in 1959 was raised to the status of an Indian Institute of Technology in 1961.

Regional engineering colleges

There are 14 regional engineering colleges set up with UNDP assistance. Seven of these colleges have introduced industrially oriented post-graduate courses in selected branches of engineering and technology in co-operation with industry.

National Council of Education Research and Training

The National Council of Educational Research and Training, established in 1961, was entrusted with the tasks of: (i) undertaking, aiding and promoting research in all branches of education; (ii) organizing advanced pre-service and in-service training and disseminating improved techniques and practices; (iii) organizing extension services for institutions engaged in educational research and training of teachers; and (iv) developing and improving multipurpose secondary education. The Council has ten departments covering basic education, adult education, science education, audio-visual education, teacher education, curriculum evaluation, psychological foundations, educational administration, foundations of education, field services, and a central science workshop.

The Governing Body of the Council is assisted by the Board of Educational Studies, the Central Committee on Educational Literature and Committees on Appointments, Finance and Works. Functioning through three standing sub-committees, the Board examines all proposals relating to research, training and extension projects referred to it and initiates, guides and co-ordinates research and training activities of the Council. The Committee on Educational Literature supervises the Council's programme of producing textbooks and other educational literature.

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At the beginning of the twentieth century, some attempts were made to co-ordinate the research activities of the various departments of the Government of India. As a result, the Board of Scientific Advice was set up in 1902. The Board met periodically to discuss problems of common interest; its annual reports gave valuable information on the progress of scientific research in India carried out by various scientific departments, and were communicated to the Royal Society of London, which acted as adviser to the Board and the Government of India and made valuable suggestions from time to time. The Board ceased functioning in 1924.

With the start of World War I, the Government of India became acutely aware of the need for building up scientific research in India, especially applied research, in a systematic manner. The Indian Industrial Commission, set up by the Government in 1916 under the chairmanship of Dr. Holland, was a result of the isolation of India during the war. Prominent leaders such as Pandit Madan Mohan Malaviya and J. N. Tata were members of this Commission. Its report covered exhaustively the state of research, nature of education and extent of industrialization in India up to 1918. Its recommendations were of a far-reaching character. It stressed the need for building up Indian industries based on local raw materials. It recommended the setting up of laboratories for testing industrial products, because of the inadequate testing facilities for Indian products at the Imperial Institute, London. The Commission stressed the need for an All-India Chemical Service to advise and assist provincial governments in launching an extensive programme of industrialization. The Chemical Services Committee, set up to examine this proposal, endorsed this recommendation, but the idea was abandoned after the First World War.

Co-ordination of industrial research

The need to co-ordinate industrial research activity was considered from time to time. The views of the provincial governments on this important question were sought in 1928. There was a consensus as regards the desirability of co-ordinating industrial research in India and the need to set up a council for industrial research, but on account of the prevalent financial stringency no action was taken to implement these suggestions. However, as a result of the discussions at the Fifth and Sixth Industries Conferences, it was decided to bring into being the Central Industrial Intelligence and Research Bureau to act as a central clearing-house for industrial intelligence, to keep abreast of industrial development both in India and in other countries and to be in a position to give information and advice to industrialists and persons seeking industrial openings. This was established in 1934 and later became known as the Industrial Research Bureau.

At the outbreak of the Second World War in 1939, the need for a strong and well-staffed industrial research institute was again felt. Supplies of many vital commodities for the war effort were either completely stopped or considerably curtailed. It was soon realized that India, to be an effective source of war supplies, should become industrially self-sufficient. The establishment of a Central Research Organization, therefore, became essential. In 1940 it was decided to create the Board of Scientific and Industrial Research, and soon afterwards the Bureau was merged with the Board. The activities of the latter were supplemented by the Industrial Research Utilization Committee, set up by the Government of India in 1941, to advise on the ways and means for the commercial development of the processes evolved under the auspices of the Board. During the same year the Industrial Research Fund was constituted by the Government of India for the purpose of fostering industrial development in the country, and this was followed by the establishment of the Council of Scientific and Industrial Research as an autonomous body, in 1942. Since then the Council has played a prominent role in fostering scientific and industrial research in India.

The Hill report

Professor A. V. Hill, then Secretary of the Royal Society of London, was invited by the Government of India to visit the country, in 1943, and discuss the organization of scientific and industrial research as a part of India's post-war reconstruction plan. After a careful study, he submitted a valuable report embodying a forceful plea for the expansion and better co-ordination of research in India backed by liberal financial support from the Government. Two of the most important recommendations called for the establishment of a Central organization for scientific liaison between India and other countries, and the creation of a central organization for scientific research. It was noted that so long as research organizations of the Central Government remained dispersed under a number of separate departments or bodies, most of them having many other duties and preoccupations, it was not possible to evolve a common plan to guide them all in the best interest of the country. It was therefore, proposed that all the scientific work affecting the welfare of the country, namely, in medicine and public health, agriculture and animal husbandry, industry, surveys and industrial resources, engineering and various services, should be brought under a single central organization, which would function under the
Member (Minister) for Planning and Development.

The Report also proposed the appointment of a Consultative Committee to advise the Member for Planning and Development on general policy in relation to research and on any special matters submitted to it. On the basis of these recommendations, the Government of India set up a Scientific Consultative Committee for Planning and Coordination of Research administered by the various departments.

Industrial Research Planning Committee

Another important step taken, immediately after Professor Hill's visit, was the setting up of the Industrial Research Planning Committee, early in 1944, by the Council of Scientific and Industrial Research. This Committee was appointed under the Chairmanship of Sir K. K. Shanmukham Chetty to make a comprehensive survey of the existing facilities for scientific and industrial research in India, including the Indian States, universities, research institutions and laboratories attached to industrial and other concerns, and to report on the means necessary for the co-ordination, control, direction and development of such research by these various agencies, and other steps necessary for the planning of such research. As a result of this survey, the Committee brought out a comprehensive report embodying specific proposals, in the form of a five-year plan, for the development of scientific and industrial research in India. The Committee also recommended the establishment, by the Government of India, of a central research organization to be called the National Research Council, and similar scientific organizations for the promotion of scientific and industrial research in the provinces as well as in the major States.

The Industrial Research Planning Committee considered detailed proposals for setting up a National Chemical Laboratory, a National Physical Laboratory, an Institute of Food Technology, a Metallurgical Institute, a Glass and Ceramics Institute, a Fuel Research Institute, a Road Research Institute, a Leather and Tanning Institute, an Industrial Fermentation Institute and an Electrochemical Institute. It also considered providing grants-in-aid to universities for strengthening and developing their scientific departments, and the award of scholarships tenable in India and abroad for training research personnel for staffing the various national laboratories. The Committee also recommended the creation of a National Trust for Patents and the formulation of a Board of Standards for drawing up Indian standard specifications.

The reports of Professor Hill and the Industrial Research Planning Committee were considered by the Scientific Consultative Committee. It was decided to prepare a scheme for the central organization of scientific research on the basis of the proposals contained in both these reports and some other suggestions placed before the Consultative Committee, for submission to the government. Regarding the establishment of some additional specialized research institutes, as recommended by the Industrial Research Planning Committee, the Consultative Committee decided that these might wait until after the establishment of the five laboratories already sanctioned, namely, the National Physical Laboratory, the National Chemical Laboratory, the National Metallurgical Laboratory, the Central Fuel Research Institute, and the Central Glass and Ceramics Research Institute. It was, however, recognized that an Institute of Food Technology was also essential.

The Scientific Consultative Committee endorsed the proposal by the Industrial Research Planning Committee for a cess on industry, supplemented by an equivalent contribution from Government, as essentially a sound method of financing research, and proposed that the method of collection of the cess should be by a surcharge on income tax paid by industrial undertakings; grants-in-aid to universities; the establishment of a National Trust for Patents; and the inauguration of the Board of Standards and Specifications.

Electronics Commission

The Government of India set up in March 1971 an Electronics Commission under the chairmanship of Professor M. G. K. Menon, Director, Tata Institute of Fundamental Research.

The scope of the Commission will be to chart out a strategy for the speedy development of the electronics industry, which is expected to produce goods worth Rs. 2,000 crores per year by the end of the decade.

The major functions of the Commission will be to co-ordinate and aid electronics research in the country, to advise the government on the import of technology and to guide the industry.

On the research front the Commission will coordinate the efforts of national laboratories, R&D units in the industry and electronics laboratories in the universities and IITs. It may call for periodic reports from all such units engaged in research to identify technological gaps and overlapping projects and suggest corrective measures.

The Commission will provide financial assistance to specific projects, particularly those falling within the priority areas. The industrial R&D units will be asked to undertake projects aimed at the development of new production processes, cost reduction and import substitution.

The Commission proposes to establish a cell of experts to monitor technological developments in the field the world over. It may seek advice from outstanding Indian scientists working outside the country and set up a pool of electronics scientists and technologists with the view to attract Indians working in the field in advanced countries and find suitable placements for them.
The Commission will plan manpower for the electronics industry. Personnel requirement for research, industry, servicing and teaching will be assessed and a programme for their training will be worked out.

AGRICULTURAL RESEARCH

Agricultural research in India has been carried out for many years, mainly under Government auspices. It was realized even at the beginning of the century that the establishment of agricultural research institutes, experimental farms and agricultural colleges was an essential step for bringing about radical improvement in agricultural practices. The Imperial (now Indian) Agricultural Research Institute, transferred to New Delhi in 1936, celebrated its Diamond Jubilee in 1965, and is recognized as the premier agricultural research establishment and constitutes one of the most important sources of expert technical knowledge, advice and instruction in agriculture and its cognate branches. The Indian Veterinary Research Institute, has done pioneering work in veterinary research; and the Forest Research Institute has done pioneering work in the improvement and utilization of forest products for commercial exploitation, and also provides advanced training in forestry.

Need for a central organization

Following constitutional changes in 1919, responsibility for agricultural research and development was transferred to the State Governments in 1921. Previously the administration and co-ordination of agricultural development work and the Government policy relating to it had been the responsibility of the Central Government. The need for a central agency to co-ordinate agricultural research was considered by the Royal Commission on Agriculture (1928) under the chairmanship of Lord Linlithgow, whose report pointed out that there was a wide field open for co-ordination of the efforts of the Central and State Governments, in regard to agricultural research and that it was the duty of the Government of India to advance research in every way possible without encroaching upon the functions of the State Governments in that sphere. In accordance with the recommendations of the Commission, the Imperial Council of Agricultural Research was set up in 1929. In 1947, the name of the Council was changed to Indian Council of Agricultural Research.

Reorganization of I.C.A.R.

The Council underwent a major reorganization in 1966, so as to make it truly functional, technically competent and fully autonomous. The reorganization brought under the Council all the central research institutes, which were hitherto under the control of the Ministry of Food and Agriculture of the Government of India, and the Central Commodity Committees. The Central Commodity Committees, which had been established earlier for promoting research and developing various commercial crops such as cotton, jute, oilseeds, lac, tobacco, coconut, arecanut, cashew and spices, and whose activities were co-ordinated by the Council, were abolished. The research work handled by them was taken over by the Council, and the development and marketing programmes were left to the care of the Department of Agriculture, Ministry of Food and Agriculture. It was proposed that the Indian Agricultural Research Institute, the Indian Veterinary Research Institute and the National Dairy Research Institute be designated as national institutes. They and other institutes have been delegated enhanced administrative and financial powers, and brought under the Council.

One of the significant improvements, as a result of reorganization, was the appointment of an outstanding scientist as the Chief Executive of the Council with the designation of Director-General. The reorganization also provided for making arrangements for recruitment to scientific posts through its own selection committees. The Governing Body of the Council was reconstituted to make it pre-eminently a body of scientists and those with interest in or knowledge of agriculture. The Boards of Agricultural Research, Animal Husbandry Research, Agricultural Education, and Agricultural Development and Marketing set up under the earlier rules were abolished and in their place four Standing Committees, viz., those on (i) Agricultural Research, (ii) Animal Science Research, (iii) Agricultural Education, and (iv) Agricultural Economics, Statistics and Marketing Research were set up. To meet the requirements of the new situation, the organizational set up at the headquarters of the Council was also revised suitably. Proposals were also framed for organizing the Indian Agricultural Research Service.

Out of the eighteen PIRRCOM (Project for Intensive Regional Research in Cotton, Oilseeds and Millets) Centres set up by the Council in 1958 to intensify research on cotton, oilseeds and millets, thirteen have been transferred to the State
Governments or agricultural universities. The remaining five centres, located at Coimbatore, Kanpur, Sirsa, Hyderabad and Ajmer, have been made Regional Research Centres of the Indian Agricultural Research Institute.

**Agricultural education**

India has accepted the concept of fullest integration of agricultural research, education and research extension. Accordingly, agricultural universities have been set up based on this concept. It was decided that each State should have one such university. So far agricultural universities at Hyderabad, Hissar, Jorhat, Jabalpur, Patna, Poona, Bhubaneswar, Ludhiana, Akola, Bangalore, Kalyani, Udaipur and Pantnagar have been established. In certain States, research work has been fully transferred to the agricultural universities, in others, this transfer is in progress.

In addition to the agricultural universities which are exclusively devoted to agricultural education, a number of Indian universities have established faculties of agriculture and/or veterinary science. Some of these are the universities of Agra, Annamalai, Banaras, Bhagalpur, Bihar, Calcutta, Gauhati, Gorakhpur, Jammu and Kashmir, Kerala, Madras, Madurai, Magadh, Nagpur, Ranchi, Sardar Patel, and Saurashtra. There are 73 agricultural colleges in the country, and at least 37 of them have facilities for post-graduate training. About 18 veterinary colleges have also facilities for post-graduate training.

**National Commission on Agriculture**

The Government of India set up in 1970 a National Commission on Agriculture under the chairmanship of Mr. C. Subramaniam. At its first meeting, the Commission decided to submit interim reports, within six months, on the following six topics:

1. Research and development. The effort so far will be reviewed and improvements will be suggested. New targets will be set.
2. Seed multiplication. There have been complaints of a deterioration of the quality of seed and this will be investigated.
3. Supplies of fertilizers and chemicals. There have been complaints of adulteration of these two items while it is also well known that the different kinds of fertilizer are not being applied to appropriate types of soil.
4. Pilot projects will be suggested for the creation of labour potential in rural areas. This is expected to be a major report, for unemployment and underemployment can be tackled on a sufficiently large scale only through rural programmes.
5. The provision of agricultural credit, particularly short-term loans to small and marginal farmers.
6. The implementation of land reforms.

**MEDICAL RESEARCH**

As a result of the recommendations made by the Indian Medical Congress in 1894, a series of central and provincial laboratories were established by the Government, with adequate facilities for research. The Haffkine Institute was followed by the first Pasteur Institute established in Kasauli in 1900, and a second Pasteur Institute was started in Coonoor in 1907. All these institutes had adequate facilities for research work. The Government of India also established a cadre of scientific workers, known as the Bacteriological Department, who were mostly members of the Indian Medical Service and were posted at the central and provincial laboratories. The great discoveries of Haffkine, Ross, Donovan, Raghavendra Row and Brahmachari coming closely one after the other, at the beginning of the century, created an atmosphere which inspired and stimulated other members of the Medical Service to engage in research work.

**Indian Research Fund Association (IRFA)**

This Association, which received an annual grant of half-a-million rupees, lost no time in stimulating research activities in the country, especially on work relating to malaria, kala-azar, plague, etc. It also took a keen interest in increasing the supply of scientific personnel, and in 1914 the Government enlarged the cadre under its new medical research department.

The First World War interrupted research activities, as the scientific personnel were drafted into the army. The funds of the Association continued to accumulate during this period, and the savings were later used partly for supporting the establishment of a Central Medical Research Institute. This project failed to mature owing to the suspension of the Government grant, as a measure of economy, immediately after the war. Fortunately, conditions subsequently improved and the Government grant was fully restored in 1926. The Association had put up two schemes, one for establishing a Central Medical Research Institute at Dehra Dun and the other for a Public Health Institute at Calcutta. The Calcutta scheme, supported by the initiative of the Rockefellier Foundation, had
the better reception and the All-India Institute of Hygiene and Public Health was set up in 1928. The economic depression during the early thirties again restricted the activities of the Association and the position did not improve until the end of the Second World War. During this period there was a change in the status of the Association, which became an autonomous body on 22 March 1938.

**Bhore Committee**

After the war, the Bhore (Health Survey and Development) Committee reviewed the position of medical research in India. While complimenting the IRFA on its work in promoting medical research, the Committee highlighted the absence of organized research in medical colleges and stressed the need for a strong central organization for medical research, which should ultimately become the National Research Council of India.

**Indian Council of Medical Research (ICMR)**

After Independence, the IRFA was renamed as the Indian Council of Medical Research. As a first step, the ICMR took stock of the situation and, instead of confining its activities merely to infectious diseases, began to pay attention to a wider spectrum of medical topics both in fundamental and applied research. Important areas in the latter included communicable diseases, cancer, nutrition, cardio-vascular diseases, mental health, reproductive physiology, occupational health, environmental medicine, medical education and health practices. It also kept sight of the need for pursuing fundamental research.

**Post-graduate education and research**

One of the recommendations of the Bhore Committee stressed the need for organized research in medical colleges and the setting up of an institute for training highly-qualified teachers and research workers. The Government of India established, in 1956, the All-India Institute of Medical Sciences at Delhi as an autonomous institution of national importance, for undertaking training and advanced research. This was followed by the establishment of Institutes of Post-graduate Medicine at Chandigarh, Pondicherry and Calcutta. The Government of India also created centres of excellence in the different medical colleges by upgrading certain departments for post-graduate education. Post-graduate centres in medical sciences were established in Ahmedabad, Calcutta, Chandigarh and Pondicherry by taking over and strengthening the existing institutions. In addition, the facilities in medical colleges and institutions for post-graduate work have been considerably expanded. The Government is also providing facilities for post-graduate education in the indigenous systems of medicine. The Post-Graduate Institute of Indian medicine was set up at the Banaras Hindu University in 1963. Separate faculties for Ayurvedic studies have been established in the Universities of Indore, Jammu and Kashmir, Jiwaji, Kerala, Lucknow, Marathwada, Poona, Rajasthan and Ravishankar. The Gujarat Ayurvedic University was set up at Jamnagar in 1967.

**DEFENCE RESEARCH**

Until the nineteen thirties, the application of science and technology to defence was very limited and mostly confined to testing defence stores and equipment. Some technical units, known as Inspectorates, had existed earlier; they were located in ordnance factories for the inspection of the output. The Second World War brought in its wake a number of technical problems connected with procurement, maintenance, storage, preservation and modification of equipment and stores to suit local conditions and the utilization of indigenous materials. This led to the expansion of laboratories and technical development establishments. During the forties these units were further expanded and reorganized. The Defence Science Organization was set up in 1948 to study all aspects of the application of science to defence, and the Defence Production Board was created to provide an integrated control over research, development, production and inspection.

In 1958, the Defence Research and Development Organization, formed by amalgamating the Defence Science Organization and the Technical Development Establishments, was set up to complement the organizations for defence production and inspection. With this as nucleus, an adequate organization has now been built up to meet the growing scientific needs of defence.
The Atomic Energy Commission was set up in 1948 under the Atomic Energy Act of 1948. The Commission's decisions were executed through the Department of Scientific Research and later through the Ministry of Natural Resources and Scientific Research. In the light of the Commission's activities, the need for a full-fledged atomic energy programme was felt, and the Government of India set up the Department of Atomic Energy (DAE) in 1954.

By 1958 it was felt that research and development in the uses of atomic energy had made such important strides that a greatly expanded programme would be required to produce all the basic materials required for the utilization of atomic energy and the building of atomic power stations. The Government accordingly modified the constitution of the Commission so as to give it full financial and executive powers.

With the rapid development of atomic energy in India, further legislation became necessary. The Atomic Energy Act of 1962 provides for the development, control and use of atomic energy for peaceful purposes. The Act vests greater responsibilities in the Department of Atomic Energy, particularly as regards safeguarding the health of workers in all establishments and institutions making use of radiation sources.

Atomic research

The Atomic Energy Establishment at Trombay (AEET) was set up in January 1954 by the Atomic Energy Commission for research in and development of atomic energy. Initially, the Establishment had groups only for chemistry and metallurgy, to which the theoretical physics, nuclear physics and electronics groups, which were functioning at the Tata Institute of Fundamental Research on behalf of the Commission, were added. Later, groups working in biology and medicine at the Indian Cancer Research Centre, Bombay, on behalf of the Commission, were also merged with the Establishment.

The contribution of the Tata Institute to the early activities of the Commission was so significant that the Institute can rightly be regarded as the cradle of India's atomic energy programme.

During the first few years, the main work of the Establishment in nuclear physics, reactor engineering and electronic instrumentation was directed towards providing the necessary scientific and technical data for the design and construction of research reactors. Both Apsara, the first reactor to go into operation in Asia outside the Soviet Union, and ZERLINA were entirely designed and built by Indian engineers and scientists. Later on, the work of the Establishment diversified in a number of fields such as atomic fuel, heavy water, radio-isotopes, pure materials, radio-chemistry, biochemistry, food irradiation, biology, mutation breeding, health physics, waste treatment, and vacuum engineering.

The Establishment was renamed after its founder and the first Director, Dr. H.J. Bhabha on 12 January 1967 as Bhabha Atomic Research Centre (BARC).

Space research

The Indian National Committee for Space Research (INCOSPAR) was set up by the Government of India in 1963 under the Department of Atomic Energy, but was reconstituted in 1969 under the Indian National Science Academy and made responsible for liaison with other national and international organizations and United Nations agencies interested in space research. The responsibilities for formulating and executing the policies of Government concerning the peaceful uses of outer space were entrusted to a new organization called the Indian Space Research Organization (ISRO) set up under the DAE in August 1969. ISRO has its headquarters at the Physical Research Laboratory (PRL), Ahmedabad, and is responsible for the management and operation of the six space research units of the DAE (see Annex VII).

Scientific societies have been responsible for fostering scientific awareness. Their main activities have been organizing meetings and conferences and issuing publications and periodicals. The earliest society to be established in India was the Royal Asiatic Society of Bengal in 1784. With the growth of scientific research, a number of specialized societies were started from the beginning of this century.

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During the period 1931-1950, the number of societies increased, mainly in the discipline-oriented fields. This trend to establish societies for specialized fields of science and technology continued to gain momentum during the following decade (see Table, "Growth of Scientific Societies in India"). A list of some of the important scientific societies is given in Annex II.
Growth of Scientific Societies in India

<table>
<thead>
<tr>
<th>Societies registered/established up to the end of</th>
<th>1900</th>
<th>1910</th>
<th>1920</th>
<th>1930</th>
<th>1940</th>
<th>1950</th>
<th>1960</th>
<th>1963</th>
</tr>
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<tbody>
<tr>
<td>Physical Sciences</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>4</td>
<td>11</td>
<td>17</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>Medical Sciences</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>7</td>
<td>15</td>
<td>23</td>
<td>26</td>
<td></td>
</tr>
<tr>
<td>Biological Sciences</td>
<td>2</td>
<td>3</td>
<td>5</td>
<td>9</td>
<td>15</td>
<td>26</td>
<td>26</td>
<td></td>
</tr>
<tr>
<td>Engineering and Technological Sciences</td>
<td>2</td>
<td>3</td>
<td>6</td>
<td>10</td>
<td>12</td>
<td>20</td>
<td>26</td>
<td>26</td>
</tr>
<tr>
<td>General</td>
<td>1</td>
<td>2</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>10</td>
<td>12</td>
<td>14</td>
</tr>
<tr>
<td>Total all Sciences</td>
<td>4</td>
<td>10</td>
<td>16</td>
<td>27</td>
<td>38</td>
<td>71</td>
<td>104</td>
<td>110</td>
</tr>
</tbody>
</table>


STANDARDIZATION OF INSTRUMENTATION AND SERVICING FACILITIES

The instrument industry in India originally confined itself to the manufacture of simple laboratory apparatus required by educational institutions. The manufacturing units were small, and were mostly concentrated in Calcutta, Bombay, Banaras, Lucknow, Ambala, Agra, Madras and Masulipatam. There are now about 400 such units.

The manufacture of optical instruments for land survey work by the Ordnance Factory at Dehra Dun, was an early development. The National Instruments Ltd., Calcutta, is another government organization producing scientific instruments. Since Independence there has been a steady growth in the industry, both in range and volume. Electronic measuring instruments are now being produced for use in research and industrial operations. The Bhabha Atomic Research Centre has designed and developed a number of these instruments, and a factory has been established at Hyderabad for manufacturing them. Private industries are also producing similar instruments.

The Indian Standards Institution has framed a number of standards and specifications for scientific instruments, and issues certification marks for goods manufactured according to its specifications. A wide range of testing facilities are available at the National Physical Laboratory, New Delhi, and the Government Test House, Calcutta; they are used fully by industry.

One of the major problems faced by research institutions, is the servicing and maintenance of scientific instruments. Since many instruments are imported, servicing facilities are not available from local firms. Some laboratories have workshop facilities for handling minor repairs, and the Instrumentation and Servicing Section of the National Physical Laboratory provides servicing facilities to a number of institutions.

The Central Scientific Instruments Organization (CSIO), Chandigarh, was set up in 1959 by the Council of Scientific and Industrial Research with the following objects:

(i) Survey and assessment of the present and future needs of various types of scientific instruments required for teaching, research and industry including essential services. Collection and co-ordination of all available information on the subject in the country, and the problems and requirements of the various departments;

(ii) preparation of a phased programme of development of the industry;

(iii) creation of new design and development units and centres of instruments production;

(iv) preparation of specifications and blueprints for instruments and the development of testing techniques and equipment for testing instruments, and production of prototypes;

(v) co-ordination with the Indian Standards Institution in the establishment of national standards for instruments;

(vi) organization of advanced training of technicians and specialized personnel required for production of scientific instruments, repair and maintenance;

(vii) stimulating the manufacture of scientific instruments on an industrial scale; and,

(viii) formulation and co-ordination of policies and procedures relating to development of the
industry, distribution of scientific instruments, their importation, customs duty, etc.

The CSIO has also adequate facilities for servicing and repair of instruments at its regional centres in Delhi and Madras, and is running the Indo-Swiss Training Centre for training precision instrument mechanics. It has set up development centres within instrument manufacturing concerns for developing certain specialized instruments, and is publishing a quarterly, Instrument News, giving information about new instruments developed and facilities available to industries and research institutes. In 1969, it brought out an exhaustive compilation entitled the Directory of Scientific Instruments and Components Manufactured in India.

SCIENTIFIC PUBLICATIONS

The origin and growth of the publication of scientific periodicals in India almost synchronized with the establishment and development of scientific institutions and societies. Modern scientific research in India began in 1784 with the founding of the great Asiatic Society, whose findings were recorded in Asiatick Researches, the first Indian periodical, started in 1788. In 1832, when James Prinsep was the secretary of the Society, the title of the periodical was changed to Journal of the Asiatic Society of Bengal, incorporating Gleanings in Science which appeared in 1829 as a venture of James Dowland Herbert, Deputy Surveyor General.

The Madras Literary Society, founded in 1818, brought out the Journal of Literature and Science, which ran to seventeen volumes between 1833 and 1894.

The Agricultural Society of India, established in 1820 and later known as the Agricultural and Horticultural Society of India, published its Transactions and a monthly journal.

Towards the end of the nineteenth century a good deal of scientific work was being done in the surveys and departments of Government, and in some private societies. Though medical research was organized only in 1869, the Medical and Physical Society of Calcutta was formed in 1823, and its Transactions, first issued in the same year, was the first professional medical periodical published in India. A number of other medical journals were started during the century.

The publication of journals was an important activity of most of the scientific societies, both general and specialized, which began to spring up in the early decades of the twentieth century. With the reorientation of university education which resulted in increased facilities for post-graduate teaching and research, the tempo of scientific research then increased considerably. As a natural consequence, publication activity showed a corresponding increase and many universities started to publish their own periodicals. There are more than 70 universities, and most of them have their own periodicals.

Independence brought about another big change in scientific research activity in the country. With

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**Post-Independence Yearly Increase of Indian Scientific Periodicals**

**Breakdown by Subject of Periodicals and Annual Reports Covered in the Directory, 1964 and 1968**

<table>
<thead>
<tr>
<th>Subject</th>
<th>1964</th>
<th>1968</th>
</tr>
</thead>
<tbody>
<tr>
<td>Building and Architecture</td>
<td>11</td>
<td>13</td>
</tr>
<tr>
<td>Geosciences</td>
<td>119</td>
<td>129</td>
</tr>
<tr>
<td>Physical Sciences</td>
<td>122</td>
<td>123</td>
</tr>
<tr>
<td>Biological Sciences</td>
<td>144</td>
<td>146</td>
</tr>
<tr>
<td>Management, Trade and Industry</td>
<td>125</td>
<td>126</td>
</tr>
<tr>
<td>Chemicals</td>
<td>145</td>
<td>145</td>
</tr>
<tr>
<td>Technology</td>
<td>159</td>
<td>153</td>
</tr>
<tr>
<td>General Science</td>
<td>172</td>
<td>186</td>
</tr>
<tr>
<td>Agriculture</td>
<td>3137</td>
<td>3159</td>
</tr>
<tr>
<td>Engineering</td>
<td>1149</td>
<td>1192</td>
</tr>
<tr>
<td>Medical Sciences</td>
<td>1231</td>
<td>1202</td>
</tr>
</tbody>
</table>

Source: Directory of Indian Scientific Periodicals, 1968
Published by Insloc, New Delhi.
the number of research institutions, universities, scientific societies, scientific workers engaged in research multiplying several times during the last two decades, the number of scientific journals has also increased phenomenally. Organizations such as ICAR, ICMR and CSIR bring out a number of publications in their respective fields.

At present about 996 periodicals and annual reports are published in the field of pure and applied sciences, as listed in the 1968 edition of the Directory of Indian Scientific Periodicals brought out by Insdoc. The Directory lists 108 periodicals in Indian languages. The number of periodicals has grown considerably since Independence, the annual addition being in the range of 15 to 25 up to 1955, after which the growth became somewhat steeper reaching the record of 65 new periodicals in 1964.

Technical books and monographs

The CSIR, the ICAR, the ICMR, and other scientific organizations publish monographs in their respective fields. The universities bring out advanced treatises. The University Grants Commission provides grants to universities for the establishment and improvement of university printing presses. Private publishers are bringing out textbooks for university courses.

The Bhabha Atomic Research Centre brings out annually over 100 technical reports on the research and development work carried on in the Centre and also the proceedings of symposia, seminars, etc. held under the auspices of the Department of Atomic Energy.

The Government of India has initiated a number of schemes in collaboration with appropriate authorities in the U.K., the U.S.A. and the USSR for publishing standard books at nominal prices. Books are selected and evaluated in the context of the needs of university students. The republished books cost about one-third of the original price. The Government has also set up a Book Development Board to examine all aspects of book production in India.

SCIENTIFIC AND TECHNICAL INFORMATION SERVICES

Only recently has attention been paid to organizing adequate scientific and technical information services. Prior to this the universities and research organizations had built up their libraries as a first step for providing information to scientists. Systematic documentation was also organized in special fields. The Forest Research Institute took up documentation of literature on forestry and allied subjects. Similarly, the Central Board of Irrigation took up documentation of literature on irrigation. The Industrial Research Bureau was set up by the Government of India during World War II to provide, among other things, technical information in the applied fields. The advent of Independence saw a number of scientific laboratories come into existence. At this juncture the need for an active documentation service was keenly felt. In order to supplement the limited facilities available in the various research institutions a national documentation centre was created.

National Documentation Centre

The establishment of a national centre to provide documentation services to the national laboratories, scientific institutions, universities and industrial concerns occurred when the Government of India entered into an agreement with Unesco on 7 July 1951 for technical assistance for this project. The Indian National Scientific Documentation Centre (Insdoc) was established in 1952 under the Council of Scientific and Industrial Research, with the following functions:

(i) To receive and retain all scientific periodicals required in India;
(ii) to inform scientists and engineers of articles which may be of value to them by issuing a monthly bulletin of abstracts;
(iii) to answer specific inquiries from information available in the Centre;
(iv) to supply photocopies or translation of articles required by laboratories or individual workers;
(v) to be a national repository for reports of the scientific work of the nation, both published and unpublished; and
(vi) to be a channel through which the scientific work of the nation is made known and available to the rest of the world.

Insdoc offers services in: information; document procurement; photocopying; and translation. These services are provided only on request and are charged for at nominal rates. They are fully utilized by research organizations, universities, industry, Government Departments and scientific workers. Requests are also received from foreign countries for copies of scientific papers published in India and translations done by the Centre.

To expedite documentation services, utilizing all the available resources in India, Insdoc is setting up regional centres with a full complement of photocopying equipment in big cities. To start with a regional centre at Bangalore has been set up in
1964 with technical assistance from Unesco, for providing document procurement information and reprographic services.

As a part of its bibliographical activity, Insdoc brings out a monthly publication entitled the Indian Science Abstracts, which covers the literature on the current scientific work being done in India.

Documentation facilities in special fields

Documentation services have also been organized in special fields. The laboratory complexes in the Council of Scientific and Industrial Research, the Bhabha Atomic Research Centre, the Indian Council of Medical Research etc., provide documentation facilities in their respective fields. The Defence Research and Development Organization has set up DESIDOC for providing a full range of information services. As a professional organization, the Indian Association of Special Libraries and Information Centres, offers photocopying and translation services.

The Library and Technical Information Section of the Bhabha Atomic Research Centre (BARC) is India's principal nuclear information and documentation centre. It brings out comprehensive bibliographies on topics of interest and importance to India's nuclear programme. Its Translation Unit undertakes translation of scientific and technical papers from as many as ten European languages and Japanese. It collects nuclear information generated in the country for preparing the Indian input for International Nuclear Information System (INIS). It also disseminates the INIS output throughout BARC and other institutions in the country.

Training of documentation personnel

With the expansion of documentation services, adequate training facilities for documentation personnel have had to be developed. At present, the training is partially provided by the post-graduate course in Library Science offered by some of the Indian universities - Aligarh, Andhra, Banaras, Baroda, Bombay, Calcutta, Delhi, Madras, Nagpur, Panjab, Poona, Rajastahan, and Vikram. In the University of Delhi, the subject of documentation is included in the Master of Library Science course.

To provide a full-fledged one-year training course in documentation, the Indian Statistical Institute started the Documentation Training and Research Centre at Bangalore in 1962. To meet the growing need for highly-trained personnel, Insdoc started a one-year advanced training course in Documentation and Reprography in August 1964.

Translation training course

Technical translation has now come to be recognized as a separate discipline requiring a specialized training. Insdoc has been actively engaged in scientific translation work since 1952 and has built up adequate expertise in this field. In order to meet the demand for scientific and technical translators, Insdoc established courses in scientific and technical translation in 1964.

SCIENTIFIC AND TECHNICAL LIBRARIES

There are more than 600 scientific and technical libraries. They are located in important cities in India. Their collections range between 10,000 volumes to 50,000 volumes, particularly in libraries set up after Independence. Older institutions established in Calcutta, Bombay, Madras, Delhi, etc., have larger collections. The university libraries, numbering 83, have grown at a rapid rate. The University Grants Commission has been providing substantial financial support to the universities for their book acquisition programmes and for putting up new library buildings. It has so far contributed nearly forty million rupees towards book acquisitions and another forty million for library buildings. In addition to this, the university libraries have been acquiring American publications on an extensive scale, under the Wheat Loan Programme. The universities have also increased
steadily their recurring book budgets to meet the requirements of their expanding activities. INSDOC has been gradually building up its collection of scientific publications, and it is currently getting nearly 4,000. Using this as the nucleus INSDOC has started the National Science Library. It has been envisaged more as a co-operative acquisition effort involving the location of materials, with only bibliographic control of these holdings through a Union Catalogue at the Centre. INSDOC has undertaken a programme for the compilation and publication of a series of catalogues representing the massive holdings of important libraries, as well as the holdings of groups of libraries in the major cities and regions in India. This programme was initiated in 1965. It is envisaged that the Union Catalogue will contain 15,000 titles of periodicals representing the holdings of about 600 libraries within this country.

There are also proposals for developing national libraries in the field of agriculture. Similarly, the Ministry of Health of the Government of India is actively engaged in setting up the National Medical Library.

PHOTOCOPYING FACILITIES

Government departments were the earliest to set up photographic reproduction facilities. The Photo Registry Office in Poona was the earliest to be established for providing photographic copies of title deeds. The National Archives of India uses, on an extensive scale, microphotographic techniques for the preservation of historical records.

For supplying copies of scientific papers, photostating units were set up by the Indian Institute of Science at Bangalore and the Indian Agricultural Research Institute at New Delhi. The Indian Council of Medical Research provided microfilm services to the medical profession from their units at the Central Research Institute, Kasauli, and the Tata Memorial Hospital, Bombay.

With the establishment of INSDOC in 1952, an organized and well equipped photocopying service for copying scientific documents was available to a wide range of clientele for the first time in India. During the last 18 years this service has been used extensively by the scientific, technical, engineering and medical communities.

Photocopying facilities are also available at the Indian Statistical Institute, Calcutta, and the Bhabha Atomic Research Centre, Bombay. Some of the university libraries have small microfilming units to serve the needs of their own research departments. The Indian Association of Special Libraries and Information Centres operates a microfilming service from Calcutta. There are also commercial photocopying services at Bombay, Ahmedabad, Delhi and Calcutta.
PART II

ORGANIZATION OF SCIENTIFIC AND TECHNICAL RESEARCH
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Scientific research in India is carried out mainly by a number of organizations operating with financial assistance from the Government: the Council of Scientific and Industrial Research (CSIR); the Department of Atomic Energy; the Indian Council of Agricultural Research (ICAR); the Indian Council of Medical Research (ICMR); and the Research and Development Organization of the Ministry of Defence. In addition, there are a number of institutes attached to the various ministries for carrying out research programmes of practical application in their respective fields of activities, such as irrigation, power, railways, telecommunications, broadcasting, civil aviation, etc. The public sector agencies in the field of electronics, machine tools, steel, fertilizers, etc., also carry out research in their respective fields.

Research programmes of laboratories and research institutions are approved by their Executive Councils. The overall guidelines are, however, laid down by the governing bodies of the various councils which, though autonomous, draw their finances from their respective ministries. The programmes carried out by the institutions under the government departments are approved by their respective ministries. The total activities of the various organizations in the field of scientific and industrial research form an integral part of the national planning process.

Planning process

The laying down of an overall policy for the planned development in all sectors of national activities is the responsibility of the Government. The National Development Council, the Planning Commission with its working groups and advisory panels, the Ministries of the Central Government, the State Governments and the Parliament are all involved in the planning process, leading to the drawing up of five-year plans.

The formulation of the plans is done in four stages. In the first stage studies are undertaken by the Planning Commission to examine the state of the economy and to identify the principal social, economic and institutional shortcomings. The results of these studies are used to formulate a general approach to the Five-Year Plan. These are submitted to the Cabinet and then placed before the National Development Council which indicates the rate of growth and broad priorities.

In the second stage, the general dimensions of the plan are worked out on the basis of the suggested growth rate. A number of working groups are set up for carrying out detailed studies. A draft memorandum outlining the main features of the Plan under formulation is prepared. This is presented to the Cabinet and placed before the National Development Council.

In the third stage, the Draft Outline of the Five-Year Plan is prepared. This is an elaboration of the memorandum and gives the broad features of the various sectoral programmes and spells out the principal policy measures needed to carry them out. The views of the States and Central Ministries are obtained before the outline is submitted to the Cabinet and the National Development Council. When the document is approved by the Council it is circulated for public discussion. It is considered by the Informal Consultative Committee of the Members of Parliament and by the Parliament as a whole.

The fourth stage relates to the preparation of the final report. The Planning Commission, in association with the Central Ministries concerned, holds detailed discussions with the State Governments regarding the Plan. Estimates of resources likely to be available and measures for mobilization of additional resources as well as proposals for sectoral programmes of the States are discussed. Discussions are also held with the major organized industries through various Development Councils as well as the Chamber of Commerce and Industry.

In the light of these discussions the Planning Commission prepares a paper giving the principal features of the Plan and submits it to the Central Cabinet and the National Development Council. A draft of the final report is considered by the Central Ministries and the State Governments. It is then submitted for approval to the Cabinet and the National Development Council. Thereafter, it is presented to the Parliament for discussion and approval.

For effective implementation, annual development programmes, within the framework of overall plan, are drawn up. These are included in the annual budgets of the Central and State Governments. This mechanism provides an opportunity for revising and adjusting the broad annual phasing indicated in the Five-Year Plan.

The planning of scientific and industrial research goes through all the four stages of planning mentioned above.

Co-ordination of scientific activities

The question of the effective co-ordination of the scientific activities of the various ministries and institutions in India has been receiving the attention of the Government of India for some years. An Advisory Committee for co-ordinating scientific work was set up in 1948 under the chairmanship of the then Prime Minister, Shri Jawaharlal Nehru, with the following aims and objects:
(i) To co-ordinate the scientific activities of the various Ministries of the Government of India;

(ii) to devise ways and means to encourage team work;

(iii) to reduce expenditure on research as far as possible by avoiding duplication;

(iv) to utilize the existing equipment to the best advantage of the country; and,

(v) to give up a fillip to scientific research by encouraging co-operative research in general.

In May 1956 this was replaced by the Scientific Advisory Committee to the Cabinet (SACC). This Committee functioned under the chairmanship of the Cabinet Secretary and included representatives of most of the principal scientific organizations. It held regular meetings every two months to advise the Cabinet on the following matters:

(a) the formulation and implementation of the Government's scientific policy;

(b) co-ordination of scientific work between the various Government Ministries and between Government, semi-Government and non-Governmental scientific institutions in the country;

(c) scientific and technical co-operation with other countries and with international scientific and technical organizations; and,

(d) such other matters as may be referred to it.

The functions of the Committee included the placing before the Cabinet of such proposals and advice as might improve and develop scientific and technical work in the country. The Committee addressed itself mainly to scientific and technological matters of wide application, either on its own initiative or on requests received from the Ministries.

As an Advisory Body, the SACC was not directly concerned with any research activity, and did not finance any research project.

Committee on Science and Technology

The Government of India reconstituted the Scientific Advisory Committee to the Cabinet under the new designation "The Committee on Science and Technology" with effect from 17 August 1968. This has been placed under the Department of Cabinet Affairs of the Government of India. The Committee on Science and Technology will advise the Government:

(i) on the formulation and implementation of Government's policy on science and technology and determination of national priorities in these areas;

(ii) on the pace of the development of scientific research and technology suggesting measures for correcting imbalances wherever necessary;

(iii) on co-ordination, co-operation and communication between Ministries of Government and between Government, semi-Government and non-Government scientific and technological institutions in the country;

(iv) on the development and full utilization of the nation's scientific and technological resources and measures for ensuring a proper balance between these indigenous resources and purchase of foreign technology consistent with needs of national development:

(v) on scientific and technological co-operation with other countries and with international scientific and technological organizations; and,

(vi) on any other matter that may be referred to it by Government.

The Committee will maintain a close relationship with the Planning Commission so as to develop a unified policy for scientific and technological growth.

The major scientific complexes such as the Council of Scientific and Industrial Research, the Indian Council of Agricultural Research, the Indian Council of Medical Research, the Atomic Energy Commission, and the Defence Research and Development Organization, the University Grants Commission and the Planning Commission are represented on this Committee. The Member (science) of the Planning Commission is the chairman of the Committee. The Secretariat for the Committee is provided by the Cabinet Secretary and the Science Officer in the Department of Cabinet Affairs functions as the Secretary of the Committee; he is also the Chief (Science) of the Planning Commission.

An important task of the Committee is to survey the existing state of science and technology and anticipate future development during the next 20 years. The Committee has constituted the following panels/standing committees of experts to initiate studies in depth in (i) non-ferrous metals and minerals, (ii) water resources, (iii) irrigated farming, (iv) dry farming, (v) agrochemicals, (vi) design, production and installation of computers, (vii) silicon and silicones, (viii) non-ferrous metals, high polymers and ceramics, (ix) fine chemicals, and (x) natural resources and their efficient exploitation.

The Committee on Science and Technology proposes to undertake a number of studies in depth, an analysis involving R&D expenditure in certain areas, R&D in industry, both in public and private sectors and their relationship with national research organizations; an analysis of personnel policies to evolve policies for efficient use of R&D funds; migration of scientists; and working conditions.

Standing Group of Ministers on Science and Technology

The Government of India has set up a Standing Group of Ministers on Science and Technology under the chairmanship of the Prime Minister. The main functions of this body are:

(i) To review the progress of science and technology and take an overall view of the scientific effort in the country; and

(ii) to provide policy guidance to the Committee on Science and Technology in the country.
The Council of Scientific and Industrial Research (CSIR), is an autonomous body responsible to the Department of Scientific and Industrial Research of the Cabinet Secretariat and administers the Industrial Research Fund to which contributions are made annually by the Government of India. The functions assigned to the Council are:

(i) the strengthening of the existing research institutions and the establishment of new ones as appropriate;
(ii) the promotion, guidance and co-ordination of scientific and industrial research and the financing of specific research schemes;
(iii) the utilization of research for the development of industry;
(iv) the establishment and award of research studentships and fellowships;
(v) the establishment, maintenance and management of laboratories, workshops, institutes and organizations for the promotion of scientific and industrial research; and
(vi) the collection and dissemination of information and the publication of scientific literature.

The administration, direction and control of the CSIR is vested in the Governing Body, which is reconstituted every three years. The Prime Minister of India is the President and the Minister in charge of the Department of Scientific and Industrial Research of the Cabinet Secretariat is the Vice-President of the Governing Body, which includes eminent scientists, industrialists and administrators as its members, some of whom are also members of its main scientific advisory body, the Board of Scientific and Industrial Research. All decisions on matters of policy, management of funds, sanctioning grants for research schemes and other matters falling within the scope of the activities of the Council are taken by the Governing Body, subject to such limitations in respect of expenditure as the Central Government may from time to time impose.

The members of the Board are scientists and technologists. All proposals relating to scientific or technological matters, whether research or developmental, are referred to it for advice. The Board may also make recommendations to the Governing Body as to the lines on which scientific and industrial research should be conducted in order to ensure the co-ordinated development of science and industry in the country. The Board initiates, guides and supervises research projects, and examines and co-ordinates schemes of research; it is assisted in its work by several standing research committees specializing in various disciplines of science, as well as a number of other advisory committees, including the important Finance Sub-Committee.

The Director-General is the principal executive officer of the Council; he is responsible for its day-to-day administration and controls its research and technical activities.

The Executive Council of each national laboratory/institute of the CSIR is responsible for the control and general direction of the laboratory within the framework of the rules, regulations and directions issued to it from time to time, by, or on behalf of, the Governing Body. It consists of the Director-General of the CSIR, the director of the laboratory concerned, the Financial Adviser to the CSIR, all as ex-officio members, and such other members as may be nominated by the Governing Body of the CSIR. The Chairman of the Executive Council is also appointed by the Governing Body.

The Council's laboratories are distributed all over the country. In the location of the laboratories, many requirements had to be considered and met; such matters as the existence of industries which benefit directly by the laboratory concerned, proximity of academic and research institutions, and sometimes the availability of existing buildings have been taken into account.

There are at present 30 research institutions functioning under the CSIR, including 4 regional research laboratories besides the Publications and Information Directorate, the Indian National Scientific Documentation Centre, the Birla Industrial and Technological Museum, and the Visvesvaraya Industrial and Technological Museum (see Chart II and Annex III). In addition, there are 62 experimental stations, survey stations and field centres attached to the various laboratories. Some of the laboratories dealing with physics and chemistry are engaged on research and development activities which are basic to industrial development generally. Some are concerned with problems of interest to specific industries such as electronics, glass and ceramics, leather, minerals and metals, marine chemicals, drugs and scientific instruments. Some deal with the nation's general needs in regard to food, fuel, building and roads. There are establishments concerned with research in mechanical engineering, aeronautical engineering, public health.
engineering, electrochemistry, geophysics, oceanography, experimental medicine and toxicology.

The regional research laboratories are concerned with problems of industrial development in their respective areas. During the last 25 years the Council has developed in its laboratories more than 400 processes for industrial application, published nearly 10,000 research papers and taken out about 1,200 patents.

Range of activities

All the laboratories are equipped for applied and development research. They do a substantial amount of basic research, particularly oriented basic research. Pilot plant facilities are provided fairly liberally for developing research results and establishing technical and economic feasibility for industrial production. In addition, they maintain a close liaison with industries and provide them with the technical services of testing and certification of products. The work of the laboratories relating to investigations on the utilization of indigenous materials, the development of substitutes for imported products, the adaptation of known technologies to suit local needs, and the development of expertise, has laid the foundation for the establishment of several industries in the country. The work of the Central Fuel Research Institute on coal surveys, coal washing and blending of coals has helped to augment the metallurgical coal resources of the country greatly and to ensure their rational utilization in industry. Research on the production of optical glass by the Central Glass and Ceramic Research Institute has laid the foundation for a sound optical instruments industry. Mineral beneficiation studies at the National Metallurgical Laboratory have made a major impact on the development of mineral resources. The techniques developed for the production of electronic components from indigenous raw materials at the National Physical Laboratory and for the production of dye intermediates at the National Chemical Laboratory has led to the establishment of a number of thriving industries. Research at the Central Food Technological Research Institute on the development of infant food has resulted in the establishment of the infant food manufacturing industry in the country. Techno-economic surveys carried out by the Indian Institute of Petroleum have helped in the planning of industrial complexes and the location of refineries. Fundamental and applied research on corrosion conducted at the Central Electrochemical Research Institute and the National Metallurgical Laboratory has solved a number of corrosion problems encountered in industry.

New branches of science and technology such as geophysics, petroleum technology, oceanography, aeronautics, which had previously received little attention in India have been developed in newly-established CSIR laboratories, thus creating the
much needed expertise in these fields. Many laboratories have initiated research in fields not covered comprehensively in the universities and advanced schools in such fields as dyestuff technology, synthetic aromatics, solid-state physics, microwave technology, and earthquake engineering.

Sponsored research

In pursuance of its assigned functions, the CSIR has been providing, ever since its inception, grants-in-aid to stimulate research at a large number of centres, to expand research facilities and to cover the cost of training research personnel.

The various research committees of the CSIR relating to aeronautical and atmospheric sciences, scientific hydrology, biological and chemical science, chemical engineering, civil engineering and hydraulics, electrical and mechanical engineering, geology and mineralogy, geophysics, metals, pharmaceuticals and drugs, physical sciences, and radio and telecommunication research, have been supporting a large number of research schemes in their respective fields. Sponsored research recognizes the importance of fundamental investigations as the source of new knowledge on which industrial advancement depends, and utilizes the facilities offered particularly by post-graduate departments in universities for pursuing unoriented research. Such research has proved effective in the training of research personnel and in the creation of active schools of research around competent scientists in universities and research institutions. This policy has tended to bring about fruitful collaboration between the Council and the universities and cross-fertilization in respect of scientific research. The policy of providing grants to senior scientists as investigators-in-charge of projects has created leaders of schools of research in various fields.

During 1969, there were 627 research schemes in progress in the various university departments and research institutions other than CSIR laboratories, and 2,294 research fellowships were awarded for working in various institutions. In addition, 17 emeritus scientists and 58 retired scientists were also provided grants for research in their respective fields.

Co-operative research

The CSIR has taken an important step in promoting the establishment of co-operative research laboratories for industry, particularly since most industrial concerns in India are too small to maintain research departments in their own. The Government has encouraged this activity by exempting subscriptions to approved industrial research institutions from income tax and in other ways. The scope of the research covered by these institutes includes:

(a) Investigations on improving raw materials, manufacturing operations and products of the related industries;
(b) Utilization of the products of the industry;
(c) Improvement of machinery and appliances used by the industry and the allied trades, and development of new machines and appliances for manufacturing, testing and quality control;
(d) Conditions of work, time and motion studies, fatigue and rest pauses, standardization of methods of work, conditioning of factories, and diseases and accidents arising specifically out of employment in the industry.

There are at present 9 co-operative research laboratories associated with the textile, cement, plywood, and tea industries. They undertake, on behalf of the member firms, not only basic and applied research germane to the problems of industry, but also carry out market surveys, consumer trials, and quality control operational research. Practically half of their expenditure, recurring and capital, is met by CSIR grants.

Indian Council of Agricultural Research

The objects of the Council are primarily to undertake, aid, promote and co-ordinate agricultural and animal husbandry research and education and its practical application by all means calculated to increase scientific knowledge of the subjects and to secure its exploitation in everyday life, as well as to act as a clearing house of information for agricultural research including animal science and agricultural education.

The Council is responsible for advising the Government of India, the State Governments and other public authorities in matters concerning agriculture and animal husbandry research and education.

The Minister for Food and Agriculture is the President of the Council and the Director-General of the Council. The Council functions through a Governing Body, a Standing Finance Committee, an Advisory Board and four Standing Committees - one each for Agricultural Research, Animal Sciences Research, Agricultural Education, and Agricultural Economics, Statistics and Marketing Research. The Standing Committees are assisted by 18 Scientific Panels in various disciplines.
Indian Council of Agricultural Research

The Indian Council of Agricultural Research has 23 research institutes and 9 soil conservation centres under its administrative control (see Annex IV). Of these, it is proposed that the Indian Agricultural Research Institute, New Delhi, the Indian Veterinary Research Institute, Izatnagar, and the National Dairy Research Institute, Karnal, be designated as national institutes. The central research institutes have 98 research stations/sub-centres in various parts of the country.

Indian Council of Medical Research

The main functions of the ICMR are: (i) to identify the areas of research which need to be sponsored for finding solutions to urgent problems in the fields of medicine and public health; (ii) to create new institutions for conducting medical research in specific fields; (iii) to strengthen existing research facilities which are particularly suitable for tackling regional problems; and, (iv) to create opportunities for training research workers in medical colleges, universities and...
research institutions by a system of fellowships and other schemes.

It is an autonomous body, responsible to the Union Ministry of Health. Its affairs are managed by a Governing Body which has the Minister of Health as its President and which is assisted and advised on scientific matters by a Scientific Advisory Board, consisting of eminent scientists and medical and health administrators. The Board examines all proposals in relation to the scientific objects of the ICMR and reports on their feasibility, being helped in turn by a number of expert committees appointed by it in different fields of medical science.

It has been the established policy of the ICMR to promote research by making full use of the facilities available in its existing institutions and supplementing these by the provision of additional resources in men and money. Besides giving short-term grants to research workers for specific investigations in both fundamental and applied research, the ICMR has established research units in medical colleges, research institutes and hospitals. These units are formed around persons who have done active work in the relevant field.

**Fellowships**

Training of workers in appropriate methods of research is one of the functions of the ICMR. This is achieved through the award of fellowships and scholarships to promising young workers. There are five categories of fellowships, namely, short-term visiting fellowships, post-graduate doctoral fellowships, junior fellowships for training and research, fellowships for training technicians and international post-graduate doctoral research fellowships.

**Research cadre**

In view of the increasing attractions of teaching and service assignments, there is a certain hesitancy on the part of scientific workers to take up medical research careers. Steps have been taken by the ICMR to give long-term security to promising young workers by creating a permanent research cadre.

To enable qualified research workers trained in India or abroad to seek research careers in the country, the Council has also constituted a "super-numerary research cadre".
Technical cadre

The need to create a cadre for technical staff, who work in the research laboratories, to provide them with the necessary security and the hope of getting a reasonable emolument after 15-20 years of service has been realized by the Council. The Governing Body has agreed to the creation of this cadre.

Emeritus medical scientists

To enable senior scientists possessing long and distinguished record of research work, to continue active work in their speciality after retirement, the Council has recently created a few posts of emeritus medical scientists.

Collaboration with other organizations

At the national level, the ICMR has developed a system of mutual representation on the advisory bodies of research organizations, such as the Council of Scientific and Industrial Research, the Armed Forces Medical Research Committee and the Indian Council of Agricultural Research. This enables the Council to offer and receive advice on the formation of research programmes in fields of mutual interest.

Range of activities

A review of the work of the Council and of its predecessor the Indian Research Fund Association, shows a wide variety of subjects successfully investigated. To begin with, the subjects studied were limited to communicable diseases. After Independence, the Council's activities covered a wide range from fundamental issues such as bacterial genetics to everyday applied problems such as village sanitation. The contributions, made from time to time, have received wide acknowledgment in the scientific world. Many of the scientific advances made under the auspices of this organization have led to practical achievements in the field of public health. The successful eradication of malaria, the effective control of plague, the solution of the problems relating to kala-azar, the advances made in the serological and clinical classification of typhus, the extensive research on cholera and its control, significant contributions to the knowledge of the pathology of leprosy, methods for control of filariasis, uses of chemotherapy and antibiotics for the treatment of tuberculosis, are some of the major achievements of the Council.

The Indian Council of Medical Research has also promoted investigations in the field of cancer in various research centres. During the emergency created by the "Chinese Invasion" of 1962, medical research in India moved in a new direction. In collaboration with the Armed Forces Medical Services, it initiated several studies on the effects of climate on those subjected to strenuous work and great emotional stress. The scope of indigenous drug research was further widened in recent years by launching the Composite Drug Research Scheme, which has given some significant leads. The many-pronged investigations into reproductive biology and fertility control, supported by the Council, are aimed at evolving the ideal contraceptive for India. The Council has augmented its research effort in the fields of nutrition, virus diseases, tuberculosis, cholera, occupational diseases, clinical and experimental medicine, maternal and child health, mental diseases, basic medical sciences, environmental hygiene and sanitation. A number of research projects on medical education and health practices are also under way. Through its permanent institutes, research units and ad hoc investigations, numbering over 500, the Council directs a sizeable problem-oriented medical research network.

The institutes under the ICMR are described in Annex V.

DEFENCE RESEARCH AND DEVELOPMENT ORGANIZATION

The Defence Research and Development Organization has a two-tier organizational pattern: (1) the headquarters, responsible for policy direction, control and co-ordination as well as liaison with the armed services; and (2) a large field set-up consisting of 31 research and development establishments/laboratories, two functional directorates and one documentation centre. The whole organization is under the Director-General of Defence Research and Development, who is also the Scientific Adviser to the Defence Minister, and ex-officio Secretary in the Ministry of Defence.

Policy direction

The Defence Research and Development Council was created in 1962, to provide some measure of internal autonomy for scientific research within the defence set-up. The Council is responsible for directing and co-ordinating scientific research and development, and has the Defence Minister and the Minister for Defence (Production) as Chairman and Vice-Chairman respectively. It is composed of 12 members, namely the Minister in the Ministry of Defence, the Defence Secretary, Secretary for
Defence Production, Scientific Adviser, Financial Adviser, the three Service Chiefs, Director-General of Armed Forces Medical Services, Director-General of Scientific and Industrial Research, Dr. D.S. Kothari (Chairman, University Grants Commission), and Dr. S. Dhawan (Director, Indian Institute of Science).

The needs of the Defence Services call for the application of science and technology to problems of equipment as well as questions relating to selection of personnel, their food, clothing and overall organizational and operational problems. The scope of scientific research, design and development activity of the Defence R&D Organization ex-
tends over a wide field, embracing armaments, electronics, aeronautics, oceanography, instrumentation, engineering, metallurgy, applied mathematics, physics, chemistry, biology, physiology, psychology, and, in fact, every discipline which has application to defence.

Practically all the R&D effort is related to specific objectives, only a small fraction being devoted to basic research. The emphasis in development work is on the utilization of indigenous materials and products designed to function efficiently in the climatic conditions obtaining in different regions and at different altitudes. Reliability and serviceability of equipment and weapons are the primary requirement of the services, and the variety of conditions under which these must be maintained presents no small challenge to the research and development teams.

In Annex VI is given the details of the R&D Establishments for Defence.

Training facilities

The Defence R&D Organization provides training in certain specified fields of defence science and technology, mainly for meeting the needs of the Defence Services and its own manpower requirements, and to some extent the needs of the country as a whole. For this purpose the Organization has five training units, namely: (i) the Institute of Armament Technology, which functions in the field of defence somewhat similar to the advanced institutes of technology set up in the country; (ii) the Defence Institute of Work Study; (iii) a school to impart training in scientific selection techniques based on psychological tests; (iv) a Fire Fighting Research and Training Establishment; and (v) a Defence Institute of Stores Preservation and Packaging. To meet the shortage of trained scientists for manning the Defence R&D establishments/laboratories, an Apprenticeship Training Scheme has been instituted. Under this Scheme a number of officer apprentices are trained in specific fields of defence science. R&D personnel are also given advanced training in special fields while in service.

Committees

There are 11 technical panels in DR & DO representing the users, the R&D establishments concerned, inspection and technical experts. These panels specify the problems, lay down the priorities and review the progress of the projects undertaken by the R&D establishments. With a view to allowing greater degree of autonomy to the various R&D establishments, 10 Governing Councils have been constituted for different groups of establishments engaged in similar and allied fields of work. These Councils are composed of eminent scientists in the country besides the users, the Ministries of Finance and Defence and the R&D Organization.

DEPARTMENT OF ATOMIC ENERGY

The Atomic Energy Commission has the following objectives:

(i) to survey the country for atomic minerals; to work and develop such minerals on an industrial scale;

(ii) to do research in scientific and technical problems connected with the development of atomic energy for peaceful purposes;

(iii) to train and develop the necessary scientific and technical personnel for this work; and

(iv) to foster fundamental research in nuclear physics in its own laboratories and in the universities and research institutes in India.

The Department of Atomic Energy (DAE) functions directly under the Prime Minister. The Chairman of the Atomic Energy Commission is the Secretary to the Department of Atomic Energy.

The Department has set up the following advisory bodies:

(1) The Board of Research in Nuclear Science advises the Department of Atomic Energy on the funds to be given to the universities and research institutions for research projects formulated by them, periodically reviews the progress of various projects and inspects various universities and institutions requesting grants for research projects.

(2) The Indian National Committee on Space Research (INCOSPAR) advises the Government on the promotion of research in, and exploration of, space and its utilization for peaceful purposes, promotes international co-operation in space research and exploration, secures liaison with the Committee on Space Research (COSPAR) and the International Council of Scientific Unions and other national and international organizations interested in space research, and advises the Government on its participation in the work of United Nations and other international organizations with similar objects.

The Department is responsible for the following projects.
in the equatorial region was realized. The creation of such a facility would serve the interests of the international scientific community and would contribute to international co-operation by providing opportunities to all member nations for undertaking scientific research in outer space. Accordingly, in 1963, with assistance from the U.S.A., USSR and France, the Thumba Equatorial Rocket-Launching Station (TERLS) was set up at Thumba near Trivandrum. It became operational in November 1963 with the launching of the first Nike-Apache Rocket. Subsequently, the United Nations has accorded its sponsorship to the Station. By the end of 31 March 1970, a total of 205 rockets of various types have been launched. The facility is now freely available to all members of the United Nations, for technical and scientific research for peaceful purposes.

Indian Space Research Organization (ISRO)

The responsibilities for formulating and executing the policies of the Government concerning the peaceful uses of outer space were entrusted to a new organization called the Indian Space Research Organization (ISRO) set up under the DAE in August 1969. ISRO is responsible for the management and operation of all the space research units of the DAE.

Space Science and Technology Centre (SSTC)

On Veli Hill, about two miles to the South East of TERLS, the Space Science and Technology Centre was established in 1966 for the development of sounding rockets of superior performance, expertise in aerospace engineering as well as in ground-based experiments and for scientific payload construction. The initial objective of SSTC was the development of:

(a) a rocket capable of reaching an altitude of at least 500 km with a payload of 30 to 40 kgs, and
(b) a meteorological rocket.

The development of Rohini-75, a 75 mm diameter rocket for flight testing of propellants, was successfully flown with different propellants. RH-70 and RH-125 have been successfully completed. RH-100 and Menaka-1, rockets for routine meteorological sounding experiments are expected to be completed very shortly.

During 1967, the Government of India decided on the development of space technology leading to a modest satellite launcher. The feasibility and optimization studies have been completed to finalize the specifications of a launch vehicle, which would be of four stages, burning solid propellants, and capable of putting a satellite of 30-40 kg payload into a 400 km near-circular orbit, by 1973-1974. The follow-up action required for the implementation of these objectives include the development of special facilities which are under construction.

Thumba Equatorial Rocket-Launching Station (TERLS)

In 1962, in recognition of the importance of sounding rocket research, the Scientific and Technical Sub-Committee of the United Nations Committee on the Peaceful Uses of Outer Space and COSPAR jointly proposed, during the International Quiet Sun Year (IQSY) and the International Indian Ocean Expedition (IIOE), an extensive synoptic sounding rocket programme in meteorology, aeronomy, ionospheric solar activity and the earth's magnetic field. For this purpose, the necessity of having an international sounding rocket-launching facility
Rocket fabrication facility

To implement these objectives large rocket motors would be needed, and a rocket fabrication facility is expected to be commissioned during the latter part of 1970 and will undertake the manufacture of large-size rocket casings and hardware for rocket motors including the development of special materials for rocket motor systems.

Rocket Propellant Plant

The Rocket Propellant Plant which was commissioned in February 1969 has achieved significant success in the manufacture of solid propellant grains.

Sriharikota Range (SHAR)

As it is not possible, because of the density of population in the area, to use TERLS for flight testing and evaluating the performance of the superior rockets being developed at SSTC, a second rocket testing and satellite launching station on the east coast of India at Sriharikota Island (Andhra Pradesh) is being established. In deciding on the location, the advantages in relation to the rotation of the earth, availability of land, water supply and electricity, low density of population and certain meteorological aspects were taken into consideration. It is proposed to construct a plant for the manufacture of large solid propellant blocks at SHAR and a facility for static testing of these propellant blocks on the ground and under simulated high altitude condition.

Experimental Satellite Communications Earth Station (ESCES)

With the assistance of the United Nations Special Fund, the Experimental Satellite Communications Earth Station (ESCES) was established in 1965 at Ahmedabad for experiments and research on the use of satellite communications in India. The station successfully linked up with NASA’s ATS-2 Satellite on 30 August 1967. The link-up involved transmission and reception of messages and television pictures via the ATS-2 satellite with ground stations in Australia and Japan. The experience gained by Indian scientists and engineers at the station has enabled them to take up the responsibility for setting up the first Indian satellite communication earth station at Arvi near Poona. The station is expected to be commissioned in the second half of 1970.

Satellite Instructional Television Experiment (SITE)

In September 1969, DAE and NASA of U.S.A. signed a Memorandum of Understanding to conduct a joint experiment in broadcasting educational TV programmes using the ATS-F Satellite to be launched by NASA during 1972-1973. NASA has agreed to position this satellite in synchronous orbit over the Indian Ocean for a period of one year. The experiment will lay emphasis on community viewing and on instructional television as an aid to development in the field of education, family planning, agriculture, etc. DAE will be responsible for developing and maintaining the ground segment of the experiment. To participate in this experiment, it is planned that television programmes will be beamed to the satellite from ESCES at Ahmedabad.

Microwave Antenna Systems Engineering Group (MASEG)

With the experience gained by the Indian engineers and technicians in the fabrication of a 97 foot antenna for the first satellite communication earth station being built at Arvi, a group known as the Microwave Antenna Systems Engineering Group (MASEG), has been set up as a unit of ISRO and has been entrusted with the designing of microwave antenna systems.

Reliability Evaluation Laboratory

The Electronics Committee, under the chairmanship of Dr. H. J. Bhabha, had recommended that independent zonal laboratories should be established in India to carry out reliability and quality evaluation of electronic products. The recommendations were accepted by the Government of India and the Reliability Evaluation Laboratory at Bombay was formed on 1 September 1967, as an independent unit in the Electronic Group of the Bhabha Atomic Research Centre.

The functions of this Laboratory are to test, measure, evaluate and predict the reliability of electronic components, equipment and systems under various environmental conditions; to undertake failure analysis work in respect of electronic components; and to develop "reliability engineering" as a speciality in India.

Atomic Minerals Division

The Atomic Minerals Division of the Department is responsible for conducting surveys for the location of atomic minerals, development of mineral technology, drilling, mining, and construction of atomic minerals.

Public sector industries

The Department of Atomic Energy is also responsible for the administration of the public sector undertakings, the Uranium Corporation of India
Limited, which carries out uranium mining and processing operations in Bihar; the Indian Rare Earths Limited, for commercial exploitation of the mineral sands on the beaches of Kerala and Madras; and the Electronics Corporation of India Limited, which undertakes the manufacture of a wide range of electronic equipment for nuclear and non-nuclear use.

The Department is responsible for the following projects: Tarapur Atomic Power Project, Rajasthan Atomic Power Project, Madras Atomic Power Project, Nuclear Fuel Complex, Heavy Water Project. The Department also supports a number of special research institutes such as the Tata Institute of Fundamental Research, the Saha Institute of Nuclear Physics, the Physical Research Laboratory, and the Tata Memorial Centre, which was formed by amalgamating the Indian Cancer Research Centre and the Tata Memorial Hospital.

RESEARCH INSTITUTIONS UNDER THE CENTRAL GOVERNMENT DEPARTMENTS

The Government of India, in addition to giving financial assistance to the Council of Scientific and Industrial Research, the Indian Council of Agricultural Research, the Indian Council of Medical Research, the Defence Research and Development Organization and the Atomic Energy Commission, maintains a number of research institutions which are attached to the various ministries, for carrying out research programmes of practical application in their respective fields of activities. Some of them, like the surveys, the Meteorological Department, and the Forest Research Institute, function directly under the ministries concerned, while the others, like the rubber, coffee and silk research institutes, and the Indian Standards Institution are autonomous organizations functioning under the overall supervision of the concerned ministries.

The Departments of the Ministries of Agriculture, Civil Aviation, Communications, Education, Family Planning, Food, Foreign Trade, Health, Home, Industry and Internal Trade, Irrigation and Power, Petro-Chemicals, Mines and Metals, Railways, Steel and Heavy Engineering, and Works, have one or more research institutions attached to them. Many of these Departments have at the headquarters technical divisions for policy direction, planning and co-ordination.

The scope and activities of some of the important institutions under the government departments are given below, grouped under the various ministries.

DEPARTMENT OF COMMUNICATIONS

Telecommunication Research Centre

The Telecommunication Research Centre (1956) attached to the Posts and Telegraphs Department (Department of Communications) has done pioneering work in respect of development and improvement of telecommunication services in the country. It carries out basic studies on telecommunication systems and undertakes the design of different units and standardization of equipment.

Research in industry

The Department of Communications is also responsible for the administration of Indian Telephone Industries Limited, Bangalore and Hindustan Teleprinters Limited, Madras. The Research and Development Department of the Indian Telephone Industries Limited has facilities for the designing, development and production of a wide variety of telecommunication equipment for open-wire, cable and microwave systems. In the Hindustan Teleprinters Limited, there is also a Research and Development Department which is engaged in the designing and development of teleprinters and allied equipment for production purposes.

MINISTRY OF PLANNING, DEPARTMENT OF SCIENCE AND TECHNOLOGY

Survey of India

The main role of the Survey of India (1767), with its headquarters at Dehra Dun is to carry out topographical surveys and to prepare up-to-date maps.

Botanical Survey

The Botanical Survey of India (1890) explores the plant resources of the country by systematic surveys with its headquarters at Calcutta. There are five regional circles centred on Dehra Dun, Shillong, Coimbatore, Poona and Allahabad.

Zoological Survey

The Zoological Survey of India (1916), located at Calcutta, functions as the guardian of the National
Zoological Collections of India. It identifies zoological specimens for Government departments, other institutions and individuals and obtains the fullest possible information about the systematic and geographical zoology of India. It publishes zoological journals, monographs and books and advises on matters regarding wild life. Eight regional stations have been established at Shillong, Poona, Jabalpur, Jodhpur, Madras, Patna, Solan and Dehra Dun.

MINISTRY OF EDUCATION AND SOCIAL WORK

Anthropological Survey

The Survey was separated from the Zoological Survey of India on 1 December 1945, and set up as an independent body. Apart from its headquarters at Calcutta, the Survey has so far established five sub-stations at Port Blair, Shillong, Nagpur, Mysore and Dehra Dun to study the aboriginals and tribes in their own environs. The Survey has studies of the physical type of man in the Indian population; genetic constitution; rates of growth; physiological conditions, e.g. health and serology, diet and nutrition; ethnographic character, psychological reactions and social attitudes and linguistics.

Archaeological Survey

This Survey is responsible for the preservation of ancient monuments of national importance, exploration, excavation, examination of epigraphical records, acquisition and preservation of cultural collections in various archaeological museums, and dissemination of information on Indian culture through an extensive programme of publications. Since 1959 the Survey has been running a school of archaeology. The Survey maintains archaeological museums, attached to a few important sites, through an extensive programme of publications.

The Government of India is financing the Corporation partly by subscription to share capital and partly by advance of loans in the ratio of 50:50. The Corporation’s funds were Rs.7.8 million on 31 March 1969.

Development of inventions is secured by (a) arranging large-scale trials in co-operation with industry, (b) sponsoring and financing pilot plant investigations and (c) licensing patents and inventions to industrialists for commercial production depending upon the nature of the work and the stage to which laboratory investigations have been pursued.

The reports received from research institutions are carefully scrutinized to examine the stage to which laboratory investigations have been conducted and decide whether further pilot-scale trials are indicated to develop the research work and establish its practical and economic possibilities.

The Corporation has played a major role in promoting application of inventions and in supporting research development. The annual production from commercial exploitation of processes licensed by the Corporation has increased from Rs.1.9 million in 1959-1960 to Rs.50 million in 1968-1969. The total value of production licensed up to 31 March 1969 comes to Rs.256 million.

MINISTRY OF AGRICULTURE

Deep Sea Fishing Organization, Bombay

This Organization was established in 1946 to undertake exploratory fishing operations and collecting of offshore data; and to assist private fishing enterprises and State Fisheries Department by giving technical guidance and advice regarding suitability of fishing vessels, fisheries equipment, and fishing gear. Its activities were further enlarged with the setting up of offshore fishing stations at Cochin, Tuticorin and Visakhapatnam during the Third Five-Year Plan.

Forest Research Institute and Colleges

The Institute located at Dehra Dun was established in 1906 to carry out research work on various problems relating to forestry, forest biological sciences and utilization of forest products; to advise various Government Departments on matters relating to forestry and utilization of forest products; to impart specialized training to various types of technicians required for forest-based industries; and to train forest officers and rangers for various State Forest Departments. It functions as an FAO training and educational centre for forestry and forest research for the South East Asian region. The Forest Research Centre at Coimbatore and the Forest Research Laboratory at Bangalore now come under the Forest Research Institute, Dehra Dun.
National Sunar Institute

The Institute was established at Kanpur in 1936 to undertake research on problems pertaining to sugar technology, sugarcane chemistry, and the utilization of the by-products of the sugar industry. It provides technical education in all branches of sugar chemistry and technology.

MINISTRY OF FOREIGN TRADE

Central Coffee Research Institute

The Coffee Board of the Government of India took over, in 1946, the Coffee Experimental Station set up by the Mysore Government at Balehonnur in 1925. The functions of the Institute are to investigate the nutritional value of the coffee plant, soil and moisture conservation, and coffee processing technology; to undertake research on the various pests and diseases of coffee, and to find out internal processes and conditions controlling coffee growth.

Central Coir Research Institute

The Institute was set up in Allepy in 1959 on the recommendation of the Committee for Research and Statistics of the Coir Board. It carries out research investigations for the development of coir industry and provides trained personnel in this field.

Central Sericultural Research and Training Institute

The Institute set up by the Mysore Government was taken over by the Central Silk Board in 1961. The All-India Sericultural Training Institute was merged with this in 1965. The functions of the combined set-up are to carry out scientific, technological and economic research in sericulture; to investigate silkworm and mulberry diseases; and to train personnel in sericulture.

Rubber Research Institute of India

The Institute was set up in 1954 at Kottayam and functions under the Rubber Board. It advises rubber growers on all problems relating to plantations, undertakes systematic research for achieving higher production, carries out soil and leaf analysis, and evolves methods for improving the technological properties of rubber.

MINISTRY OF HEALTH AND FAMILY PLANNING

Central Research Institute, Kasauli

The Institute was established by the Government of India in 1905. It undertakes research on the fundamental aspects of immunological behaviour and the mechanism of pathogenesis of various diseases such as tuberculosis, typhoid, cholera, dysentery. The Institute serves as a centre for the collection and distribution of bacterial-type cultures and international standards of toxins and antitoxins. National centres for the Salmonella and Escherichia group of organisms and for influenza are located at the Institute.

Besides research, the Institute manufactures vaccines and sera and also standardizes and tests different biological products such as penicillin, tetanus antitoxin, etc.

The Institute is a training centre for laboratory personnel in the techniques of bacteriology, virology, immunology and biochemistry, and for medical and veterinary personnel in diagnosis, prevention and treatment of rabies. It conducts regular courses for the B.Sc. (Hons.) and M.Sc. degrees of the Panjab University in the subject of microbiology, and also imparts training at the post-graduate level in pathology, bacteriology and biochemistry, for which it has been recognized by several universities. The Institute acts as an "information bureau" by supplying expert advice on questions concerning rabies, snake bite, cholera, and typhoid.

National Institute of Communicable Diseases, Delhi

The Institute was established in 1963 as a result of the expansion and reorganization of the activities of the erstwhile Malaria Institute of India. The functions of the Institute broadly fall under four categories i.e., advisory, research, control and training not only in malaria but also in other important communicable diseases including arthropod-borne diseases. The Institute has five field centres: the Southern India Branch at Coonoor; the Filaria Training-cum-Research Centre at Kozhikode (Kerala); Rajamundhry Centre, Andhra Pradesh and Varanasi Centre, U.P.; and a field station at Kolar, Mysore for investigating epidemiology and control of endemic plague foci.

The Institute conducts regular training in epidemiology, advanced medical entomology and malarialogy. The Institute also organizes orientation seminars. In addition, the Institute collaborates with WHO in conducting special courses in epidemiology which are conducted for WHO fellows at Prague and Delhi.

The Institute is divided into five divisions: epidemiology, medical entomology, microbiology,
biochemistry, zoonosis and virology, where, besides training, research work is also done. The Institute has been recognized by various universities in India for the purpose of research and submission of thesis leading to post-graduate degrees.

The Institute is assisting the National Small-pox Eradication Programme and the Cholera Control Programme in testing the vaccines used for these programmes, both imported and indigenous. The National Filaria Control Programme is also guided by the Institute. A division is being established for the Neurovirulence testing of the indigenously produced oral polio vaccine.

The Institute has been designated as a Regional Malaria Reference Centre of WHO.

All-India Institute of Medical Sciences, New Delhi

The Institute was established in the year 1956 under an Act of Parliament with the following objectives:

(i) To attain self-sufficiency in post-graduate medical education;
(ii) to develop patterns of teaching to demonstrate a high standard of medical education to all medical colleges and allied institutions in the country; and
(iii) to bring together in one place educational facilities of the highest order for the training of personnel in all branches of health activity.

The hospital, the outpatients' clinics, research laboratories and teaching units of the Institute are housed in a large complex of buildings closely interconnected with each other to facilitate interdisciplinary collaboration. The Government of India provides financial support for the establishment and maintenance of the Institute. It has also been receiving valuable help from a number of foreign and international agencies like the Rockefeller Foundation, Unicef, and Harvard University.

The faculty of the Institute serves on a whole-time basis. Every year, 50 students are admitted to the undergraduate course leading to the M.B.B.S. degree. During the year 1969-1970, a new post-graduate course leading to the degree of D.M. is being instituted in the field of gastroenterology and, at present, facilities are available at the Institute for 42 different courses leading to post-graduate degrees of M.D., M.S., M.Sc., Ph.D., M.Ch., D.M., and M.H.A. The Institute is also conducting a technician's training course of 2 years' duration leading to a diploma, and a B.Sc. nursing post certificate course had also been instituted. A training programme for the maintenance of electro-medical equipment for technical personnel working in various teaching hospitals in the country has also been started under the auspices of WHO.

Almost all the departments of the Institute are engaged in fundamental and applied problems of medical research. Many clinical departments are involved in studies on diseases of regional and national importance,
research in the industrial sector of the country. To this end, considerable co-ordination exists between the Directorate General of Technical Development of this Ministry and the Council of Scientific and Industrial Research. Moreover, this Ministry maintains close touch with the Research and Development work undertaken by the industries of the public and private sectors under the purview of other ministries. The Minister for Industrial Development is represented on the Governing Body of the Council of Scientific and Industrial Research and he is also the Chairman of the Joint Standing Committee for Scientific Research and Industry set up in the Council of Scientific and Industrial Research. The Secretary, Department of Industrial Development and the Director-General, Technical Development are also members of this Committee. The Joint Standing Committee meets periodically and important decisions are taken for guiding research in applied science and industrial fields, which may be fruitful and advantageous commercially.

This Ministry shoulders the major responsibility for the import substitution programme. As a vital fact of this programme, which covers almost the entire gamut of industry both in the private and public sector, the development of indigenous technical research in the industrial sector is encouraged. This has resulted in the identification and development of raw materials as substitutes for imported ones, as well as the development of items of equipment which had hitherto been imported.

### Directorate General of Technical Development (DGTD)

This organization is assigned the responsibility of giving technical advice to all ministries/departments of the Central Government concerned with the different industries, particularly the Ministries of Steel and Heavy Engineering and Petroleum, Chemical, Mines and Metals, and also the Planning Commission. The DGTD is also directly responsible for the planning and development of indigenous production in the private and public sectors either by establishment of new industries or by helping in the growth and expansion of existing industries. With its widespread coverage and also the variegated nature of the technical services rendered by it to multifarious agencies, the DGTD plays a dynamic role in industrial growth, which includes development of scientific and technical research in the various sectors of industry in close co-operation with the CSIR and Indian Standards Institution. Representatives of the DGTD serve on the executive councils of most of the national laboratories to ensure that the research and development efforts progress simultaneously. Similarly, the representatives of the CSIR are included in the composition of most of the development councils and panels to ensure that the research carried out under the aegis of the CSIR could become more purposeful in the development efforts in the various sectors of the industry.

### Indian Standards Institution (ISI)

The Indian Standards Institution (1946), Delhi, is responsible for preparing standards relating to products, commodities, materials, and processes. It provides facilities for the examination and testing of industrial and other commodities, processes and practices, and for the co-ordination of applied research that may be necessary in carrying out these functions. The ISI is the Secretariat for the International Standards Organization for such commodities as lac and mica, which are indigenous to India.

### Inventions Promotion Board

In order to harness the dormant inventive talent of the Indian people, the Inventions Promotion Board was established in 1960. The main objectives of the Board are to give encouragement to artisans, technicians, and others with potential inventive skill to work out details and specifications for processes, appliances and useful gadgets, by giving awards and financial and technical assistance to persons whose inventions are of a distinctive character and of marked value in commercial development and industry. This programme has resulted in research and development of about 297 original industrial items so far.

### Public sector undertakings

Under this Ministry there are eighteen public sector undertakings concerned with the development and production of items. The undertakings are: National Industrial Development Corporation Limited, New Delhi; National Small Industries Corporation Limited, New Delhi; Cement Corporation of India Ltd., New Delhi; Bharat Heavy Electricals Ltd., (BHEL), New Delhi; Marine Tool Corporation of India Ltd., Ajmer; National Instruments Ltd., Jadavpur, Calcutta; Hindustan Photo Films Manufacturing Co., Ootacamund, National Newsprint and Paper Mills Ltd., Nepanagar, Hindustan Salts Ltd., Jaipur; Sambhar Salts Ltd., Jaipur; Hindustan Cables Ltd., Burdwan, West Bengal; Hindustan Machine Tools Ltd. (HMT), Bangalore, Instrumentation Ltd., Kota, Heavy Electricals (India) Ltd. (HEI), Bhopal, Tannery and Footwear Corporation of India Ltd., Kanpur, Indian Consortium for Power Projects Ltd., New Delhi, Bharat Pumps and Compressors Pvt. Ltd., New Delhi, Hindustan Paper Corporation of India (P) Ltd., New Delhi.

A sizeable volume of research and development is going on in an organized manner in most of these undertakings. For illustration, some are indicated:
jobs like ionospheric studies relating to frequency performance of microphones and loudspeakers; to investigate problems in basic and applied science planning for short wave network of AIR, measurement of field strength of Indian and foreign stations, design and development of electrical items in the Research and Development Organization for the Electrical Industry, Bhopal, which has been set up to evolve standards and designs for electrical equipment. 

(d) Research in sensitive photographic, X-ray film material and allied fields conducted by the Hindustan Photo Films Manufacturing Co., Ootacamund, in the development of cine positive film, cine sound, document copying paper, graphic arts film, cine negative film, etc.

MINISTRY OF INFORMATION AND BROADCASTING
Research Department, All-India Radio (AIR)

This Organization was set up in 1937 at New Delhi to investigate problems in basic and applied science having a direct bearing on the technical operation, maintenance and improvement of the services for sound broadcasting and television by All-India Radio. Its activities have been channelized into separate sections dealing with different aspects of broadcast engineering: Propagation Section, dealing with the study of ionospheric radio wave propagation and their application to network planning; Acoustic Section, dealing with the study of acoustic property of materials, studio designs, performance of microphones and loudspeakers; High Frequency Section, dealing with problems relating to transmitters, aerials and receivers; Design Section, for evolving designs of various types of broadcasting equipment; and, a Prototype Section, to prepare models of the equipment. The Research Department has also been assigned jobs like ionospheric studies relating to frequency planning for short wave network of AIR, measurement of field strength of Indian and foreign stations, check on frequency of operation of AIR transmitters and clear channel watch.

MINISTRY OF IRRIGATION AND POWER
Central Water and Power Commission

The Commission consists of a chairman and vice-chairman, assisted by members, chief engineers and directors specialized in their own field. The Commission is responsible for initiating, co-ordinating and furthering, in consultation with the State Governments concerned, schemes throughout the country for the control, conservation and utilization of water resources for purposes of flood control, irrigation and power generation, as well as schemes of thermal power development and also schemes of transmission and utilization of electric energy.

There are three research stations under the Commission. The Central Water and Power Research Station, Poona, is the oldest hydraulic research station in the country. It has successfully tackled problems relating to river training and flood control, irrigation and power structures, development of ports and harbours, and ship building, thereby assuring safety, economy, and operational efficiency of various projects.

The Central Soil Mechanics Research Station, New Delhi, is engaged in research investigations on soil mechanics and foundation engineering, cement concrete, agro-irrigational soil surveys, hydraulic sediment flows and sedimentation of reservoirs. Investigation studies of foundations of heavy structures of public sector undertakings are also carried out by the station.

The Central Power Research Institute, set up in 1960, consisting of two units, one at Bangalore and the other at Bhopal. It undertakes applied engineering research on various problems connected with the generation, transmission and distribution of power. Assistance is being received from the Government Special Fund for meeting the cost of imported equipment, and for services of experts and training facilities for Indian engineers abroad.

Central Board of Irrigation and Power

The Central Board of Irrigation and Power, an autonomous body, co-ordinates research on irrigation, electricity, and allied subjects and publishes relevant literature. It acts as the Indian National Committee for the International Commission on Large Dams and for the International Commission on Irrigation and Drainage. It is the national body in India for the International Society of Soil Mechanics and Foundation Engineers, and acts as a liaison body for the International Association for Hydraulic Research and other similar international scientific organizations. The Board assists in the deliberations of several other technical organizations such as the Indian Standards Institution, the Indian Roads Congress and the Indian Council of Agricultural Research. The Board has two Research Committees, one for Irrigation and the other for Power.

MINISTRY OF PETROLEUM AND CHEMICALS

Oil and Natural Gas Commission

The Oil and Natural Gas Commission had set up a Research and Training Institute in 1963 with technical assistance from the United Nations Development Programme. The functions of this Institute are: to undertake detailed basin studies of different sedimentary basins in India and to submit
recommendations to the ONG Commission regarding oil prospects in different regions; to submit to the Commission an independent second opinion based on reinterpretation and reassessment of available scientific and technical data regarding exploration, production and drilling; to assist the Commission in deciding new locations for oil well drilling, both exploratory and development; to solve drilling mud and oil well cementation problems; to evolve improved geophysical techniques and interpretation methods for exploration in problematical areas; to conduct geochemical investigations and studies of formation fluids, to help in exploration and development of oil and gas fields; to design and fabricate prototype geophysical equipment from indigenously available materials and equipment; to prepare project reports for development of oil and gas fields; to analyse and predict the future behaviour of oil fields with the help of analogue computer; to process the well data and behaviour of oil fields and to study their performance with the help of analogue and digital computer; to undertake laboratory studies on geological, reservoir and production problems; to submit a second opinion on the half-yearly reserve estimates of the oil and gas fields of the Commission; to study and work out optimum drilling programme for different regions of India; to conduct training courses to orient newly-recruited technical personnel for the geological, geophysical, drilling and production operations; to conduct short-term refresher courses for experienced scientific and technical officers of the Commission; to keep the scientific and technical officers of the Commission informed of the recent trends in research and techniques in various aspects of petroleum exploration and development by way of publishing technical manuals, documentation notes, organizing seminars, etc.; and to repair and maintain geophysical seismic well logging and other sophisticated instruments and equipment in well equipped geophysical workshop.

Public sector industries

Under this Ministry there are a number of public sector projects, including Indian Oil Corporation, Fertilizer Corporation of India, Hindustan Antibiotics Ltd., Hindustan Insecticides Ltd., and Hindustan Organic Chemicals Ltd., which in addition to production, are also responsible for design and development work in their respective fields. An independent organization has been set up, known as Engineers India Ltd., to provide engineering and consulting services for the design and construction of refineries and other chemical units in the country.

MINISTRY OF STEEL AND MINES

Geological Survey of India

The Geological Survey of India (1851) is located in Calcutta and its field work is conducted by three regional circles. Its activities cover geological mapping, stratigraphy, economic geology, physical geology, tectonics, petrology, mineralogy, palaeontology, palaeobotany, engineering geology, underground water, geophysical prospecting, petroleum geology, and mining geology.

Indian Bureau of Mines

The Indian Bureau of Mines was set up in 1948 to advise the Central and State Governments on all matters relating to the granting of mineral concessions and on the exploitation and utilization of the country's mineral resources.

In addition, the Bureau's work will now involve providing technical consultancy services to the mining industry on payment of fair charges, inspection of mines for effecting systematic development of mineral deposits, elimination of avoidable waste, promotion of improved methods of mining and reduction of mining costs, conducting research in mining and mineral beneficiation problems, assisting the mineral trade in marketing of minerals and metals in indigenous and international markets, technical publications on problems concerning development and exploitation of various minerals in different parts of the country, and on "mineral statistics and information", and advising the Government in all matters connected with the mineral industry.

Public sector industries

The Government of India has set up under this Ministry a number of public sector industries such as Hindustan Steel Ltd., Ranchi Heavy Engineering Corporation Ltd., Ranchi, Bokare Steel Ltd., Bokare Steel City, Hindustan Steel Works Construction Ltd., Calcutta, Mining and Allied Machinery Corp., Durgapur, Triveni Structurals Ltd., Allahabad, Tungabhadra Steel Products Ltd., Tungabhadra Dam, and Bharat Heavy Plates and Vessels Ltd., Visakhapatnam. They are responsible for the planning, construction, creation and operation of steel plants, heavy engineering machinery, etc. They are also actively engaged in design and development work in their respective fields.
MINISTRY OF RAILWAYS

Research, Designs and Standards Organization

The Research, Designs and Standards Organization (RDSO) of the Ministry of Railways functions as technical consultants to the Railway Board, Zonal Railways and Railway Production Units. It undertakes the design and standardization of all railway assets, besides tackling all technical problems relating to the manufacture of railway equipment by the Railway Production Units, the private sector and the public sector undertakings. RDSO is also responsible for undertaking research, investigations and testing necessary for the effective and efficient utilization of railway assets as well as building up the technical expertise and competence necessary to eliminate foreign consultancy by progressive development of indigenous personnel, materials, products and technology. The organization is headed by a director-general. Under him, there are 10 major disciplines each directly under a director and a separate wing for traffic research including a psycho-technical cell under a joint director. Most of the directorates have more than one wing, each wing under a joint director.

MINISTRY OF TOURISM AND CIVIL AVIATION

Research and Development Directorate

The Research and Development Directorate was the first aeronautical research and development organization to be set up in the country. It was established in 1950 in accordance with the post-war reconstruction plans to handle the scientific and technical problems relating to aircraft engineering airworthiness in civil aviation. Its principal functions include: type certification of civil aircraft designed and developed in the country; scientific laboratory investigations of aircraft accidents including incidents and service failures; technical investigations on operational problems like temperature accountability, aeroengine noise including fatigue; design and development of prototypes of aircraft, gliders and sailplanes; quality control tests and standardization of indigenous aircraft materials and equipment; evaluation of civil transport aircraft types and equipment.

India Meteorological Department

The India Meteorological Department was established in 1875 with headquarters initially at Calcutta and later successively at Simla and Poona. It was shifted to New Delhi in 1942. It was set up for carrying out a systematic study of the climatic conditions and the weather of India as a whole and for issuing of daily weather forecasts and storm warnings.

Its activities now cover meteorology in all its aspects, including agricultural meteorology and hydrometeorology, terrestrial magnetism, seismology, and solar physics.

The Director-General of Observatories (DGO) is assisted by four deputy DGO's responsible for forecasting, climatology and geophysics, instruments, and administration, respectively. The work of the forecasting and other services is distributed among the regional meteorological centres at Bombay, Calcutta, Madras, Nagpur and New Delhi, each functioning under a director. The regional centres have been in existence for the past 25 years.

The Meteorological Communication Centre at Bombay controls the landline teletype network. The Telecommunication Directorate at New Delhi is responsible for national and international exchanges on Radio Teletype and Radio Facsimile. Under the World Weather Watch (WWW) Scheme of WMO, the Directorate of Telecommunications and the Northern Hemisphere Analysis Centre at New Delhi will be expanded to function as a Regional Telecommunication Hub (RTH) and Regional Meteorological Centre (RMC) for WMO and exchange global data and computer processed analyses and prognostic charts. The Department will take an active part in the Global Atmospheric Research Programme (GARP) with particular emphasis on the Indian Monsoon area.

There is a training directorate at Poona which provides instructions in general meteorology and specialized branches. Training facilities are also available in radiometeorology at Delhi. The Department manufactures its own instrument requirements for the observatories. Some instruments for specialized observations are also made, e.g. APT receivers for receiving televised pictures from weather satellites.

The Institute of Tropical Meteorology, Poona, is mainly responsible for the research work of the Department and is actively engaged with programmes in numerical weather predictions, development of rocket payload, stimulation of artificial rainfall and other. Whole-time research units were set up in 1964 at all the five regional centres. To provide an effective organization for advanced detection of and more timely warnings against storms and cyclones, a cyclone warning and research organization is being developed. At the conclusion of the International Indian Ocean Expedition, the International Meteorological Centre, located at Bombay ceased functioning and from 1 April 1966 the Directorate of Indian Ocean and Southern Hemisphere Analysis Centre was started at Bombay and later shifted to Poona in June 1966.

To provide a forum for publishing the results of research work done in the Department, an Indian Journal of Meteorology and Geophysics was started in 1950. The journal has now completed twenty years of continuous publication.
The Department is a founder-member of WMO. The Director-General of Observatories is an elected member of WMO's Executive Committee.

MINISTRY OF WORKS AND HOUSING

National Buildings Organization

The National Buildings Organization was set up in 1954. It is guided by a Standing Committee. Its functions are: to advance the best use of national resources, manpower and technical knowledge in the public and private sectors of the construction field; to engage in technical, economic and social activities in the field of housing and building not covered by other existing agencies and to coordinate the efforts and findings of all agencies concerned with the technology and practice of building construction and building materials production; to promote the standardization and improvement of traditional materials and acceptance of new materials and methods of construction; to provide information and technical assistance to Government organizations and individuals engaged in the field of housing and building and to organize display of building materials, techniques, etc.; and to collect, co-ordinate, and analyse housing and building statistics including that of building materials and to undertake studies and surveys of social, economic, financial and investment aspects of housing.

RESEARCH INSTITUTIONS UNDER THE STATE GOVERNMENTS

The State Governments generally have research establishments in the fields of agriculture, animal husbandry, fisheries, medicine, public health and public works. A few States have research institutions in forestry and sericulture also. Agricultural and animal husbandry experimental stations account for the largest number of State Government research establishments. Since the concept of fullest integration of research, extension and education has been accepted, the State Governments are taking steps to transfer research stations to their agricultural universities. In the fields of medicine and public health, the State Departments have usually a vaccine institute (Pasteur Institute in a few States) and an analysis laboratory. The State Public Works Departments have some engineering institutions for carrying out testing and developmental work and the home departments have forensic laboratories.

A list of some of the important research institutions grouped under the States is given in Annex E.

PRIVATE RESEARCH INSTITUTIONS

Research is carried out by a number of private research institutions, such as the Indian Association for the Cultivation of Science, Calcutta, the Raman Research Institute, Bangalore, and the Bose Research Institute, Calcutta. The Government of India provide grants to some of the private scientific and research institutions, associations and societies for the maintenance and advancement of their work, for expanding and enlarging their research activities, publishing scientific journals, and holding of conferences and symposia. A list of some of the more important private research institutions is given in Annex X.

Some of these research institutes were endowed privately by scientists and philanthropists. The most notable are described in the following.

Indian Association for the Cultivation of Science, Calcutta

Founded in 1876 by Dr. Mahendra Lal Sircar, the Association at first contented itself with organizing illustrated popular lectures on scientific subjects, with a view to making the public science-minded and familiarizing them with the methods of experimentation. Gradually it embarked on fundamental research in physics and chemistry. The outstanding contributions of Dr. C. V. Raman, leading to the discovery of the Raman Effect, came from this institution. At present, work is carried out mainly on X-rays and magnetism, optics, and physical chemistry.

Indian Institute of Science, Bangalore

The Institute was set up in 1909, with financial support from Sir J. N. Tata, as a centre for applied research. It has facilities for research in many fields of physics, aeronautics, chemical engineering, mechanical engineering, and instrumentation. It is now "deemed" to have university status.
Bose Institute, Calcutta

The Institute was founded in 1917 by the late Sir J.C. Bose, who wanted special attention to be devoted to the application of scientific methods to the solution of problems of agriculture, industry and medicine. At present the Institute is mainly concerned with the following subjects - physics and biophysics; inorganic chemistry; organic chemistry and biochemistry; plant physiology, plant breeding and cytogenetics; and microbiology. In addition, the Institute undertakes investigations on behalf of various Government organizations, CSIR, industries and others.

Indian Statistical Institute, Calcutta

Established in 1931, this Institute has earned international recognition as a centre of research in statistics. The Government of India in 1959 recognized it as an institution of national importance. The Institute, besides providing facilities for teaching, training and research in statistics, carries out national surveys, and maintains the International Statistical Education Centre.

Since its inception, the Indian Statistical Institute has been carrying out work in fields such as flood control, agriculture, anthropometry, meteorology, and demography. The National Sample Survey, initiated by the Government of India, with the help of the Institute in 1951, is a comprehensive and continuing socio-econometric survey. The studies on planning started at the Institute in 1954 formed the basis for the frame for the second Five-Year Plan. The Institute is working in close collaboration with the Perspective Planning Division of the Planning Commission. The Statistical Quality Control started in 1953 has developed into a training and consulting service to industry and is fulfilling a basic need in promoting industrial progress.

Physical Research Laboratory, Ahmedabad

Started in 1945 by the Marmakshetra Educational Foundation, this laboratory has grown into an institution of international repute. It is an active centre for study and research in physics in the western part of India, and has helped to raise the standard of post-graduate education in experimental and theoretical physics. Its four departments deal with atmospheric physics, cosmic rays, theoretical physics, and radiophysics and electronics.

Tata Institute of Fundamental Research, Bombay

This Institute was founded in 1945 with financial support from the Sir Dorab Tata Trust. It is recognized by the Government of India as a national centre for advanced study and fundamental research; its activities cover nuclear science, cosmic rays, geophysics, mathematics, instrumentation, and electron magnetism. The Institute works in close collaboration with the Bhabha Atomic Research Centre.

Institute of Palaeobotany (renamed Birbal Sahni Institute of Palaeobotany), Lucknow

Founded in 1946, the Institute was subsequently renamed after its founder and first Director, Professor Birbal Sahni. The Institute has carried out some valuable research on the age of Saline Series in the Panjab, microfossil investigations for the measurement of geological time, Gondwana flora and fossil algae.

Raman Research Institute, Bangalore

This Institute was set up by Dr. C. V. Raman in 1943; it has developed as a strong centre for research in the physical sciences.

Maharashtra Association for the Cultivation of Science, Poona

This Association was established in 1946 by some leading educationists and scientists as an autonomous body. Until 1962, all its professors worked in an honorary capacity. Since 1963, the Association has been aided by the Government of Maharashtra State. At this Institute, research work is being carried out in the fields of botany, genetics and plant breeding, plant taxonomy, and pollution of waters. Facilities are also provided to the post-graduate students for research work. The Institute organizes research on ad hoc projects sponsored by the Indian Council of Agricultural Research, the Council of Scientific and Industrial Research, the Atomic Energy Commission, the University Grants Commission, and the National Institute of Sciences of India.

Sheila Dhar Institute of Soil Science, Allahabad

This Institute was founded in 1949, on the initiative and with the financial support of Dr. Dhar. It is an active centre for research in soil science and is connected with the University of Allahabad.

Saha Institute of Nuclear Physics, Calcutta

The Institute of Nuclear Physics was established in Calcutta in 1950 through the initiative of Profes-
sor Meghnad Saha. It was formally opened by Professor Madame Joliot Curie. It was the first institute in India to make use of the cyclotron, electron microscope, and the NMR spectrometer. It is an active centre for research in nuclear science. The Institute was renamed as the Saha Institute of Nuclear Physics after the death of Professor Saha in 1956.

Tata Memorial Centre, Bombay

The Indian Cancer Research Centre was founded in 1952 and was under the administrative control of the Ministry of Health, Government of India. In 1962, the administrative control was transferred to the Department of Atomic Energy. The name of the Centre was changed to Cancer Research Institute in 1967. The Cancer Research Institute and the Tata Memorial Hospital have since been amalgamated into the Tata Memorial Centre, of which the Institute is now a component unit.

RESEARCH IN INDUSTRY

Industrialization in India has made phenomenal progress since Independence. The establishment of new types of heavy, medium and light industries has accelerated progress towards national prosperity. There is a growing awareness among industries of the need to undertake research work in their fields of interest. Industrial research associations in such fields as textiles, plywood, cement, and tea, have been formed to support research with assistance from the Council of Scientific and Industrial Research.

A large number of industries are collaborating with the national laboratories on technical and scientific matters. The collaboration is at various levels, e.g., representatives of industry participate through the Executive Councils of laboratories in programme formulation, and sit on special committees of the laboratories. Often the laboratories act as technical consultants to the industry and take up specific research projects of interest to it.

A number of design and consultancy organizations, both in public and private sectors, have appeared in the fields of iron and steel, mining and fertilizers.

The National Industrial Development Corporation, set up by the Government of India for financial assistance to industries through loans, started a Technological Consultancy Bureau in 1961. The Bureau undertakes investigations on raw material resources, provides working drawings and complete designs for plans, and prepares project reports for setting up industries. Panels of advisers assist the Bureau on specific assignments, both with regard to problems during the progress of work and, on its completion, to exercise a check before it is passed on to the client.

A survey of 500 industrial firms, conducted in 1956 by the Research Survey and Planning Division of the CSIR, revealed that many of them have laboratories for doing routine work, but only about 50 organizations had facilities for research. The total investment in research by the industries was therefore extremely limited. According to the survey, private industry spent Rs. 11.7 million on scientific research in 1963–1964 and employed 390 scientists.

A preliminary survey of R&D in drugs and pharmaceuticals industry in India for 1967 was reported by A. Rahman and others in Lok Udyog (July 1970, Vol. 4, No. 4, 493-498). A questionnaire was sent to 150 companies and out of these 42 companies reported. According to the survey, the pharmaceutical industry spent in 1967 Rs. 25 million on research, which came to 1.1 per cent of the total sales, and employed 771 R&D personnel.

A preliminary survey on the status of research and development in chemical industry was taken up by the Indian Chemical Manufacturers Association in 1969. A report on this survey was published in 1970 (Chemical Industry News, Special Number, July 1970). A questionnaire was sent to all the members of the Association and replies were received from 77 companies representing a satisfactory coverage. The survey revealed that the ratio of R&D budget to the annual turnover in a large number of cases came to well below 1 per cent and even lower than 0.5 per cent.

The Industrial Credit and Investment Corporation of India Ltd., made a sample study in 1970 among 100 companies engaged in the manufacture of electricals, electronics, engineering items, chemicals, paper and cement, to collect information on their experience in developing R&D facilities in their units. About 55 companies furnished requisite data. According to the survey, all the units have routine R&D cells, while more than two-thirds have R&D departments staffed with qualified scientists and engineers. Some of the units are also equipped with engineering and economic evaluation divisions for translating research into pilot scale, and then on to commercially viable products. In general, the objectives of R&D among these units can be broadly classified as follows:

(1) Improvements in existing product lines, either by extrapolation from existing knowledge
and experience or by new solutions of the original aim;

(ii) import substitution and diversification; and
(iii) creation of a patent position sufficient for
the firm to be able to compete successfully with
other manufacturers in the same field.

The annual expenditure on R&D by these units
during 1969–1970 is nearly Rs. 40 million. An
analysis of the R&D facilities of the companies
grouped by industry, by annual turnover, and by
pattern of research is given in the following tables:

### R & D Expenditure by Selected ICICI Clients

<table>
<thead>
<tr>
<th>Industry</th>
<th>No. of companies</th>
<th>Total annual turnover (Rs. crores)</th>
<th>Companies with no fixed budget</th>
<th>Companies with fixed budget</th>
<th>Total expenditure (Rs. crores)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Chemicals (incl. drugs, pharmaceuticals and toiletries)</td>
<td>17</td>
<td>291.66</td>
<td>6</td>
<td>11</td>
<td>2.40</td>
</tr>
<tr>
<td>2. Engineering</td>
<td>14</td>
<td>85.49</td>
<td>6</td>
<td>8</td>
<td>0.75</td>
</tr>
<tr>
<td>3. Cement</td>
<td>2</td>
<td>74.66</td>
<td>-</td>
<td>2</td>
<td>0.16</td>
</tr>
<tr>
<td>4. Electricals and Electronics</td>
<td>13</td>
<td>44.93</td>
<td>3</td>
<td>10</td>
<td>0.61</td>
</tr>
<tr>
<td>5. Wood, paper and pulp</td>
<td>3</td>
<td>12.62</td>
<td>1</td>
<td>2</td>
<td>0.09</td>
</tr>
<tr>
<td>6. Miscellaneous</td>
<td>6</td>
<td>24.80</td>
<td>3</td>
<td>3</td>
<td>0.08</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>55</strong></td>
<td><strong>534.16</strong></td>
<td><strong>19</strong></td>
<td><strong>36</strong></td>
<td><strong>4.09</strong></td>
</tr>
</tbody>
</table>

### R & D Expenditure in relation to Annual Turnover

<table>
<thead>
<tr>
<th>Range of turnover</th>
<th>No. of companies</th>
<th>Total turnover (Rs. crores)</th>
<th>Companies with no fixed budgets</th>
<th>Companies with fixed budgets</th>
<th>Total expenditure (Rs. crores)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to Rs. 1 crore</td>
<td>9</td>
<td>5.80</td>
<td>4</td>
<td>5</td>
<td>0.14</td>
</tr>
<tr>
<td>Rs. 1 - 5 crores</td>
<td>22</td>
<td>62.05</td>
<td>8</td>
<td>14</td>
<td>0.57</td>
</tr>
<tr>
<td>Rs. 5 - 15 crores</td>
<td>14</td>
<td>128.60</td>
<td>4</td>
<td>10</td>
<td>1.33</td>
</tr>
<tr>
<td>Over Rs. 15 crores</td>
<td>10</td>
<td>337.71</td>
<td>3</td>
<td>7</td>
<td>2.05</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>55</strong></td>
<td><strong>534.16</strong></td>
<td><strong>19</strong></td>
<td><strong>36</strong></td>
<td><strong>4.09</strong></td>
</tr>
</tbody>
</table>

### Pattern of Research Undertaken by ICICI Sample Companies

<table>
<thead>
<tr>
<th>Range of turnover</th>
<th>Import substitution</th>
<th>Product improvement and adaptation</th>
<th>Process modification</th>
<th>Product innovation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to Rs. 1 crore</td>
<td>9</td>
<td>3</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>Rs. 1 - 5 crores</td>
<td>22</td>
<td>14</td>
<td>18</td>
<td>2</td>
</tr>
<tr>
<td>Rs. 5 - 15 crores</td>
<td>14</td>
<td>13</td>
<td>14</td>
<td>4</td>
</tr>
<tr>
<td>Over Rs. 15 crores</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>8</td>
</tr>
</tbody>
</table>

*Source: Research and Development in Industry: a background paper prepared for the Conference on Research and Development in Industry organized by the Industrial Credit and Investment Corporation of India Ltd. 15-16 December, 1970, pp. 11 and 12.*
Shri Ram Institute

The Shri Ram Institute for Industrial Research, set up in Delhi in 1947, was the first institute for industrial research in India in the private sector. It is modelled on the lines of the Mellon Institute, U.S.A. A salient feature of its activities is sponsored, or contract, research. It undertakes work for industrial firms, Government departments and other organizations, and specializes in the fields of chemistry and technology of textiles, high polymers and chemicals. It also provides a well equipped analytical and testing laboratory and engineering services.

Ciba Research Centre

The Ciba Research Centre in Bombay, established in 1963, is a specialized centre sponsored by private industry. Its primary object is the furtherance of pharmaceutical research in India, particularly fundamental research in chemistry and biology, with particular emphasis on natural plant products.

Birla Research Institute

The Birla Research Institute for Applied Sciences, in Birlagram, Nagda, established in 1965, provides research, development and testing facilities for industry. Process studies and the preparation of feasibility reports are also undertaken.

Hindustan Lever

This industrial organization has been interested in market research for the last 30 years, and started economic and operational research about 12 years ago. For technical research support it has been relying to a large extent on the work of the Unilever Research Laboratories in other countries. However, the peculiar problems relating to Indian raw materials, consumer tastes, range of climatic and transport conditions, and the necessity for import substitution, show the need for carrying out scientific research within Hindustan Lever in India.

A new research centre was set up in Andheri, Bombay, by Hindustan Lever in December 1967. The research work undertaken by this centre is closely related to the organization's Five-Year Plan which sets out the tasks for the major operating groups connected with marketing, production, development and research. The current annual expenditure on research amounts to Rs.2.6 million, or 0.25 per cent of the sales turnover, about 5 per cent of the profit before tax in 1967. This centre has a well-equipped laboratory and a workshop which is used for the design and construction of new pilot plants. It has 130 research personnel.

Sarabhai Research Centre

The Sarabhai Research Centre, Baroda, was started in 1967 by amalgamating the various small research units of the Sarabhai Group of Industries. The research work of this Centre relates to development of new drugs, fine chemicals, pharmaceuticals, cosmetics, and toiletries.
PART III

FINANCING OF SCIENTIFIC AND TECHNICAL RESEARCH
Scientific and technical research is supported by the Central Government, the State Governments, universities and industry. India spent 57 million rupees on research in 1950-1951. In 1969-1970, the total expenditure was of the order of 1,460 million rupees. Out of this, the Central Sector contributed 1,232 million rupees. The rough distribution of the total research expenditure during 1969-1970 of the Central Sector among the various organizations is as follows: Council of Scientific and Industrial Research 16.3%; Department of Atomic Energy 21.77%; Defence R&D Organization 11.6%; Indian Council of Agricultural Research 13.0%; Indian Council of Medical Research 1.4%; and the Ministries of the Central Government 36%.

ANNUAL PLANS

The Central Government expenditure on scientific research during the Annual Plans for the years 1966-1967, 1967-1968 and 1968-1969 came to Rs. 881.05 millions, Rs. 929.63 millions and Rs. 1,110.0 millions respectively.

EXPENDITURE BY THE STATES

Expenditure on scientific research by the State Governments has increased from Rs. 10 millions in 1958-1959 to Rs. 122 million in 1969-1970. The State Governments spent mainly on agricultural, veterinary and medical sciences.

FIRST PLAN PERIOD

The Central Government expenditure on scientific research increased during the First Plan period from Rs. 46.85 millions in 1950-1951 to Rs. 121.35 millions in 1955-1956. In 1955-1956, the capital expenditure was only 6.43% of the total allocation. Support for research in agriculture, animal husbandry, veterinary science, industry and technology declined over this period, while allocation to atomic energy research attained 14.33% of the total by the end of the period.

SECOND PLAN PERIOD

The Central Government expenditure rose to Rs. 299.223 millions in 1960-1961. Of the total expenditure in 1960-1961, the capital allocation was 17.6%. Most of this was on atomic energy (48.6%) and CSIR (44.1%). During the Second Plan period, the rate of growth per annum of expenditure on animal husbandry, fisheries and dairy research rose to 14%, that of CSIR to 24%, of medical, public health and forensic science to 30%, of geological survey to 29%, of atomic energy to 34% and of railways to 36%.

THIRD PLAN PERIOD

The Central Government expenditure on scientific research rose to Rs. 791 millions in 1965-1966. The distribution of the expenditure among the various organizations is as follows: Department of Atomic Energy 25.31%; Council of Scientific and Industrial Research 17.9%; Defence Research and Development Organization 12.3%; Indian Council of Agricultural Research 8.1%; Indian Council of Medical Research 1.3%; and the Ministries 35.1%.

SOME FEATURES OF R&D EXPENDITURE

An index that is often used to measure the scientific effort of a nation is the research and development (R&D) expenditure expressed as a percentage of the Gross National Product (G.N.P.). At the CASTASIA Conference held in New Delhi in 1968, a recommendation was made to the governments of all the developing countries to increase their R&D expenditure to the level of 1% of the G.N.P. during the course of the next decade. In India, the expenditure on R&D has increased from 0.23% to 0.44% of G.N.P. during the last decade. This is expected to rise to about 0.5% by the end of the Fourth Plan. In terms of the Central budget, the R&D expenditure has increased from 2.0% to 2.8% during the last decade. There are other important demands such as education and health, on the resources, which have to be taken into account to ensure that the expenditure on...
R&D is fruitful. The expenditure on education now accounts for less than 2.75% of the G.N.P., which has to be considerably increased in order to compare with the expenditure on education in many of the developed countries, which reaches nearly 6.5% of their G.N.P.

In the private sector the amount of investment in R&D is of the order of Rs. 106 million during 1969-1970. It comes to about 7% of the total R&D investment. Taking a total production of about Rs. 25,000 millions in the private sector, industry in India is spending only about 0.6% on R&D.
PART IV

SCIENTIFIC WORKERS AND RESEARCH TECHNICIANS
An adequate supply of scientific and technical manpower is a crucial factor in the development of the science and technology of a country. At the time of Independence, in 1947, the Ministry of Education made a quick survey of the scientific manpower position and established a National Register of scientific and technical personnel under the Council of Scientific and Industrial Research (CSIR). Since then the Division of Scientific and Technical Personnel of CSIR has made continuous assessments of the manpower position in the country with the help of its Register and other facilities.

During the last two decades, education and training facilities have been greatly increased. The annual output from the universities, colleges and polytechnics increased to seven times since 1950. The figures for scientific and technical personnel for 1950 and 1970 are given below:

### Annual Output

<table>
<thead>
<tr>
<th></th>
<th>1950</th>
<th>1970</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post-graduates</td>
<td>1,579</td>
<td>15,000</td>
</tr>
<tr>
<td>Science Graduates</td>
<td>9,628</td>
<td>60,000</td>
</tr>
<tr>
<td>Agriculture and Vet. Graduates</td>
<td>1,100</td>
<td>5,600</td>
</tr>
<tr>
<td>Engg. &amp; Tech. (Graduates)</td>
<td>2,000</td>
<td>16,000</td>
</tr>
<tr>
<td>Engg. &amp; Tech. (Diploma)</td>
<td>2,478</td>
<td>21,000</td>
</tr>
<tr>
<td>Medical Graduates</td>
<td>1,557</td>
<td>9,500</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>18,342</td>
<td>127,100</td>
</tr>
</tbody>
</table>

The total number of personnel with recognized degrees and diplomas who can be classified as scientific and technical categories has been estimated at 1,187,500 in 1970. The increase of scientific and technical personnel between 1950 and 1970 is shown below:

### Scientific and Technical Personnel in India

<table>
<thead>
<tr>
<th></th>
<th>1950</th>
<th>1970</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post-graduates</td>
<td>17,000</td>
<td>152,700</td>
</tr>
<tr>
<td>Science Graduates</td>
<td>60,000</td>
<td>420,000</td>
</tr>
<tr>
<td>Agriculture and Vet. Graduates</td>
<td>6,900</td>
<td>60,200</td>
</tr>
<tr>
<td>Engg. &amp; Tech. (Graduates)</td>
<td>21,600</td>
<td>185,400</td>
</tr>
<tr>
<td>Engg. &amp; Tech. (Diploma)</td>
<td>31,500</td>
<td>244,400</td>
</tr>
<tr>
<td>Medical Doctors (Deg.)</td>
<td>18,000</td>
<td>97,800</td>
</tr>
<tr>
<td>Medical Licentiates</td>
<td>33,000</td>
<td>27,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>188,000</td>
<td>1,187,500</td>
</tr>
</tbody>
</table>

### DATA ON SCIENTIFIC PERSONNEL

The data on scientific personnel does not clearly differentiate the different types. The personnel classified as belonging to the R & D sector are highly heterogeneous in character, some being scientists and technologists with very advanced training, some being less skilled scientists and technical personnel and still others simply administrative staff with some understanding of science. The relative percentages of each of these categories of the total personnel shown as belonging to the R & D sector are important both for assessing the potentialities for the development of R & D and for formulating policies relating to education and training in the field of science and technology. At the CASTASIA Conference, it was observed that the scientific staff employed, in India and similar
countries, to assist and support the scientists was, on the average, similar in number. It was pointed out that the supporting staff employed in western countries was over 2 1/2 times the number of research scientists/engineers.

In aggregate terms, the growth of scientific and technical personnel in India in the last two decades has been impressive. The scientific and technical manpower employed in R & D work has increased from 21,000 in 1958-1959 to 80,000 in 1969-1970. Although there has been considerable increase in the number of scientific and technical personnel during the last two decades, the number actually engaged in R & D work is only about one per 10,000 of the population.

A number of scientists, engineers and doctors receive their education and do research abroad. About 1,000 of them return every year after completion of their education, training, research or other assignment. The Government of India instituted a scheme for a 'Scientists' Pool' in 1958 to help the returning scientists and technologists from abroad to get temporary placement. The scheme is also open to persons possessing high qualifications from Indian universities. A special Recruitment Board, in consultation with the Union Public Service Commission, selects suitable persons for the pool. The National Register of Scientific and Technical Personnel in the Council of Scientific and Industrial Research provides the particulars of the majority of candidates. The pool scheme serves a specific but limited objective. It provides temporary employment for a year or two by which time the pool scientists are expected to find regular jobs. Selected candidates are attached as pool officers to appropriate organizations, where they can work in their field of specialization. Their salaries in the pool are paid by the Council of Scientific and Industrial Research. About 7,000 persons have so far been selected for the pool.

The number of scientists who have migrated mainly to the United Kingdom, the U.S.A., Canada and West Germany from India is estimated at about 30,000 of the total stock. Steps are being taken to provide adequate facilities and job opportunities for scientists to avoid this brain drain.

The scientific and technical manpower in India is doubling every seven to eight years. Government has been employing about two-thirds of the scientific and technical personnel while the private industries and organizations take the remaining one-third. Of the M.Sc. and Ph.D. in science, nearly 30 per cent are engaged in research. Among the graduates in engineering and medicine about 8.5 per cent are engaged in research.

FUTURE REQUIREMENTS

As the output in each sector and in each branch of manufacturing industry increases, the capacity for employment of educated manpower will also increase proportionately. According to the estimates given in the Fourth Plan Document (1969-1974) of the Planning Commission, the overall growth targets are 5.5% a year from 1969 to 1974 and 6.2% a year for the subsequent period up to 1981. Within these overall targets, the sectional targets vary - from 9% (mining and manufacturing industries and construction) to 5% (agriculture) in the period 1970 to 1980. Projecting the growth of output in each sector separately allows for shifts in patterns of employment and reveals demands for educated workers in fast growing highly technical industries which would be lost in a simple overall growth rate.

In 1961, one quarter of the employed graduates were in public administration and defence. It is assumed that the requirements in these sectors will increase at the rate of 4% a year.

The demand for teachers is assessed from enrolment estimates and assumptions about pupil-teacher ratios and teachers' qualifications. The demand for medical personnel is calculated on the basis of one doctor for 4,300 of the population in 1973-1974 and one for 3,700 in 1978-1979. For all the other services combined, a growth rate of 3% a year is assumed up to 1976 and of 5% thereafter. On the basis of the estimates given in the Education Commission Report, the number of graduate workers should increase from 1.1 million in 1961 to 3.3 million in 1976 and 6.5 million in 1986.

FOURTH PLAN

The requirements for various categories of manpower are dealt with in the Fourth Plan document. There has been expansion at all levels of education during 1960-1961 to 1968-1969. The enrolment at the university stage for arts, science and commerce facilities increased from 0.74 million to 1.69 million. The admission capacity in engineering and technological institutions increased from 13,824 to 23,000.
at the degree level and from 25,800 to 48,600 at the diploma level. The enrolment target in universities will reach 2.66 million by 1973-1974.

### Expansion of University Education

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Total enrolment <em>(million)</em></td>
<td>0.74</td>
<td>1.24</td>
<td>1.69</td>
<td>2.66</td>
</tr>
<tr>
<td>2 Percentage of age-group</td>
<td>1.5</td>
<td>2.3</td>
<td>2.9</td>
<td>3.8</td>
</tr>
<tr>
<td>3 Enrolment in science courses (million)</td>
<td>0.19</td>
<td>0.51</td>
<td>0.68</td>
<td>1.19</td>
</tr>
<tr>
<td>4 Enrolment in science courses as percentage of total enrolment</td>
<td>25.7</td>
<td>41.5</td>
<td>40.2</td>
<td>44.7</td>
</tr>
</tbody>
</table>

*Arts, science and commerce subjects excluding intermediate students of the U.P. Board but including the pre-university classes run by the universities.

Manpower planning has to concern itself with different categories, such as doctors, nurses, engineers, agricultural graduates and craftsmen. Educational facilities to meet the estimated manpower requirements of some of the categories are being augmented during the Fourth Plan.

The number of medical colleges is expected to increase to 103,000, by 1973-1974. The stock of doctors increased from 70,000 in 1960-1961 to 102,000 in 1968-1969. It is estimated that it will increase to 138,000 in 1973-1974. The doctor-population ratio in 1968-1969 was approximately 1:5,200. It is expected that in 1973-1974 the ratio will be 1:4,300. The stock of all categories of para-medical personnel is expected to increase from 170,500 in 1968-1969 to 259,900 in 1973-1974.

To meet the requirements of trained manpower for agricultural development, there has been a rapid expansion of facilities for training agricultural and veterinary graduates. The stock of agricultural and veterinary graduates has increased from 14,000 and 5,000 in 1960-1961 to 32,000 and 9,300 respectively in 1965-1966. The stock of agricultural and veterinary graduates is expected to increase to 65,000 and 15,500 respectively in 1973-1974. Adequate training facilities to meet the requirements of agricultural technicians are being provided during the Fourth Plan.

The stock of graduate engineers increased from 58,000 in 1960-1961 to 134,000 in 1968-1969 and of the diploma holders from 75,000 in 1960-1961 to 198,000 in 1968-1969. The existing facilities built up for engineering education are considered to be adequate for meeting the Fourth and Fifth Plan requirements.

### SOURCES OF FINANCE FOR EDUCATION

Education is financed by the Central Government, State Governments, local bodies and through fees and other sources. During the first three Five Year Plans there was a steady increase in the contribution by the various agencies. The largest increase occurred in the expenditure from government funds, with an overall annual growth of 13.3%. Their contribution in 1965-1966 was 71.2% of the total expenditure, as against 51.1% in 1950-1951. Although the contribution of all other sources has declined proportionately, it increased in absolute value. This trend is likely to continue, the responsibility for financing education at all stages will fall increasingly on government funds. Taking an overall view of the situation, it appears that the Central and State Governments will ultimately have to bear about 90% or even more of the total educational expenditure.

### SCHOLARSHIPS AND FELLOWSHIPS

Scholarships and Fellowships are awarded by CSIR, Department of Atomic Energy, University Grants Commission, ICAR and ICMR, for undergraduates doing B.Sc. course, for graduates doing M.Sc. course, for M.Sc.'s doing research leading to Ph.D. and for post-doctoral research. The value of the scholarship/fellowship varies from Rs. 100 per month in the case of undergraduates is Rs. 500 per month for post-doctoral research. A total number of 17,550 scientists has received CSIR Fellowships/grants during the decade ending 1968. The CSIR and ICAR have also been sponsoring a large number of research projects in university laboratories and other institutions. Their annual expenditure on sponsored research comes to about Rs. 11,500,000 and Rs. 8,600,000 respectively.

### CHANGE OF EMPHASIS IN TECHNICAL EDUCATION

There has been a gradual change in the relative outputs of engineers in subjects such as civil, electrical and mechanical engineering. Between 1920 and 1930 the annual production of electrical and mechanical engineers together was less than half that of civil engineers. More recently the annual number of newly-graduated electrical and mechanical engineers together is more than double the number of civil engineers. The output of chemical engineers and technologists has increased from 31 in 1931 to 344 in 1960, 472 in 1965 and is estimated at 900 in 1970. The annual output of graduate metallurgists rose from 47 in 1950 to 329 in 1965 and to 575 in 1970. The annual output of agricultural graduates doubled between 1950 and 1960, from 1,000 to 2,000, and more than doubled again by 1965.

### SCIENTIFIC AND TECHNICAL PERSONNEL IN NON-TECHNICAL WORK

According to the Census of India 1961 relating to scientific and technical personnel, about 18.6% of
the scientific and technical personnel are in non-technical work. There were 143,000 working science graduates in 1961 and out of them 56,000 (40%) were in non-technical vocations. In addition, 25,000 science graduates were unemployed.

Non-technical employment of post-graduate scientists comes to 17% and amounts to over 5,500 post-graduates. Over 2,500 post-graduate scientists are wasted through unemployment. About 4,000 engineers (1,500 graduates and 2,500 diploma holders) held non-technical jobs. About 6,000 doctors were following non-professional and semi-professional pursuits. Broadly speaking, there is a considerable wastage of trained personnel through the drift to non-technical occupations as well as through unemployment.

EMPLOYMENT PATTERNS

Two-thirds of the scientific and technical personnel were working in the public sector. A little less than one-fourth in the private sector, and about one-tenth were self-employed. In the case of graduate engineers and technologists 45% were working in industry and 42% in technical work outside industry. 46% of the diploma level engineers and technologists were working in industry and 44% in technical work outside industry. Industrial employment of post-graduate scientists is 10% only. 28% of the science graduates are engaged in technical work and out of this half of them are working in technical work in industry and the remainder in technical work outside industry.

RECRUITMENT POLICIES

Personnel policies of recruitment, promotion, security of service and incentive have generally followed the rigid patterns of administrative services which are not suitable for administration of science. The recruitment policies of the Atomic Energy Commission, the CSIR and the ICAR are, however, different from the rigid pattern of normal administrative services. Most of the other organizations have tended to follow government procedures of recruitment and promotion. This has not been conducive to the development of mobility, initiative, responsibility and co-operation among scientists. In science and technology, where a high degree of specialization is called for in different disciplines, interchangeability of the staff horizontally is not feasible.

PAY AND EARNINGS

Earnings of engineers in the private sector are higher than those in the public sector. However, the private sector does not treat the better qualified scientist in the same way. The pay level of scientists with higher qualifications in the private sector is lower than that in the public sector. Only 30% of the more highly qualified scientists are employed in the private sector. Teaching posts are also comparatively low paid in the private sector. As regards simple science graduates, their relative situations in the public and private sectors are more or less similar to those of the more highly-qualified scientists. Medical personnel are also better paid in the private sector than in the public sector. Among the various professions, the graduate engineers and doctors rank highest in respect of earnings.

EMPLOYMENT OPPORTUNITIES

Early in 1967, a survey was conducted by the National Register Unit of the CSIR, to ascertain the employment outlook for graduate and higher-degree holders in various sectors. The survey revealed the extent of vacancies in various institutions, as summarized below:

Nearly 30% of the sanctioned posts in agricultural universities, 27% in I.I.T.'s, 20% in engineering colleges and 15% in polytechnics are vacant. Staff in the medical colleges and hospitals are 16% below sanctioned strength. Post-graduate science departments of the universities recorded 15% staff vacancies, while science colleges had 6% of staff positions unfilled.

Research organizations have 19% of their posts unfilled. Engineering construction and service departments (public works, irrigation, electricity) of the government indicated less than 1% of vacancies.

The mineral resources exploration sector showed nearly 35% staff vacancies.

Public sector industries have only about 7 1/2% vacancies and private sector industries less than 1%.

About half the vacancies reported had remained unfilled for more than a year.

Vacancies with starting salaries of Rs. 400 per month or higher are slightly less than half the total vacancies.

The expansion in scientific and technical staff in 1967 is less than 5% of the current sanctioned strength.

UNEMPLOYMENT

In spite of the shortage of technical manpower, the problem of unemployment among them also persists. Geologists and geophysicists recorded the highest proportion of unemployment, 10.7%. The extent of unemployment among the higher-degree holders in science in other fields is: biological scientists 9.4%, agricultural scientists 4.7%, mathematicians 7.2%, statisticians 7.7%, chemists 5.7%, physicists 4.8%. Among the general science graduates the unemployment percentage was found to be 16% and among agricultural graduates about 4%. This indicates a high proportion of wastage among graduates who have had three to four years of college education in general science.
NATIONAL REGISTER ENROLMENT

Nearly 400,000 persons have been enrolled in the National Register maintained by the Council ofScientific and Industrial Research, June 1969. This includes 129,633 in science, 120,804 in engineering, 11,702 in technology and 75,000 in medicine and veterinary science.
PART V

PRINCIPAL AIMS OF NATIONAL SCIENCE POLICY
When India achieved independence, the national policy-makers tried to determine priorities for scientific investigation. In the earlier stages, agriculture and food production and human shelter were the priorities. Then an upsurge of enthusiasm for rapid industrialization shifted the emphasis to industrial potential, and attention was concentrated on primary matters such as steel, water power and electricity. The technical knowledge for setting up the steel plants came from various overseas sources and the national involvement had to be related to assimilating this knowledge and executing the work. This meant that indigenous design development received a temporary set-back; more recently, however, this has been set right and design work has been given priority.

Petroleum, road research and fuel research have received strong support. National products such as wheat, cotton, coffee, tea and jute have been investigated thoroughly, and there is much encouragement to be derived from the way research in these fields has progressed. The Atomic Energy Commission has made tremendous strides and has built up resources for electric power and energy in an impressive fashion. The great scientific complexes inherited from the British period, such as the Geological and Botanical Surveys and the Survey of India Organization are continuing their good work with added intensity. In the field of agriculture, research has been continued at the Indian Agricultural Research Institute, the Indian Veterinary Research Institute, the National Dairy Research Institute, the National Dairy Research Institute, the National Dairy Research Institute and the other research institutions of the Ministry of Food and Agriculture all over the country.

SCIENTIFIC POLICY RESOLUTION

The aims of India's science policy were first set forth by the Government in its Scientific Policy Resolution of 1958. The Resolution was the following:

(i) to foster, promote and sustain, by all appropriate means, the cultivation of science, and scientific research in all its aspects - pure, applied and education;

(ii) to ensure an adequate supply, within the country, of research scientists of the highest quality, and to recognize their work as an important component of the strength of the nation;

(iii) to encourage and initiate, with all possible speed, programmes for the training of scientific and technical personnel, on a scale adequate to fulfill the country's needs in science and education, agriculture and industry, and defence;

(iv) to ensure that the creative talent of men and women is encouraged and finds full scope in scientific activity;

(v) to encourage individual initiative for the acquisition and dissemination of knowledge, and for the discovery of new knowledge, in an atmosphere of academic freedom.

It will thus be observed that the Scientific Policy Resolution is both a declaration of faith in science and technology as an instrument of national progress and a directive enjoining specific steps to be taken in this regard for the benefit of the country. The full statement is given in Annex 12.

IMPLEMENTATION OF SCIENCE POLICY RESOLUTION

The important objective of the Science Policy Resolution of the Government of India was to promote the development of science and technology in the country both to assist the process of economic development and to create among the people at large a scientific temperament. India, being one of the late starters in the race for industrial and agricultural development, has to make long strides in a short period merely to catch up with the advances already made by the more developed countries. India is also faced with shortage of resources not only in trained specialist manpower, but also in other supporting resources such as material and equipment, which are vital to the rapid development of science and technology. One of the basic tasks of the Science Policy, therefore, is to identify the precise nature of the constraints operating now, quantify them to the extent possible and formulate measures as precisely as possible.

Another aim of the Science Policy Resolution is to ensure that the creative talent of men and women is encouraged and finds full scope in scientific activity. Science talent schemes have been introduced to attract promising students and to provide necessary encouragement for pursuing studies in basic and agricultural sciences. With effect from 1964, the Scheme has been extended to the entire country and the number of scholarships given under this Scheme comes to 375. In order to ensure that creative talent of scientific and technological personnel is encouraged, a scheme of merit promotion and advance increments has been introduced by a number of scientific research institutions. The number of posts that are covered under this Scheme by different Ministries and Departments comes to 7,267. With a view to assisting promising young scientists and technical personnel working abroad to find suitable positions in India, the Government has made provision for the creation of supernumerary posts in a number of research institutions. The number of such posts created so far comes to 68.

The Inventions Promotion Board also offers incentive for inventions by workers, artisans, technicians, scientists, engineers and others.
Another important objective of the Science Policy Resolution is to secure for the people of the country all the benefits that can accrue from the acquisition and application of scientific knowledge.

The research and development work carried out by a number of scientific and research institutions in India have contributed to economic development in the country.
PART VI

POLITICAL STRUCTURE AND BASIC SOCIO-ECONOMIC DATA
CONTENTS

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India is a Republic with a parliamentary form of government based on universal adult franchise. Sovereignty rests ultimately with the people. The Constitution of India was adopted by the Constituent Assembly on 26 November 1949, and came into force on 26 January 1950. The preamble to the Constitution embodies the resolve of the people of India "to secure for all citizens Justice, social, economic and political; Liberty of thought, expression, belief, faith and worship; Equality of status and opportunity; and to promote among them all Fraternity assuring the dignity of the individual and the unity of the Nation".

The Constitution provides a single and uniform citizenship for the whole of India. It guarantees seven broad categories of fundamental rights which are justifiable: (i) equality before the law and equality of opportunity in matters of employment; (ii) freedom of speech and expression; (iii) rights against exploitation, prohibiting all forms of forced labour; (iv) freedom of conscience; (v) the right of minorities to conserve their culture; (vi) the right to property; and (vii) the right to constitutional remedies for the enforcement of fundamental rights.

The Republic of India is a Union of States and Territories. The allocation of powers between the Union and the States is spelt out in the Constitution. Defence, foreign affairs, transport and communications, currency and coinage, banking, customs and export duties, and the administration of justice at the higher levels are all Central (Union) matters. The States' powers include those over police, public health, education, agriculture, forests, etc. However, there are some common subjects such as trade and industry, economic and social planning, social security and insurance, labour welfare, prices control, electricity, newspapers and books, and vital statistics, on which both the Union and the States are empowered to legislate. But whenever there is a conflict between the Union and the States legislation, the Union laws will ordinarily prevail.

The Union Executive consists of the President, the Vice-President, and the Council of Ministers with the Prime Minister at its head.

The President is elected by an electoral college consisting of the selected members of the two Houses of Parliament and the Legislative Assemblies of the States. His term of office is five years and he is eligible for re-election. In his capacity as the Head of the State, the President is empowered: to make appointments, to summon, prorogue, address and send messages to Parliament and dissolve the House of the People; to issue ordinances during recess of Parliament; to give assent to bills; to grant pardons, etc. The executive power of the Union vested in him is exercised either directly or through officers of the government in accordance with the Constitution.

The Vice-President is elected by an electoral college consisting of the members of the two Houses of Parliament. His term of office is also five years. He serves as the ex-officio Chairman of the Council of States and acts as President when the latter is unable to discharge his functions due to illness, absence or any other cause.

In the exercise of his functions, the President is aided and advised by a Council of Ministers headed by the Prime Minister. The latter is appointed by the President, who also appoints the other Ministers on the advice of the Prime Minister. Although the Council holds office during the pleasure of the President, it is collectively responsible to the House of the People. The Council of Ministers comprises (i) Ministers who are members of the Cabinet; (ii) Ministers of State who are not members of the Cabinet; and (iii) Deputy Ministers. A Secretary to government is the administrative head of each Ministry and the principal adviser to the Minister. The executive authority is accountable for all its decisions and actions to the people through their elected representatives in the legislature.

The Legislature of the Union, i.e. Parliament, consists of the President and the two Houses known as the Council of States (Rajya Sabha) and the House of the People (Lok Sabha). Rajya Sabha consists of not more than 250 members, of whom 12 are nominated by the President and the rest elected. It is not subject to dissolution, one-third of its members retiring at the end of every second year. The elections are indirect, the allotted quota of the representatives, of each State, as provided in the Constitution, being elected by the elected members of the Legislative Assembly of that State. The Lok Sabha consists of not more than 500 members directly elected from territorial constituencies in the States and not more than 25 members to represent the Union Territories chosen in such a manner as Parliamentary bye-law provides. The number of seats for each State is so allocated that the ratio between this number and the population of the State is, as far as practicable, the same for all States. The full term of the Lok Sabha is five years from the date of its first meeting; however it may be dissolved sooner.

The main functions of Parliament are to make laws for the Country, to make finances available for the needs of the government and to appropriate funds necessary for the services of the State. All legislation requires the consent of both Houses. Parliament's power to debate public questions and to review the work of different departments of the government is unfettered by any limitations except those imposed by the Constitution. The power to amend the Constitution also rests solely with Parliament.

The system of government in the States closely resembles that of the Union. The State Executive consists of the Governor, who is appointed by the President of India for a period of five years, and a
Council of Ministers with a Chief Minister at its Head. Every State has a Legislature consisting of the Governor and two Houses respectively called the Legislative Council (Vidhan Parishad) and the Legislative Assembly (Vidhan Sabha). The Council of Ministers is collectively responsible to the Legislative Assembly. The Legislative Assembly consists of not more than 500 and not less than 60 members directly elected from territorial constituencies in the State. The full term of an Assembly is five years, but it may be dissolved earlier. The Legislative Council comprises not more than one-third of the total number of members in the Legislative Assembly, with a minimum of 40 members. It is a permanent body, one-third of the members retiring at the end of every second year. The financial powers of the Legislative include authorization of all expenditure, taxation and borrowing by the State Government.

GEOGRAPHICAL FEATURES

India covers an area of over 3 million sq. km. and is the seventh largest country in the world. Bounded on the north by the Himalayas, the country tapers southwards in a triangular shape towards the Indian Ocean. Lying entirely in the northern hemisphere, it measures 3,219 km. from north to south and nearly 3,000 km. from east to west. With a land frontier of 15,200 km. and a coastline of 5,700 km., India is commonly referred to as a sub-continent.

The mainland comprises three well-defined regions: the great mountain zone of the Himalayas; the Indo Gangetic Plain; and the Southern Peninsula. The rivers are of four main types: Himalayan, Deccan, coastal, and those of the inland drainage basin. The Himalayan rivers are generally snow-fed and have continuous flow throughout the year. The Deccan rivers are generally rain-fed and fluctuate very much in volume. The coastal streams, especially in the west, have limited catchment areas. Most of the streams of the interior drainage basins are of an ephemeral character. The total available volume of flow from India's rivers is assessed at 1,683,000 million cubic metres per year.

There are four broad climatic regions, based on rainfall. Practically the whole of Assam and the Western Ghats, extending from the north of Bombay to Trivandrum, are areas of very heavy rainfall. The Rajasthan desert, extending to Kutch and the high plateau in the north, are regions of low precipitation. In the plateau of the Peninsula and the Ganga plains, the rainfall is moderately high. In the belt extending from the Panjab plains across the Vindhyas mountains into the western part of the Deccan, the rainfall is low.

POPULATION

India has a total population of about 439 million (1961), and is the second largest of all countries, next only to China. The growth rate is about 2.3% per annum. According to studies based on census data for 1951-1961, the birth rate was 42 per thousand and the death rate 23 per thousand. The infant mortality rate, which in the early part of the century was around 250 per thousand live births, has now declined considerably and according to the 1958 National Sample Survey was 146 per thousand. The life expectancy also increased appreciably during 1951-1960, and is now slightly over 40 years.

Of the 1961 population of 439 million, nearly 361 million (82%) lived in villages and the remaining 18% in cities and towns. This latter percentage represents an increase from 11.2% in 1921 resulting from the steady drift towards the cities during the intervening period. There was a steady increase in the size of the active population from 1951 (140 million) to 1961 (188 million).

The total population in 1971 is estimated at 547 million. According to the Registrar General's recommended projections (medium variant), the population would increase at the rate of 2.5% during 1969-1974. This rate will fall thereafter reaching 1.7% a year by 1980-1981. This projection assumes a decrease in birth rate from 39 per thousand of population in 1968 to 25 in 1980-1981, on the basis of an active family planning programme, and a decline in the death rate from 14 per thousand of population to less than 9 over the same period.
India has sufficient mineral resources for considerable development of its industrial potential. Bihar and Orissa have the largest concentration of ore-deposits, such as iron, manganese, copper, aluminium, thorium and uranium; minerals such as mica, sillimanite and phosphates and over three-fourths of India's reserves of coal, including coking coal. More than 8,000 million tons or iron-ore reserves, over 50% of the world's best mica, and large reserves of manganese ores are in this region. Madhya Pradesh is the second mineral rich area, carrying good reserves of iron, manganese, coal, limestone and bauxite. Madras and Andhra Pradesh have workable deposits of iron, manganese, magnesite, mica, limestone and lignite. Mysore has gold and appreciable quantities of iron, porcelain clays and chrome ores. Kerala possesses enormous concentrations of heavy mineral-sands estimated to contain 150 million tons of ilmenite and workable quantities of monazite, zircon, rutile and sillimanite. Gujarat produces bauxite, salt and manganese-ore, and has newly discovered oilfields of considerable potential. Maharashtra has resources in coal, iron, manganese, titanium, bauxite and salt. Rajasthan is becoming a productive centre in copper, lead, zinc, mica, steatite, beryllium and precious stones. Assam supplies about 700,000 tons of petroleum and has important reserves of this fuel and of Tertiary coal. West Bengal's mineral resources are confined to coal and iron-ore. Only the Punjab and Uttar Pradesh have not yet figured significantly in India's mineral statistics.

**ECONOMIC STRUCTURE**

India is a country with a developing economy, rich in natural resources and manpower. Its resources are capable of fuller exploitation and more intensive utilization. The economy is still predominantly agricultural; about half of the national income is derived from agriculture and allied activities, which absorb nearly three-fourths of the working force. Since Independence, the aim has been to accelerate the pace of industrial development, increase agricultural productivity and achieve all-round progress under national plans.

There has been a steady growth in national income. In 1960-1961 the total national income came to Rs 133,080 millions. During the Third Plan, the national income at 1960-1961 prices rose by 20% in the first four years and registered a decline of 5.6% in the last year. The per capita real income in 1965-1966 was about the same as it was in 1960-1961. This was due to the complete neutralization of the growth rate of national income by the 2.5% rate of growth of population during this period. In 1966-1967, the national income registered only a nominal increase of 0.9%, on account of a severe drought. But the record harvest in 1967-1968 was instrumental in raising the national income by 9% that year. There was an increase of 2.2% in the net national income in 1968-1969 compared to the preceding year at 1960-1961 prices.

In the field of agriculture, the main approach of the Fourth Plan is to provide the conditions necessary for a sustained increase of about 5 per cent per annum over the next decade. To secure this rate of increase in production of food grains and major commercial crops through intensive agriculture, the Plan provides for: continued expansion of irrigation facilities; expansion in the supply of fertilizers, plant protection materials, farm machinery and credit; full exploitation of the possibilities of raising yields opened by the new seed varieties in the case of cereals; intensive efforts in selected areas for raising the yield levels of major commercial crops; and improvement in the agricultural marketing system. The outlay for the agricultural programmes in the Fourth Plan comes to Rs. 27,280 millions in the public sector.

The area under forests continues to decrease, whereas the demand for forest products tends to rise steadily. According to the estimates given in the Fourth Plan, the consumption of industrial wood will increase from 11 million cubic metres in 1968-1969 to 16 million cubic metres in 1973-1974 and the actual production in 1973-1974 is expected to be about 13.5 million cubic metres. The Fourth Plan provides an outlay of Rs. 925.5 million for forest development, including a large-scale plantation programme, timber preservation scheme, pasture improvement scheme and development of minor forest products.

India possesses the largest cattle population in the world, but with the lowest yield. According to the 1961 Livestock Census of India, the number of cattle was 174.50 million, buffalo 51.26 million, sheep 40.17 million, and goats 60.68 million. The Fourth Plan provides an outlay of Rs. 940.6 million for the animal husbandry programme and Rs. 1,389.7 million for dairy development.

The generating capacity for electric power increased from 5.65 million kW in 1960-1961 to 10.17 million kW in 1965-1966 and 14.50 million kW in 1968-1969. The average annual growth rate of the generating capacity was 12.5 per cent during the Third Plan and 12.6 per cent during the three Annual Plan periods. The outlay for power in the public sector in the Fourth Plan is Rs. 24,475.7 million.

Industrial progress was uneven during the Third Plan and the subsequent three Annual Plan periods. During the first four years, the progress achieved was significant. For the next three years
has been an increase in the production capacity of steel and non-ferrous metals and the petroleum, fertilizer and petro-chemical industries. In a wide range of industries it will be possible to achieve substantially higher levels of production. The industrial programmes and policies for the Fourth Plan attempt to bring about a vigorous growth in industrial output and capacity.

Rs. 52,980 million has been made for the plan period.

In spite of the uneven performance, substantial capacity has been created in many new lines. A sound base for future growth has been laid. Several of the large projects initiated during the Third Plan period have been completed and brought into production, particularly in the field of heavy engineering and machine building industries. Design and engineering capabilities have been expanded. Process technology has been developed in the designing and construction of industrial projects in fields like fertilizers, rayon and dissolving pulp. There has been an increase in the production capacity of steel and non-ferrous metals and the petroleum, fertilizer and petro-chemical industries. In a wide range of industries it will be possible to achieve substantially higher levels of production. The industrial programmes and policies for the Fourth Plan attempt to bring about a vigorous growth in industrial output and capacity. An outlay of Rs. 52,980 million has been made for the plan period.

Net Domestic Product and Expenditure

ANNEX I

INDIAN UNIVERSITIES AND CENTRES OF ADVANCED STUDY

UNIVERSITIES

Agra University, 1927
Alligarth Muslim University, 1920
Allahabad University, 1887
Andhra University, Waltair, 1926
Andhra Pradesh Agricultural University, Hyderabad, 1964
Annamalai University, 1929
Assam Agricultural University, Jorhat, 1969
Awadesh Pratap Singh University, Rewa, 1968
Banaras Hindu University, Varanasi, 1916
Bangalore University, 1964
Berhampur University, 1967
Bhagalpur University, 1960
Bhopal University, 1970
Bihar University, Muzaffarpur, 1952
Bombay University, 1857
Burdwan University, 1960
Calcutta University, 1908
Calicut University, 1968
Delhi University, 1922
Dibrugarh University, 1965
Gauhati University, 1948
Gorakhpur University, 1957
Gujarat Ayurvedic University, Jamnagar, 1967
Gujarat University, Ahmedabad, 1950
Guru Nanak University, Amritsar, 1969
Haryana Agricultural University, Hisar, 1970
Himachal Pradesh University, Simla, 1970
Indira Kala Sageet Vishwavidyalaya, Khairagarh, 1956
Indore University, 1964
Jabalpur University, 1957
Jadavpur University, Calcutta, 1955
Jammu University, 1969
Jawahar Lal Nehru Krishi Videsh, Jabalpur, 1964
Jawahar Lal Nehru University, New Delhi, 1969
Jwai University, Gwalior, 1964
Jodhpur University, 1962
Kalyani University, 1960
Kameshwar Singh Sanskrit University, Darbhanga, 1951
Kanpur University, 1966
Karnatak University, Dharwar, 1949
Kashmir University, Srinagar, 1948
Kerala University, Trivandrum, 1937
Kurukshetra University, 1956
Lucknow University, 1921
Madras University, 1857
Madurai University, 1966
Magad University, Bodh Gaya, 1962
Maharaja Sayajirao University of Baroda, 1949
Mahatma Phule Krishi Videsh, Poona, 1968
Marathwada University, Aurangabad, 1958
Meerut University, 1966
Mysore University, 1916
Nagpur University, 1923
North Bengal University, Siliguri, 1962
Orissa University of Agriculture and Technology, Bhubaneswar, 1962
Osmania University, Hyderabad, 1918
Panjab University, Chandigarh, 1947
Patna University, 1917
Poona University, 1949
Punjab Agricultural University, Ludhiana, 1962
Punjabi University, Patiala, 1962
Punjab University, 1960
Rabindra Bharati, Calcutta, 1962
Rajasthan University, Jaipur, 1947
Rajindra Agricultural University, Patna, 1970
Ranchi University, 1960
Ravi Shankar University, Raipur, 1964
Roorkee University, 1949
Sambalpur University, 1967
Sardar Patel University, Vallabh Vidyanagar, 1955
Saugar University, Sagar, 1946
Saurashtra University, Rajkot, 1967
Shivaji University, Kolhapur, 1962
S.N.D.T. Women's University, Bombay, 1951
South Gujarat University, Surat, 1966
Sri Venkateswara University, Tirupati, 1954
Udaipur University, 1962
University of Agricultural Sciences, Bangalore, 1964
U.P. Agricultural University, Pant Nagar, 1960
Utkal University, Bhubaneswar, 1943

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INSTITUTIONS DEEMED TO BE UNIVERSITIES

Varanaseya Sanskrit Vishvavidyalaya, Varanasi, 1958
Vikram University, Ujjain, 1957
Visva-Bharati, Shantiniketan, 1951
Gujarat Vidyapith, Ahmedabad
Gurukul Kangri Vishvavidyalaya, Hardwar
Indian Agricultural Research Institute, Delhi
Indian Institute of Science, Bangalore
Indian School of International Studies, New Delhi
Indian School of Mines, Dhanbad
Jamia Millia Islamia, New Delhi
Kashi Vidyapeeth, Varanasi
Tata Institute of Social Sciences, Bombay

CENTRES OF ADVANCED STUDY

<table>
<thead>
<tr>
<th>Subject and major field of specialization</th>
<th>Department/University</th>
</tr>
</thead>
<tbody>
<tr>
<td>Astronomy</td>
<td>Department of Astronomy and Nizamiah Observatory, Osmania University, Hyderabad</td>
</tr>
<tr>
<td>Bio-Chemistry</td>
<td>Department of Bio-Chemistry, Indian Institute of Science, Bangalore</td>
</tr>
<tr>
<td>Proteins, Lipids and Vitamins</td>
<td>Department of Botany, Delhi University, Delhi</td>
</tr>
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<td>Botany</td>
<td>Department of Botany, Madras University, Madras</td>
</tr>
<tr>
<td>Plant Morphology and Embryology</td>
<td>Department of Chemical Technology, Bombay University, Bombay</td>
</tr>
<tr>
<td>Plant Pathology and Mycology</td>
<td>Department of Chemistry, Delhi University, Delhi</td>
</tr>
<tr>
<td>Geology</td>
<td>Department of Geology, Punjab University, Chandigarh</td>
</tr>
<tr>
<td>Himalayan Geology and Palaeontology</td>
<td>Department of Geology and Applied Geology, University of Sagar, Sagar</td>
</tr>
<tr>
<td>Structural Geology, Geomorphology, Petrology and Minerology</td>
<td>Department of Applied Mathematics, Calcutta University, Calcutta</td>
</tr>
<tr>
<td>Mathematics</td>
<td>Department of Mathematics, Bombay University, Bombay</td>
</tr>
<tr>
<td>Applied Mathematics</td>
<td>Ramanujan Centre of Advanced Study in Mathematics, Madras University, Madras</td>
</tr>
<tr>
<td>Pure Mathematics</td>
<td>Department of Mathematics, Punjab University, Chandigarh</td>
</tr>
<tr>
<td>Pure Mathematics</td>
<td>Department of Physics and Astrophysics, Delhi</td>
</tr>
<tr>
<td>Pure Mathematics</td>
<td>Institute of Radiophysics and Electronics, Calcutta University, Calcutta</td>
</tr>
<tr>
<td>Pure Mathematics</td>
<td>Department of Physics, Madras University, Madras</td>
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<td>Physics</td>
<td>Ramanujan Centre of Advanced Study in Mathematics, Madras University, Madras</td>
</tr>
<tr>
<td>Theoretical Physics and Astrophysics</td>
<td>Department of Mathematics, Punjab University, Chandigarh</td>
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<tr>
<td>Radiophysics and Electronics</td>
<td>Department of Physics and Astrophysics, Delhi</td>
</tr>
<tr>
<td>Biophysics and Crystallography</td>
<td>Institute of Radiophysics and Electronics, Calcutta University, Calcutta</td>
</tr>
<tr>
<td></td>
<td>Department of Physics, Madras University, Madras</td>
</tr>
</tbody>
</table>
Zoology
  Cell Biology and Endocrinology
  Marine Biology

INSTITUTES OF TECHNOLOGY

Indian Institute of Technology, Kharagpur, 1950

(16) Department of Zoology, Delhi University, Delhi

(17) Department of Marine Biology at Portonovo, Annamalai University, Annamalainagar

Indian Institute of Technology, Bombay, 1958
Indian Institute of Technology, Madras, 1959
Indian Institute of Technology, Kanpur, 1959
Indian Institute of Technology, Delhi, 1961

Source: India, Cabinet Secretariat, Committee on Science and Technology: Report on Science and Technology, 1970.
ANNEX II

LIST OF SCIENTIFIC SOCIETIES

GENERAL SCIENCE

All India Science Teachers' Association, New Delhi (1956)
Asiatic Society, Calcutta (1784)
Asiatic Society of Bombay, Bombay (1804)
Assam Science Society, Panbazar, Gauhati (1953)
Bangiya Bijna Parishad, Calcutta (1948)
Current Science Association, Bangalore (1942)
Gujarat Research Society, Bombay (1936)
Hyderabad Science Society, Hyderabad (1948)
Indian Academy of Sciences, Bangalore (1934)
Indian Academy of Forensic Sciences, Calcutta (1961)
Indian Botanical Society, Madras (1921)
Indian Science Congress Association, Calcutta (1914)
Indian Science News Association, Calcutta (1935)
Kamarupa Anusandhan Samiti, Gauhati (1912)
Maharashtra Association for the Cultivation of Science, Poona (1944)
National Academy of Sciences, India, Allahabad (1930)
National Institute of Sciences of India, New Delhi (1935)
Northern India Science Association, Chandigarh (1952)
Operational Research Society of India, New Delhi (1957)
Vijnana Parishad, Allahabad (1913)

MATHEMATICS

Allahabad Mathematical Society, Allahabad (1958)
Calcutta Statistical Association, Calcutta (1945)
Computer Society of India, Hyderabad (1964)
Indian Interplanetary Society, Calcutta (1963)
Indian Mathematical Society, Delhi (1907)
The Society of Mathematical Sciences, Delhi (India), Delhi (1965)

PHYSICS

Indian Society of Theoretical and Applied Mechanics, Kharagpur (1955)

CHEMISTRY

Deccan Section of Royal Institute of Chemistry, Bangalore
Indian Chemical Society, Calcutta (1924)
Institution of Chemists (India), Calcutta (1929)
Society of Biological Chemists, India, Bangalore (1930)

GEOLOGY

Geological Mining and Metallurgical Society of India, Calcutta (1924)
Geological Society of India, Bangalore (1958)
Indian Geophysical Union, Hyderabad (1963)
Indian Society of Earthquake Technology, Roorkee (1963)
Mineralogical Society of India, Mysore (1959)
Mining, Geological and Metallurgical Institute of India, Calcutta (1906)

BIOLOGY

Association of Microbiologists of India, Bombay (1938)
Bengal Natural History Society, Darjeeling (1923)
Bombay Natural History Society, Bombay (1883)
Ethnographic and Folk-Culture Society, Lucknow (1945)
International Society for Tropical Ecology, Varanasi (1960)
Marine Biological Association of India, Mandapam Camp, Ramanathapuram District, Tamil Nadu (1959)

\textsuperscript{5} Renamed in 1970 as "Indian National Science Academy".
BOTANY

Botanical Society of Bengal, Calcutta (1935)
Indian Society of Genetics and Plant Breeding, New Delhi (1941)
International Society of Plant Morphologists, Delhi (1951)
Mycological Society, Calcutta (1954)
Palaeobotanical Society, Lucknow (1946)
Palynological Society of India, Lucknow (1965)
Phycological Society (India), New Delhi (1959)

ZOOCYLOGY

Academy of Zoology, Agra (1954)
Entomological Society of India, Delhi (1939)
International Society of Ichthyology and Hydrobiology, Srinagar (1960)

MEDICAL SCIENCES

Ahmedabad Medical Society, Ahmedabad (1902)
All India Heart Foundation, New Delhi (1962)
All India Medical Licentiates' Association, Calcutta (1906)
All India Ophthalmological Society, Bombay (1929)
Anatomical Society of India, Nagpur (1951)
Association of Otolaryngologists of India, Bombay
Cardiological Society of India, Calcutta
Dermatological Society, India, Calcutta (1960)
Family Planning Association of India, Bombay (1949)
Federation of Obstetric and Gynaecological Societies of India, Bombay (1950)
Indian Academy of Medical Sciences, New Delhi (1961)
Indian Association for the Advancement of Medical Education, Madras (1960)
Indian Association of Dermatologists and Venereologists, Bombay (1935)
Indian Association of Pathologists, Amritsar (1948)
Indian Cancer Society, Bombay (1953)
Indian Dental Association, New Delhi (1946)
Indian Medical Association, New Delhi (1928)
Indian Optometric Association, New Delhi (1963)
Indian Orthopaedic Association, New Delhi (1954)
Indian Society for Malaria and other Communicable Diseases, Delhi (1950)
Indian Society of Anaesthetists, Ahmedabad (1947)
Indian Society of Haematology and Blood Transfusion, Bombay (1959)
Madras State Ophthalmic Association, Tiruchirapalli (1961)
Neurological Society of India, Bombay (1951)
Physicians' Association of Madras, Madras (1961)
Rajasthan Homoeopathy Association, Jaipur (1955)
Society for Study of Industrial Medicine, India, Calcutta (1948)

Tuberculosis Association of India, New Delhi (1939)
West Bengal State Homoeopathic Federation, Calcutta (1962)

ENGINEERING

Aeronautical Society of India, New Delhi (1948)
Electrochemical Society of India, Bangalore (1963)
Engineer's Guild (India), Calcutta (1962)
Indian Institution of Industrial Engineers, Bombay (1957)
Indian National Society of Soil Mechanics and Foundation Engineering, New Delhi (1948)
Indian Society of Engineers, Calcutta (1934)
Institute of Consulting Engineers, Calcutta (1958)
Institution of Chartered Engineers, New Delhi (1961)
Institution of Electronic and Radio Engineers, Bangalore (1951)
Institution of Engineers (India), Calcutta (1920)
Institution of Industrial Engineers (India), Calcutta (1962)
Institution of Marine Technologists, Bombay (1952)
Institution of Surveyors, New Delhi (1950)
Institution of Telecommunication Engineers (India), New Delhi (1953)
International Commission on Irrigation & Drainage (India), New Delhi (1950)
Mechanical Engineers' Association (India), Bombay (1918)
Society for Advancement of Electrochemical Science and Technology, Karaikudi (1964)
South Indian Steam and Fuel Users' Association, Madras (1950)

AGRICULTURE AND ANIMAL HUSBANDRY

Agricultural Society of India, Calcutta (1956)
Agri-Horticultural Society, Madras (1835)
Foodgrain Technologists' Research Association of India, Hapur (1963)
Indian Phytopathological Society, New Delhi (1947)
Indian Society of Agricultural Economics, Bombay (1939)
Indian Society of Agronomy, New Delhi (1955)
Indian Society of Soil Science, New Delhi (1934)
Indian Veterinary Association, Madras (1922)
Mysore Horticultural Society, Bangalore (1856)
Society of Fisheries Technologists (India), Cochin (1961)
Society of Indian Foresters, Dehra Dun (1956)

TECHNOLOGY

Association of Food Scientists and Technologists (India), Mysore (1962)
Association of Rubber Manufacturers in India, Calcutta (1942)
Bengal Pharmaceutical Association, Calcutta (1943)
Bombay Textile and Engineering Association, Bombay (1900)
Colour Society, Bombay (1952)
Essential Oil Association of India, Kanpur (1956)
Indian Ceramic Society, Calcutta (1928)
Indian Institute of Chemical Engineers, Calcutta (1947)
Indian Leather Technologists Association, Calcutta (1952)
Indian Pharmaceutical Association, Bombay (1940)
Indian Pharmaceutical Congress Association, Calcutta (1948)
Indian Society for Quality Control, Jamshedpur (1963)

PHOTOGRAPHY
Federation of Indian Photography, Bangalore (1953)
Photographic Society of India, Bombay (1937)

GEOGRAPHY
Association of Geographers, Jodhpur (1966)
Deccan Geographical Society, Secundrabad (1955)
Indian Geographical Society, Madras (1926)

PSYCHOLOGY
Bombay Psychological Association, Bombay (1945)
Indian Academy of Applied Psychology, Madras (1962)
Indian Psychoanalytical Society, Calcutta (1922)
Madras Psychology Society, Madras (1944)

ANNEX III

NATIONAL LABORATORIES, DIRECTORATES AND ORGANIZATIONS
OF THE COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH

NATIONAL CHEMICAL LABORATORY (NCL),
Poona (1950)

Fundamental and applied research covering the whole field of chemistry for which no specialized institute has been established. The Laboratory is the custodian of National Collection of Type Culture.

NATIONAL PHYSICAL LABORATORY (NPL),
New Delhi (1950)

Research in problems relating to physics, both fundamental and applied, maintenance of standards. Testing facilities are available.

CENTRAL FOOD TECHNOLOGICAL RESEARCH INSTITUTE (CFTRI), Mysore (1950)

Food processing and conservation of food, food engineering and all aspects of fruit technology. Regional fruit and vegetable preservation stations have been established at Trichur, Nagpur, Bombay, Kodur, Simla, Jammu, Mangalore and Lucknow.

CENTRAL FUEL RESEARCH INSTITUTE (CFRI),
Jealgora (1950)

Fundamental and applied research on fuels - solid, liquid and gaseous. Physical and chemical surveys of Indian coals are conducted through seven coal survey stations under the Institute at Jealgora, Raniganj, Bilaspur, Ranchi, Jorhat, Nagpur and Jammu and two sub-stations at Bisrampur (M.P.) and Singrauli (Ranchi).

CENTRAL GLASS AND CERAMIC RESEARCH INSTITUTE (CGCRI), Calcutta (1950)

Research on different aspects of glass and ceramics, pottery, porcelain, refractories and enamels; development of processes for manufacture of glass and ceramic articles and standardization of raw materials used in the ceramic industry.

NATIONAL METALLURGICAL LABORATORY (NML), Jamshedpur (1950)

Fundamental and applied metallurgical research relating to indigenous ores and minerals, refractories, ferrous and non-ferrous metals and alloys in relation to India's metal industries. The Laboratory has three regional foundry stations functioning at Howrah, Madras, and Batala and a corrosion research station at Digha, West Bengal.

CENTRAL DRUG RESEARCH INSTITUTE (CDRI),
Lucknow (1951)

All aspects of drug research including evaluation and standardization of crude drugs, discovery of substitutes for pharmacopoeial drugs and plants, pharmaceutical and synthetic chemicals, biochemistry and biophysics, infection, immunization, pharmacology, chemotherapy and experimental medicine.

CENTRAL ROAD RESEARCH INSTITUTE (CRRI),
New Delhi (1952)

Research on design, construction and maintenance of roads, and on traffic problems and road safety and economic utilization of local resources for roads.

CENTRAL ELECTROCHEMICAL RESEARCH INSTITUTE (CECRI), Karaikudi (1953)

Research on different aspects of electrochemistry, including electro-metallurgy, electro-deposition and allied problems. The Institute has a corrosion testing laboratory at Mandapam and a unit for demonstration of production of cryolite at Madras.

Source: Council of Scientific and Industrial Research (India).
CENTRAL LEATHER RESEARCH INSTITUTE (CLRI), Madras (1953)

Fundamental and applied aspects of leather technology. The Institute has five regional extension centres functioning at Calcutta, Bombay, Rajkot, Kanpur and Jullundur.

CENTRAL BUILDING RESEARCH INSTITUTE (CBRI), Roorkee (1953)

Research in soil mechanics and foundation engineering in relation to buildings and allied structures and building materials; building elements and operations and human comfort in relation to buildings and architectural aspects of buildings.

NATIONAL BOTANIC GARDENS (NBG), Lucknow (1953)

Development of the medicinal plant resources of India, introduction and large-scale cultivation of economic and medicinal plants of industrial importance.

CENTRAL ELECTRONICS ENGINEERING RESEARCH INSTITUTE (CEERI), Pilani (1953)

Promotion of electronics research, particularly in the fields of special purposes vacuum tubes, acoustics and audio engineering, electronic instrumentation, special electronic communications, and solid state devices.

CENTRAL SALT AND MARINE CHEMICALS RESEARCH INSTITUTE (CSMCRI), Bhavnagar (1954)

Investigations for improvement in the quality of salt required for various industrial purposes, recovery of important chemicals from sea water, extraction and utilization of by-products from marine and lake bitterns, recovery, production and utilization of various marine and allied chemicals, research on marine algae and its productions.

CENTRAL MINING RESEARCH STATION (CMRS), Dhanbad (1955)

Research on problems of efficiency, safety and health in mining operations, mine machinery, and engineering.

REGIONAL RESEARCH LABORATORY (RRL, Hyderabad), Hyderabad (1956)

Research in problems relating to the industries and raw materials of the region. Surveys and investigations on raw materials, processes, techniques, and industrial products. Fields of research include fuels, vegetable oils, surface coatings, heavy chemicals and fertilizers, ceramics, organic chemicals, drugs and pharmaceuticals, chemical engineering and operational research.

REGIONAL RESEARCH LABORATORY (RRL, Jammu), Jammu (1957)

Research in problems relating to the industries and raw materials of the region and research specially directed to medicinal plants of the Himalayas (Kashmir region). The Laboratory has an experimental research farm at Chatha (Jammu and Kashmir).

REGIONAL RESEARCH LABORATORY (RRL, Jorhat), Jorhat (1959)

Research in problems relating to more efficient utilization and better conservation of important natural resources of Assam and other regional needs posing special problems.

REGIONAL RESEARCH LABORATORY (RRL, Bhubaneswar), Bhubaneswar (1964)

Research in problems relating to the industries and raw materials of the region.

INDIAN INSTITUTE OF EXPERIMENTAL MEDICINE (IIM), Calcutta (1956)

Research in various aspects of biochemistry as applied to medicine, bacteriology, etc.

BIRLA INDUSTRIAL AND TECHNOLOGICAL MUSEUM (BITM), Calcutta (1956)

A museum to depict scientific and technological advancement.

CENTRAL PUBLIC HEALTH ENGINEERING RESEARCH INSTITUTE (CPHERI), Nagpur (1958)

Research in all aspects of public health engineering and co-ordination of work of all interested agencies in this field in the country. Eight field centres of the Institute are functioning at Calcutta, Delhi, Bombay, Hyderabad, Ahmedabad, Kanpur, Jaipur and Bhopal. Besides, there are three field units at Borivili (Bombay), Jabalpur and Poona and an enteric virus research laboratory at Poona.

CENTRAL MECHANICAL ENGINEERING RESEARCH INSTITUTE (CMERI), Durgapur (1958)

Research in mechanical engineering in all its aspects.

CENTRAL INDIAN MEDICINAL PLANTS ORGANIZATION (CIMPO), Lucknow (1959)

Co-ordination of activities in the development of cultivation and utilization of medicinal plants on
organized basis. The Organization has two zonal centres, one at Bangalore and the other at Haldwani (U. P.).

CENTRAL SCIENTIFIC INSTRUMENTS ORGANIZATION (CSIO), Chandigarh (1959)

Promotion and development of indigenous manufacture of scientific instruments for teaching, research and industry. There are two service and maintenance units, one at New Delhi and the other at Madras.

INDIAN INSTITUTE OF PETROLEUM (IIP), Dehra Dun (1959)

Research in petroleum refining and processing of natural gas, petrochemicals, etc., and providing facilities for the training of personnel for petroleum industry.

NATIONAL AERONAUTICAL LABORATORY (NAL), Bangalore (1959)

Scientific investigation of the problems of flight with a view to practical application to design, construction and operation of aircraft in India.

NATIONAL GEOPHYSICAL RESEARCH INSTITUTE (NGRI), Hyderabad (1961)

Correlation of the field data in all fundamental aspects of geology and geophysics with laboratory investigations and theoretical studies.

VISVESVARAYA INDUSTRIAL AND TECHNOLOGICAL MUSEUM (VITM), Bangalore (1962)

A museum to depict scientific and technological advancement.

NATIONAL INSTITUTE OF OCEANOGRAPHY (NIO), Panaji (Goa) (1966)

Research on various aspects of physical, biological, geological and chemical oceanography including prospecting for petroleum and minerals in sea bed. The Institute has its Biological Oceanography Division and Indian Ocean Biological Centre at Cochin, a field unit at Bombay, and a unit of the Physical Oceanography Division at Cochin.

MAFATLAL SCIENTIFIC AND TECHNOLOGICAL MUSEUM (MSTM), Bombay

A museum to depict scientific and technological advancement.

STRUCTURAL ENGINEERING RESEARCH CENTRE (SERC), Roorkee (1965)

Clearing house for the latest knowledge relating to design and construction of bridges, buildings and other structures, providing design consultancy services to organizations in the private and public sectors in developing complicated designs; functions as an advanced school of structural engineering research; organizes advanced courses in specialized aspects of structural engineering from time to time for the benefit of engineers drawn from the public and private sectors.

INDUSTRIAL TOXICOLOGY RESEARCH CENTRE (ITRC), Lucknow (1965)

Objects are to investigate the harmful effects of industrial toxins in skin, blood, gastrointestinal tract, central nervous system, bones, etc., and to study industrial dust, radioactivity, physical aspects and environmental problems.

INDIAN NATIONAL SCIENTIFIC DOCUMENTATION CENTRE (INSDOC), New Delhi (1952)

To provide full range of documentation and translation services.

PUBLICATIONS AND INFORMATION DIRECTORATE (PID), New Delhi (1951)

Collection and dissemination of scientific information.

CO-OPERATIVE RESEARCH LABORATORIES

Ahmedabad Textile Industry's Research Association (ATIRA), Ahmedabad

Bombay Textile Research Association (BTRA), Bombay

South Indian Textile Research Association (SITRA), Coimbatore

Silk and Art Silk Mills' Research Association (SASMIRA), Bombay

Indian Plywood Industries Research Association (IPIRA), Bangalore

Cement Research Institute of India (CRI), Delhi

Tea Research Association (TRA), Jorhat

Wool Research Association (WRA), Bombay

Indian Jute Industry's Research Association (IJIRA), Calcutta
ANNEX IV

RESEARCH INSTITUTIONS UNDER THE
INDIAN COUNCIL OF AGRICULTURAL RESEARCH

INDIAN AGRICULTURAL RESEARCH INSTITUTE, New Delhi

Established in 1905 at Pusa in Bihar, it was shifted to New Delhi in 1936. The Institute has a great tradition of fundamental and applied research. The work of the Institute is carried out under the following divisions: agronomy, genetics, entomology, mycology and plant pathology, plant physiology and phytoponics, agricultural chemicals, agricultural physics, soil science and agricultural chemistry, agricultural engineering, horticulture, agricultural economics, agricultural extension, plant introduction, seed technology, microbiology, all-India soil and land-use survey, nematology and plant biochemistry. It conducts post-graduate research work in all the above subjects and awards degrees. Recent achievement of the Institute has been the evolution, through planned breeding work, of a number of improved varieties of high-yielding, disease-resistant wheat and maize. It has 22 regional or sub-stations.

NATIONAL DAIRY RESEARCH INSTITUTE, Karnal

The Indian Dairy Institute was shifted from Bangalore in 1955 to Karnal and redesignated as the National Dairy Research Institute. The Institute is mainly concerned with training dairy technicians and cattle development work. It maintains a large farm and pedigree herds of cattle. Some work relating to the utilization of milk and milk products and other aspects of dairying has been done here. The Institute has the following divisions: dairy bacteriology, dairy chemistry, dairy education training, dairy engineering, dairy extension, dairy husbandry, dairy technology and nutrition and dietetics. It has regional stations in Bangalore, Bombay and Kalvani.

INDIAN VETERINARY RESEARCH INSTITUTE, Izatnagar/Mukteswar

Established in 1889, the Institute conducts research on various problems connected with livestock improvement. The work is carried out under the following divisions: animal nutrition, animal genetics, pathology, bacteriology and virology, parasitology, poultry research and biological products, animal physiology and pharmacology, standardization and control of veterinary biological production and extension. It has facilities for advanced training in certain subjects. It has got one regional animal nutrition centre at Palampur (H. P.).

CENTRAL POTATO RESEARCH INSTITUTE, Simla

Since the establishment of the Institute in 1949, it has taken all aspects of potato research which were carried out through various schemes and projects. The Institute has the following divisions: genetics, seed development and production, plant pathology, virus pathology, entomology and nematology, agronomy, plant physiology, agricultural chemistry, biochemistry, statistics and agricultural engineering. Apart from the main institute at Simla it has ten regional stations.

CENTRAL RICE RESEARCH INSTITUTE, Cuttack

Established in 1946 to undertake fundamental research in all aspects of the rice crop and act as an information centre on the crop. The Institute is also one of the world centres under FAO for maintenance of genetic stocks. It is organized in research divisions of botany, agronomy, statistics, agricultural chemistry, agricultural entomology, plant pathology, agricultural engineering, plant physiology, blue-green algae, rice technology and farm. It conducts training courses for research workers, extension staff and farmers.

CENTRAL ARID ZONE RESEARCH INSTITUTE, Jodhpur

Established in 1959 with Unesco and Colombo Plan

Source: Indian Council of Agricultural Research.
assistance, the Institute is devoted to a comprehensive study of animal and plant environments and their improvement to arid conditions. The work is carried out through the following divisions: basic resources survey, resource utilization studies, human factor studies, and special animal studies. It has seven sub-stations.

CENTRAL TUBER CROP RESEARCH INSTITUTE, Trivandrum

Established in 1963, the Institute undertakes (i) fundamental and applied work on all aspects of the improvement of tuber crops (except potato) and (ii) production, maintenance, multiplication and distribution of disease-free seed of improved varieties. Research is carried out in the following five divisions: crop physiology, crops and soils, entomology, genetics and plant pathology. It has one sub-station in Orissa.

INDIAN LAC RESEARCH INSTITUTE, Namkum

Since its establishment in 1925, the Institute's main activities have centred round research and dissemination of the results of research. Improved methods of cultivation, entomological and biochemical studies of the lac insect, and chemical and chemo-technical aspects of lac are studied.

JUTE TECHNOLOGICAL RESEARCH LABORATORY, Tollygunge, Calcutta

Started work in 1938 under the Indian Central Jute Committee. All technological problems relating to jute, viz., assessment of spinning quality, properties of woven fabrics, microbiological studies, new uses of jute, utilization and prevention of waste, etc., are studied. There are four divisions: physics, chemistry, chemical technology and textile technology.

COTTON TECHNOLOGICAL RESEARCH LABORATORY, Bombay

Established in 1924, the Laboratory helps the agricultural departments in judging the quality of any new variety of cotton produced and undertakes spinning tests, measurement of fibre properties and yarn characteristics of Indian cottons and determines the relationship between the fibre properties and the spinning value of cotton. Work is carried out in the following five divisions: mechanical processing, physics, microscopy-chemistry, engineering and co-ordination and quality evaluation.

JUTE AGRICULTURE RESEARCH INSTITUTE, Barrackpore

It carried out research on aspects for the improvement of this crop. It consists of the following sections: genetics and plant breeding, agronomy, plant nutrition involving radio-tracer techniques, agricultural chemistry and microbiology, mycology and plant pathology, agricultural engineering, extension and development, entomology and statistics.

CENTRAL TOBACCO RESEARCH INSTITUTE, Rajamundry

The main function of the Institute is to investigate the fundamental problems connected with various aspects of tobacco, its agricultural production and commercial utilization. It also co-ordinates the work of other tobacco experimental farms. The Institute has, at present, sections of plant pathology, plant physiology, agronomy, entomology, agricultural chemistry and technology, statistics, training and demonstration, plant breeding and cytology. It has five sub-stations.

CENTRAL PLANTATION CROPS RESEARCH INSTITUTE, Kasargod

Established originally in 1947, as a research station on coconut, it has been upgraded as the Central Plantation Crops Research Institute since 1969 with campuses at Kasargod, Kayangulam and Vittal. Basic and applied research will be carried out on various commercial plantation crops, viz. coconut, arecanut, spices, cashew nut and cocoa. The Institute will consist of the divisions of genetics and agronomy and production-cum-extension unit at Kasargod; division of pathology and entomology and units of plant physiology and biochemistry extension and farm at Kayangulam for crops other than arecanut, and divisions of genetics and agronomy and units of entomology, plant pathology and extension at Vittal for arecanut. It has five regional stations.

SUGARCANE BREEDING INSTITUTE, Coimbatore

Established in 1912 to develop improved sugarcane varieties, to conduct fundamental investigations on the botanical cytogenetical, physiological chemical, mycological and entomological aspects of sugarcane, and to provide post-graduate training in the breeding and botany of sugarcane. The various sections of the Institute are: breeding and botany, cyto-genetics, physiology, chemistry, mycology and entomology. It has three sub-stations.

INDIAN INSTITUTE OF SUGARCANE RESEARCH, Lucknow

Established in 1952 to undertake integrated studies so that both the sugarcane growers and the sugar industry might be able to derive greater benefits. The Institute is provided with a large experimental farm and has a well-equipped meteorological observatory. The work is carried out in the following sections: agronomy, entomology, mycology, agricultural engineering, soil science and plant physiology.
CENTRAL INLAND FISHERIES RESEARCH INSTITUTE, Barrackpore

Established in 1947 for conducting scientific investigations for the appraisal of the inland fisheries resources and their proper conservation, management and development. The work of the institution is shared by four main divisions: pond culture, riverine and lacustrine and estuarine. It has three sub-stations and ten centres/units.

CENTRAL MARINE FISHERIES RESEARCH INSTITUTE, Mandapam Camp

Established in 1947, the Institute handles researches pertaining to marine fisheries. The work is broadly divided into the following categories: fishery biology, marine biology and oceanography and fishery survey. It has five sub-stations and nine research units.

CENTRAL INSTITUTE OF FISHERIES TECHNOLOGY, Ernakulam

Established in 1957 to (i) undertake research work on fishing craft gear and mechanical fishing accessories, on gear and craft materials and their preservation and on engines used in fishing boats; and (ii) study the fundamental and applied aspects of fish processing technology. It has three sub-stations and four research units.

INDIAN GRASSLAND AND FODDER RESEARCH INSTITUTE, Jhansi

Established in 1962 to carry out and co-ordinate research on grassland and fodder crops and to provide training at various levels both on the research and development of these crops. It conducts research in the following five divisions: grassland management, plant improvement, fodder agronomy and soil science, plant/animal relationship, and weed ecology and control.

CENTRAL SHEEP AND WOOL RESEARCH INSTITUTE, Malpura

Established in 1962 to (i) initiate and co-ordinate research on the problems of sheep and wool production and wool utilization; (ii) train research and development workers concerned with sheep and wool production at post-graduate level; and (iii) advise the wool and woollen industry regarding the improved methods of wool processing and utilization. The Institute has the following 12 sections: sheep genetics, grassland and forage agronomy, sheep nutrition, sheep veterinary, sheep physiology, fibre science, fibre processing, sheep statistics, sheep husbandry and post-graduate training. It has two sub-stations.

INSTITUTE OF AGRICULTURAL RESEARCH STATISTICS, New Delhi

Established in 1959 to carry out fundamental and applied research in agricultural statistics, provide post-graduate training in agricultural statistics, and advise the central and state governments on problems concerning the application of statistical methods in agricultural, animal husbandry and biological resources.

INSTITUTE OF HORTICULTURAL RESEARCH, Bangalore

Established in 1967, with temporary headquarters at Bangalore, the Institute will be eventually shifted to Hessaraghatta. It will conduct research in improvement of fruits, vegetables and ornamental plants.

SOIL CONSERVATION CENTRES

The following soil conservation research, demonstration and training centres have also come under the administrative control of the ICAR: Ootacamund (Tamil Nadu); Bellary (Mysore); Chandigarh; Kotah (Rajasthan); Dehra Dun (U.P); Vasad (Western Rly.) (Gujarat); and P.O. Ibrahimpatan, Distt. Hyderabad (Andhra Pradesh).

CENTRAL SOIL SALINITY RESEARCH INSTITUTE, Karnal

The Institute has been set up in 1968 to conduct fundamental and applied research on various problems relating to soil salinity, drainage and irrigation. There are three divisions in the Institute: soils and agronomy, agricultural engineering, and genetics and plant physiology. It has its sub-station at Canning (West Bengal).

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ANNEX V

INSTITUTIONS UNDER THE INDIAN COUNCIL OF MEDICAL RESEARCH

For the promotion of medical research in India a chain of institutes and laboratories have been established from time to time depending on the felt needs of the country and resources of the Indian Council of Medical Research as follows:

NATIONAL INSTITUTE OF NUTRITION, Hyderabad

Prior to 1969 the National Institute of Nutrition was known as the Nutrition Research Laboratories which were established in 1918. The activities of the Institute have been directed towards the following objectives: researches in the laboratory, in the hospital and in the field on the various dietary and nutritional problems of particular importance to India; training young scientists in research methods in nutrition and allied subjects; training public health and community development workers in nutrition; and acting in an advisory capacity to government and other organizations on questions of nutrition. Training courses in nutrition constitute an important aspect of the work of the Institute.

VIRUS RESEARCH CENTRE, Poona

In the beginning this Centre was maintained jointly by ICMR and the Rockefeller Foundation. After 1957, the participation of the Rockefeller Foundation was discontinued. The main function of the Centre is to study the occurrence and distribution of arthropod-borne viruses, their natural history and the diseases they cause. It has been designated as a collaborating laboratory of WHO for arboviruses. The Centre has undertaken investigations on some specific problems, notably: (i) Kyasanur Forest Disease; (ii) Japanese Encephalitis; (iii) Dengue and Chikungunya. It maintains a large disease-free mouse colony and a well-equipped tissue culture laboratory.

TUBERCULOSIS CHEMOTHERAPY CENTRE, Madras

The Centre was started in Madras in 1956 under the joint auspices of ICMR, the Madras Government, WHO and the British Medical Research Council. It has been engaged in studies of the comparative effectiveness of treating pulmonary tuberculosis patients in their own homes by administration of new anti-tuberculosis drugs and the traditional method of treating them as in-patients at hospitals and sanatoria. The Centre is recognized for post-graduate training in microbiology and biochemistry by Madras and several other universities.

CHOLERA RESEARCH CENTRE, Calcutta

The Centre was established in 1962 to strengthen and supplement the facilities for cholera research in the country. Since its inception the following lines of work have been initiated by the Centre: comparative studies on various methods of collection of stools from cholera patients and isolation of Vibrio Cholerae, possible role of flies in the transmission of cholera, bacteriological and immunochemical studies of strains of V. cholerae, studies on the antigenic patterns of cholera vibrio and studies on endotoxin of V. cholerae and other vibrios.

INDIAN REGISTRY OF PATHOLOGY, New Delhi

This institution has been located at the Pathology Department of the Safdarjung Hospital since 1965. Its two important functions are to provide expert training and research facilities in pathology and to provide teaching material to colleges which do not possess these facilities.

OCCUPATIONAL HEALTH RESEARCH INSTITUTE, Ahmedabad

Basic research in the total field of industrial health including industrial hygiene, industrial physiology, psychology and toxicology. Training of personnel in the field of industrial health in all levels including post-graduate students.

Source: Indian Council of Medical Research
INSTITUTE FOR RESEARCH IN REPRODUCTION

In order to strengthen the Family Planning Programme of the Government of India and the need to evolve more effective, safer, inexpensive and acceptable methods of fertility control, which required complete understanding of the mechanism involved in the process of reproduction, it was evident that research on the physiology of reproduction formed the backbone of an effective family planning programme. With these two objectives in view, a Family Planning Programme Unit was set up at the Indian Cancer Research Centre at Bombay. After a decade, the Unit was split into two units, known as "Contraceptive Testing Unit" and "Reproductive Physiology Unit". The Reproductive Physiology Unit and the Contraceptive Testing Unit, which began as small units, have expanded and now developed into a full-fledged Institute for Research in Reproduction. This Institute was inaugurated on 21 February 1970.

RESEARCH UNITS AND CENTRES LOCATED WITHIN NON-ICMR INSTITUTIONS

It has been the policy of the Council to promote research by making full use of the facilities available in existing institutions and supplementing these by provision of additional resources in men and money. At present the Council maintains the following units:

1. Blood Group Reference Centre,
   Haffkine Institute, Parel, Bombay-12

2. Entero Virus Research Unit,
   Haffkine Institute, Bombay

3. Neurophysiology Research Unit,
   Department of Physiology,
   All-India Institute of Medical Sciences,
   Ansari Nagar, New Delhi-16

4. Haematological Unit,
   School of Tropical Medicine,
   Calcutta

5. The ICMR Virus Research Unit,
   Pasteur Institute,
   Coonoor

6. Toxicology Research Unit,
   All-India Institute of Medical Sciences,
   Ansari Nagar, New Delhi-16

7. Peripheral units of Indian Registry of Pathology at:
   (i) S.N. Medical College, Agra
   (ii) Grant Medical College, Bombay
   (iii) Institute of Post-Graduate Medical Education and Research, Calcutta
   (iv) Kurnool Medical College, Kurnool
   (v) Christian Medical College and Hospital, Vellore
ANNEX VI

DEFENCE R&D ESTABLISHMENTS AND LABORATORIES

ARMAMENTS RESEARCH AND DEVELOPMENT ESTABLISHMENT

Responsible for research and development of all types of conventional weapons, ammunition and allied stores for the three services.

DEFENCE METALLURGICAL RESEARCH LABORATORY

Responsible for research and development on metals and alloys for use in defence equipment.

EXPLOSIVES RESEARCH AND DEVELOPMENT LABORATORY

Responsible for research and development relating to all kinds of explosives and propellants including pyrotechnics, incendiary explosives, high explosives, initiators, igniters and cap compositions and smoke compositions, etc.

INSTRUMENTS RESEARCH AND DEVELOPMENT ESTABLISHMENT

Responsible for research and development relating to optical, fire control, survey, drawing and photographic instruments, certain categories of medical instruments, map reproduction equipment and various related stores used by the services.

PROOF AND EXPERIMENTAL ESTABLISHMENT

Responsible for undertaking proving trials and evaluation in respect of all types of army and naval guns and ammunition.

DEFENCE RESEARCH AND DEVELOPMENT LABORATORY

Responsible for research and development in the field of rocketry and special weapons.

TERMINAL BALLISTICS RESEARCH LABORATORY

Responsible for basic and applied research on problems connected with detonation of explosives and terminal ballistics, terminal studies of hyper-velocity impact, transient phenomena and behaviour of metals under impulsive loads.

ELECTRONICS AND RADAR DEVELOPMENT ESTABLISHMENT

Responsible for research and development relating to electronics equipment for the armed forces, modifications of existing equipment for improved performance and investigation of advanced circuit designs and techniques for equipment, materials and processes.

SOLID-STATE PHYSICS LABORATORY

Responsible for basic studies on solid-state phenomena, investigations on materials and techniques and development work on solid-state devices.

DEFENCE ELECTRONICS RESEARCH LABORATORY

Responsible for technique-oriented research in the field of electronics with a view to applying the results for the design and development of the advanced range of defence equipment.

HIMALAYAN RADIO PROPAGATION UNIT

Responsible for carrying out radio propagation studies peculiar to the Himalayan regions, assisting the services to make the best use of the existing communication equipment in mountainous terrain and advising the services and the sister laboratories in the electronics group on propagation conditions affecting the selection and design of advanced communications equipment.
VEHICLES RESEARCH AND DEVELOPMENT
ESTABLISHMENTS

Responsible for research and development work including design, defect investigations on armoured fighting vehicles, wheeled vehicles, tractors and trailers required by the services.

RESEARCH AND DEVELOPMENT
ESTABLISHMENT (ENGINEERS)

Responsible for research and development in the field of military engineering equipment such as bridging and watercraft, electrical and mechanical equipment, structures, roads and air fields, bomb disposal and mine-laying equipment, etc.

AERONAUTICAL DEVELOPMENT
ESTABLISHMENT

Responsible for assisting in evolving aeronautical standards for specifications, evolving test procedures for evaluating new and prototype aircraft equipment and aircraft materials, undertaking research and development for improvement of safety, performance and reliability of aircraft and their equipment and designing and developing special items of aeronautical equipment.

GAS TURBINE RESEARCH ESTABLISHMENT

Responsible for design and development of gas turbine engines for future requirements, establishing test facilities for components testing and for undertaking research and development of aircraft propulsion systems.

DIRECTORATE OF SCIENTIFIC EVALUATION

Responsible for evaluation and operational research studies of weapons system, weapons and equipment.

DEFENCE RESEARCH LABORATORY
(MATERIALS)

Responsible for research and development on all non-warlike stores, such as fuels, oils, lubricants, surface coatings, drugs and pharmaceuticals, organic and inorganic chemicals, natural and synthetic fibres, and other general stores.

DEFENCE SCIENCE LABORATORY

Responsible for basic and applied research in physics, chemistry, mathematics, operational research, statistics and related sciences.

DEFENCE LABORATORY

Responsible for research on arid-zone problems as related to defence and for the field testing of weapons and equipment.

DEFENCE FOOD RESEARCH
LABORATORY

Responsible for research and development work on food problems peculiar to conditions encountered in areas where troops are deployed; improvements in peace-time rations and development of special rations, such as emergency rations, hard-scale rations, survival rations, etc., and development and pilot-plant production of processed foodstuffs.

INSTITUTE OF NUCLEAR MEDICINE
AND ALLIED SCIENCES

Responsible for the study of radio-isotope and radiation techniques in fields of interest to defence with special reference to the use of radio-isotopes and ionizing radiations for diagnostic and therapeutic purposes.

DEFENCE INSTITUTE OF PHYSIOLOGY
AND ALLIED SCIENCES

Responsible for basic and applied research in physiology and biochemistry as related to defence needs and for directing and co-ordinating physiological research carried out by field research stations and other defence research laboratories.

NAVAL CHEMICAL AND METALLURGICAL
LABORATORY

Responsible for research and development work on naval problems in the fields of marine corrosion, marine paints, marine biology and metallurgy.

DEFENCE INSTITUTE OF FIRE RESEARCH

Responsible for training of defence personnel and fire fighting methods, giving advice on these matters to the services, developing fire service equipment and appliances from indigenous materials and evaluation of new equipment.

DIRECTORATE OF PSYCHOLOGICAL
RESEARCH

Responsible for research in the field of military psychology, human engineering and related problems.

INSTITUTE OF ARMAMENT TECHNOLOGY

Responsible for training officers of the defence services and defence civilian scientists in various fields of defence science and technology.

DEFENCE INSTITUTE OF WORK STUDY

Responsible for training personnel at all levels of the defence services and inter-services organizations under the Ministry of Defence in work-study methods and allied subjects.
AERIAL DELIVERY DEVELOPMENT
ESTABLISHMENT

TEXTILES AND STORES
RESEARCH AND DEVELOPMENT
ESTABLISHMENT

DEFENCE INSTITUTE OF STORES
PRESERVATION AND PACKAGING

NAVAL SCIENCE AND TECHNOLOGY
LABORATORY

NAVAL PHYSICAL AND
OCEANOGRAPHIC LABORATORY

DIRECTORATE OF SCIENTIFIC EVALUATION
DEFENCE SCIENTIFIC INFORMATION
AND DOCUMENTATION CENTRE
ANNEX VII

RESEARCH INSTITUTIONS UNDER
THE DEPARTMENT OF ATOMIC ENERGY

Bhabha Atomic Research Centre, Bombay
Thumba Equatorial Rocket Launching Station, Trivandrum
Space Science and Technology Centre, Trivandrum
Sriharikota Range, Sriharikota
Experimental Satellite Communications Earth Station, Ahmedabad
Satellite Instructional Television Experiment, Ahmedabad
Microwave Antenna Systems Engineering Group, Bombay
Reliability Evaluation Laboratory, Bombay
Atomic Minerals Division, New Delhi
Uranium Corporation of India Limited, Jaduguda
Indian Rare Earths Limited, Alwaye
Electronics Corporation of India Limited, Hyderabad

AIDED INSTITUTIONS
Tata Institute of Fundamental Research, Bombay
Physical Research Laboratory, Ahmedabad
Saha Institute of Nuclear Physics, Calcutta
Tata Memorial Centre, Bombay
ANNEX VIII

RESEARCH INSTITUTIONS UNDER
THE CENTRAL GOVERNMENT DEPARTMENTS

CABINET SECRETARIAT

Department of Statistics
   Indian Statistical Institute
Department of Electronics
Committee on Science and Technology

DEPARTMENT OF ATOMIC ENERGY

Bhabha Atomic Research Centre
Space Science and Technology Centre
Thumba Equatorial Rocket Launching Station
Tata Memorial Centre

DEPARTMENT OF COMMUNICATIONS

Telecommunication Research Centre

MINISTRY OF AGRICULTURE

Deep Sea Fishing Organization
Forest Research Institute and Colleges
Indian Council of Agricultural Research
National Sugar Institute

MINISTRY OF DEFENCE

Defence Research and Development Organization

MINISTRY OF EDUCATION AND SOCIAL WORK

Anthropological Survey
Archaeological Survey
National Research Development Corporation

MINISTRY OF FOREIGN TRADE

Central Coffee Research Institute
Central Coir Research Institute
Central Sericultural Research and Training Institute
Rubber Research Institute of India

MINISTRY OF HEALTH AND FAMILY PLANNING

All-India Institute of Medical Sciences
Central Research Institute
Indian Council of Medical Research
National Institute of Communicable Diseases

MINISTRY OF HOME AFFAIRS

Central Forensic Science Laboratory
Institute of Applied Manpower Research

MINISTRY OF INDUSTRIAL DEVELOPMENT

Directorate General of Technical Development
Indian Standards Institution
Inventions Promotion Board
Public Sector Undertakings
   National Industrial Development Corporation Ltd.
   National Small Industries Corporation Ltd.
   Cement Corporation of India Ltd.
   Bharat Heavy Electronics Ltd.
   Machine Tool Corporation of India Ltd.
   National Instruments Ltd.
   Hindustan Photo Films Manufacturing Co.
   National Newsprent and Papers Mills Ltd.
   Hindustan Salts Ltd.
   Sambhar Salts Ltd.
   Hindustan Cables Ltd.
   Hindustan Machine Tools Ltd.
   Instrumentation Ltd.
   Heavy Electricals (India) Ltd.
   Tannery and Footwear Corporation of India Ltd.
   Indian Consortium for Power Projects Ltd.
   Bharat Pumps and Compressors Pvt. Ltd.
   Hindustan Paper Corporation of India (P) Ltd.

MINISTRY OF INFORMATION AND BROADCASTING

Research Department, All-India Radio
MINISTRY OF IRRIGATION AND POWER
Central Water and Power Commission
Central Board of Irrigation and Power

MINISTRY OF PARLIAMENTARY AFFAIRS,
SHIPPING AND TRANSPORT
Department of Light Houses and Light Ships

MINISTRY OF PETROLEUM AND CHEMICALS
Public Sector Industries
   Indian Oil Corporation
   Fertilizer Corporation of India
   Hindustan Antibiotics Ltd.
   Hindustan Insecticides Ltd.
   Hindustan Organic Chemicals Ltd.
   Oil and Natural Gas Commission

MINISTRY OF PLANNING
Department of Science and Technology
   Council of Scientific and Industrial Research
   Botanical Survey
   Survey of India
   Zoological Survey

MINISTRY OF RAILWAYS
Research, Designs and Standards Organization

MINISTRY OF STEEL AND MINES
Geological Survey of India
Indian Bureau of Mines
Public Sector Industries
   Hindustan Steel Ltd.
   Ranchi Heavy Engineering Corporation Ltd.
   Bokaro Steel Ltd.
   Hindustan Steel Works Construction Ltd.
   Mining and Allied Machinery Corp.
   Triveni Structural Ltd.
   Tungabhadra Steel Products Ltd.
   Bharat Heavy Plates and Vessels Ltd.

MINISTRY OF TOURISM AND
CIVIL AVIATION
Research and Development Directorate
India Meteorological Department

MINISTRY OF WORKS AND HOUSING
National Buildings Organization
ANNEX IX

RESEARCH INSTITUTES UNDER THE STATE GOVERNMENTS

ANDHRA PRADESH

ANIMAL HUSBANDRY
Veterinary Biological Research Institute, Hyderabad

FISHERIES
Freshwater Biology Station, Nagarjunasagar

INDUSTRY
Oil Technological Research Institute, Anantapur

MEDICINE
Medi Nawaz Jung Cancer Hospital and Radium Institute, Hyderabad

PUBLIC WORKS
Andhra Pradesh Engineering Research Laboratories, Hyderabad

ASSAM

ANIMAL HUSBANDRY
Livestock Research Station, Khanapara

MEDICINE
King Edward VII Memorial Pasteur Institute and Medical Research Institute, Shillong

PUBLIC WORKS
River Research Station, Gauhati

OTHERS
Sericultural Research Station, Titabar

BIHAR

AGRICULTURE
Agricultural Research Institute, Patna
Sugarcane Research Institute, Pusa

ANIMAL HUSBANDRY
Animal Production Research Institute, Birauli
Livestock Research Station, Patna

MEDICINE
Government Vaccine Institute and Pasteur Institute, Ranchi

PUBLIC HEALTH
Public Health Institute, Patna

PUBLIC WORKS
Irrigation Research Station, Madhipura

GOA

AGRICULTURE
Agro-Horticultural Research Station, Ela

GUJARAT

AGRICULTURE
Agricultural Experimental Station, Paria
Agricultural Research Station, Dhanduka
Agricultural Research Station, Surat
Agricultural Research Station, Vijapur

FISHERIES
Fisheries Research Station, Jamnagar
<table>
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<tr>
<th>MEDICINE</th>
<th>PUBLIC HEALTH</th>
</tr>
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<tbody>
<tr>
<td>Drugs Laboratory, Baroda</td>
<td>Government Analyst's Laboratory, Trivandrum</td>
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<tr>
<td>Institute for Ayurvedic Studies and Research, Jamnagar</td>
<td>Public Health Laboratory, Trivandrum</td>
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<tr>
<td>PUBLIC WORKS</td>
<td>PUBLIC WORKS</td>
</tr>
<tr>
<td>Engineering Research Institute, Baroda</td>
<td>Kerala Engineering Research Institute, Peechi</td>
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<td>MADHYA PRADESH</td>
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<td>HARYANA</td>
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<td>ANIMAL HUSBANDRY</td>
<td>FORESTRY</td>
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<tr>
<td>Government Progeny Testing Bull Farm, Hissar</td>
<td>State Forest Research Institute, Jabalpur</td>
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<td>HIMACHAL PRADESH</td>
<td>AGRICULTURE</td>
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<tr>
<td>ANIMAL HUSBANDRY</td>
<td>Coconut Research Station, Ratnagiri</td>
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<tr>
<td>Government Progeny Testing Bull Farm, Hissar</td>
<td>Cotton Research Station, Nanded</td>
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<td>Animal Nutrition Research Centre, Bombay</td>
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<td>Disease Investigation Centre, Poona</td>
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<td>JAMMU AND KASHMIR</td>
<td>Institute of Veterinary Biological Products, Poona</td>
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<td>ANIMAL HUSBANDRY</td>
<td>FISHERIES</td>
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<td>Central Cattle Breeding and Research Farm, Beli Charan</td>
<td>Taraporevala Marine Biological Research Station, Bombay</td>
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<tr>
<td>Central Cattle Breeding and Research Farm, Chashmashahai</td>
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<td></td>
<td>MEDICINE</td>
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<tr>
<td>FORESTRY</td>
<td>Haffkine Institute, Bombay</td>
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<td>Botanical Research Laboratory</td>
<td>PUBLIC WORKS</td>
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<td>Maharashtra Engineering Research Institute, Nasik</td>
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<td>OTHERS</td>
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<td>KERALA</td>
<td>Forensic Science Laboratories, Bombay</td>
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<tr>
<td>AGRICULTURE</td>
<td>MYSORE</td>
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<tr>
<td>Central Coconut Research Station, Nileshwar</td>
<td>ANIMAL HUSBANDRY</td>
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<td>Central Horticultural Research Station, Ambalavayal</td>
<td>Composite Livestock Farm and Research Station, Bangalore</td>
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<td>Central Rice Research Station, Pattambi</td>
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<td>ANIMAL HUSBANDRY</td>
<td>FISHERIES</td>
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<td>Cattle Breeding Research Station, Thumburmuizhi</td>
<td>Fisheries Technological Station, Kozhikode</td>
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<td>INDUSTRY</td>
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<td>Industrial Testing and Research Laboratory, Trivandrum</td>
<td>Mysore Engineering Research Station, Krishnarajasagar</td>
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</tbody>
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ORISSA

FISHERIES

Fresh Water Biological Research Station, Kausalyagang

PUBLIC WORKS

Hirakud Research Station, Hirakud

OTHERS

Genetics and Biometry Laboratory
Research Laboratory of Directorate of Mines

PUNJAB

PUBLIC WORKS

Irrigation and Power Research Institute, Amritsar
P.W.D. Building and Road Research Laboratory, Chandigarh

RAJASTHAN

AGRICULTURE

Cotton Research Station, Sriganganagar
Plant Pathology Laboratory, Jaipur
Regional Agricultural Research Station, Sriganganagar
Regional Research Station, Banswara

PUBLIC WORKS

UNDP Project on Land Water Use and Management in the Chambal Irrigated Area, Kota

TAMIL NADU

AGRICULTURE

Agricultural Research Station, Bhavanisagar
Agricultural Research Station, Nanjunad
Central Banana Research Station, Aduthurai
Cotton Breeding Station, Coimbatore
Fruit Research Station, Periyakulam
Government Fruit Research Station, Cape Comorin
Regional Agricultural Research Station, Tindivanam
Regional Research Station, Kovilpatti
Sugarcane Research Station, Cuddalore, N.T.

ANIMAL HUSBANDRY

Institute of Veterinary Preventive Medicine, Ranipet

FISHERIES

Fisheries Technological Station, Tuticorin
Fresh Water Biology Station, Bhavanisagar
Hydrobiological Research Station, Madras

MEDICINE

Barnard Institute of Radiology, Madras
Government Chest Institute, Madras
Institute of Venereology, Madras
King Institute of Preventive Medicine, Madras

PUBLIC WORKS

Highways Research Station, Madras
Irrigation Research Station, Poondi

RESEARCH INSTITUTIONS

Institute of Mathematical Sciences, Madras

OTHERS

Chemical Examiner's Laboratory, Madras

UTTAR PRADESH

AGRICULTURE

Fruit Research Station, Basti
Government Hill Fruit Research Station, Rani Khet
Government Horticultural Research Institute, Saharanpur
Regional Agricultural Research Station, Bareilly
Regional Agricultural Research Station, Hardoi
Section of the Entomologist to the Government of Uttar Pradesh, Kanpur
Sugarcane Research Station, Shahjahanpur
Vivekananda Laboratory, Almora

ANIMAL HUSBANDRY

Central Sheep and Wool Research Station, Pashulok-Rishikesh

MEDICINE

State Vaccine Institute, Nainital

PUBLIC WORKS

U.P. Irrigation Research Institute, Roorkee
U.P. P.W.D. Research Institute, Lucknow

OTHERS

Directorate of Geology and Mining, Lucknow
Uttar Pradesh State Observatory, Naintal
WEST BENGAL

AGRICULTURE
Rice Research Station, Chinsura

ANIMAL HUSBANDRY
State Institute of Animal Husbandry and Dairying, Haringhata

MEDICINE
Chittaranjan National Cancer Research Centre, Calcutta

PUBLIC WORKS
River Research Institute, Calcutta
ANNEX X

PRIVATE RESEARCH INSTITUTIONS

Allahabad Agricultural Institute, Agricultural Institute P.O., Allahabad

Birbal Sahni Institute of Palaeobotany, 53-University Road, Lucknow-7

Bose Institute, 93/1, Acharya Prafullachandra Road, Calcutta-9

Indian Association for the Cultivation of Science, 3-Raja Subodh Mullick Road, Jadavpur, Calcutta-32

Indian Institute of Science, Bangalore-12

Indian Statistical Institute, 203-Barrackpore Trunk Road, Calcutta-35

Institute of History of Medicine and Medical Research, 2/A-3, AsafAli Road, New Delhi-1

Institute of Agriculture, Anand, Dist. Kaira, Gujarat

Institute of Theoretical Physics, Bignan Kutir, 4/1, Mohan Bagan Lane, Calcutta-4

Physical Research Laboratory, Navrangpura, Ahmedabad-9

Post-Graduate Research Institute, Maharashtra Association for the Cultivation of Science, Law College Road, Poona-4

Rajendra Memorial Research Institute of Medical Sciences, Agamkuan, Patna-7

Raman Research Institute, Hebbal P.O., Bangalore-6

Ramanujam Institute of Mathematics, Madras

Rubber Research Institute of India, Kottayam-9, Kerala

Saha Institute of Nuclear Physics, 92-Acharya Prafulla Chandra Road, Calcutta-9

Schieffelin Leprosy Research Sanatorium, Karigiri, Via Katpadi, North Arcot District, Tamil Nadu

Shiela Dhar Institute of Soil Science, Allahabad

Shri Ram Institute for Industrial Research, 19-University Road, Delhi-7

Tata Institute of Fundamental Research, Homi Bhabha Road, Bombay-5

Tata Memorial Centre, Bombay

Tocklai Experimental Station, Cinnamara P.O., Assam
ANNEX XI

INDUSTRIAL ESTABLISHMENTS HAVING R&D

I. PUBLIC SECTOR

Antibiotics Research Centre, Hindustan
Antibiotics Limited, Pimpri
Bharat Electronics Limited, Bangalore
Bokaro Steel Limited, Hazaribagh
Central Laboratory, Neyveli Lignite
Corporation Limited, Neyveli
Central Plant Laboratories, Synthetic Drug
Plant, Indian Drug and Pharmaceuticals
Limited, Hyderabad
Central Research Laboratory, Antibiotics
Project, Indian Drug and Pharmaceuticals
Limited, Rishikesh
Chittaranjan Locomotive Works, Chittaranjan
Cochin Refineries Limited, Ernakulam
Central Research Laboratory, Antibiotics
Chittaranjan Locomotive Works, Chittaranjan
Cochin Refineries Limited, Ernakulam
Fertilizers and Chemicals Travancore Limited,
Udyogamandal
Heavy Engineering Corporation Limited, Ranchi
Hindustan Aeronautics Limited, Bangalore
Hindustan Cables Limited, Burdwan
Hindustan Machine Tools Limited, Bangalore
Hindustan Shipyard Limited, Visakhapatnam
Hindustan Steel Limited, Ranchi
Hindustan Teleprinters Limited, Madras
Hindustan Zinc Limited, Udaipur
Indian Airlines Corporation, Bombay
Indian Rare Earths Limited, Udyogamandal
Indian Telephone Industries Limited, Bangalore
Kolar Gold Mining Undertakings, Oorgaum
Mazagon Dock Limited, Bombay
Mogul Line Limited, Bombay
National Coal Development Corporation, Ranchi
National Newsprint and Paper Mills Limited,
Nepanagar
National Research Development Corporation
Limited, New Delhi
NGEF Limited, Bangalore
Planning and Development Division, Fertilizer
Corporation of India Limited, Sindri
Research and Development Laboratory,
Hindustan Photo Films Manufacturing
Company Limited, Ootacamund
Travancore Titanium Products Limited,
Trivandrum

II. PRIVATE SECTOR

Alembic Chemical Works Company Limited,
Baroda
Amar Dye-Chem Limited, Bombay
Anil Starch Products Limited, Ahmedabad
Arlabs Limited, Bombay
Atul Products Limited, Atul
Central Research Laboratory, Antibiotics
Project, Indian Drug and Pharmaceuticals
Limited, Rishikesh
Chittaranjan Locomotive Works, Chittaranjan
Cochin Refineries Limited, Ernakulam
Central Research Laboratory, Antibiotics
Chittaranjan Locomotive Works, Chittaranjan
Cochin Refineries Limited, Ernakulam
Fertilizers and Chemicals Travancore Limited,
Udyogamandal
Heavy Engineering Corporation Limited, Ranchi
Hindustan Aeronautics Limited, Bangalore
Hindustan Cables Limited, Burdwan
Hindustan Machine Tools Limited, Bangalore
Hindustan Shipyard Limited, Visakhapatnam
Hindustan Steel Limited, Ranchi
Hindustan Teleprinters Limited, Madras
Hindustan Zinc Limited, Udaipur
Indian Airlines Corporation, Bombay
Indian Rare Earths Limited, Udyogamandal
Indian Telephone Industries Limited, Bangalore
Kolar Gold Mining Undertakings, Oorgaum
Mazagon Dock Limited, Bombay
Mogul Line Limited, Bombay
National Coal Development Corporation, Ranchi
National Newsprint and Paper Mills Limited,
Nepanagar
National Research Development Corporation
Limited, New Delhi
NGEF Limited, Bangalore
Planning and Development Division, Fertilizer
Corporation of India Limited, Sindri
Research and Development Laboratory,
Hindustan Photo Films Manufacturing
Company Limited, Ootacamund
Travancore Titanium Products Limited,
Trivandrum
Sarabhai Research Centre, Baroda
Shalimar Paints Limited, Howrah
Sir Prafulla Chandra Research Laboratory,
  Bengal Chemical and Pharmaceutical
  Works Limited, Calcutta
Smith, Stanistreet and Company Limited, Calcutta

Sudarshan Chemical Industries Private
  Limited, Poona
Tata Chemical Limited, Mithapur
Unichem Laboratories Limited, Bombay
Zandu Pharmaceutical Works Limited,
  Bombay

ANNEX XII

GOVERNMENT OF INDIA
SCIENTIFIC POLICY RESOLUTION

New Delhi, the 4th March 1958/13th Phalguna, 1879

1. No. 131/CF/57 - The key to national prosperity, apart from the spirit of people, lies, in the modern age, in the effective combination of three factors, technology, raw materials and capital, of which the first is perhaps the most important, since the creation and adoption of new scientific techniques can, in fact, make up for a deficiency in natural resources, and reduce the demands on capital. But technology can only grow out of the study of the science and its applications.

2. The dominating feature of the contemporary world is the intense cultivation of science on a large scale, and its application to meet a country's requirements. It is this, which, for the first time in man's history, has given to the common man in countries advanced in science, a standard of living and social and cultural amenities, which were once confined to a very small privileged minority of the population. Science has led to the growth and diffusion of culture to an extent never possible before. It has not only radically altered man's material environment, but, what is of still deeper significance, it has provided new tools of thought and has extended man's mental horizon. It has thus influenced even the basic values of life, and given to civilization a new vitality and a new dynamism.

3. It is only through the scientific approach and method and the use of scientific knowledge that reasonable material and cultural amenities and services can be provided for every member of the community, and it is out of a recognition of this possibility that the idea of a welfare state has grown. It is characteristic of the present world that the progress towards the practical realization of a welfare state differs widely from country to country in direct relation to the extent of industrialization and the effect and resources applied in the pursuit of science.

4. The wealth and prosperity of a nation depend on the effective utilization of its human and material resources through industrialization. The use of human material for industrialization demands its education in science and training in technical skills. Industry opens up possibilities of greater fulfilment for the individual. India's enormous resources of manpower can only become an asset in the modern world when trained and educated.

5. Science and technology can make up for deficiencies in raw materials by providing substitutes, or indeed, by providing skills which can be exported in return for raw materials. In industrializing a country, a heavy price has to be paid in importing science and technology in the form of plant and machinery, highly-paid personnel and technical consultants. An early and large-scale development of science and technology in the country could therefore greatly reduce the drain on capital during the early and critical stages of industrialization.

6. Science had developed at an ever-increasing pace since the beginning of the century, so that the gap between the advanced and backward countries has widened more and more. It is only by adopting the most vigorous measures and by putting forward our utmost effort into the development of science that we can bridge the gap. It is an inherent obligation of a great country like India, with its traditions of scholarship and original thinking and its great cultural heritage, to participate fully in the march of science, which is probably mankind's greatest enterprise today.

7. The Government of India has accordingly decided that the aims of their scientific policy will be:

(i) to foster, promote and sustain, by appropriate means, the cultivation of science, and scientific research in all its aspects - pure, applied and education;

(ii) to ensure an adequate supply, within the country, of research scientists of the highest quality, and to recognize their work as an important component of the strength of the nation;

(iii) to encourage, and initiate, with all possible speed, programmes for the training of scientific and technical personnel on a scale adequate to fulfill the country's needs in science and education, agriculture and industry, and defence;

(iv) to ensure that the creative talent of men and women is encouraged and finds full scope in scientific activity;
(v) to encourage individual initiative for the acquisition and dissemination of knowledge, and for the discovery of new knowledge, in an atmosphere of academic freedom; and

(vi) in general, to secure for the people of the country all the benefits that can accrue from the acquisition and application of scientific knowledge.

The Government of India has decided to pursue and accomplish these aims by offering good conditions of service to scientists and according them an honoured position, by associating scientists with the formulation of policies, and by taking such other measures as may be deemed necessary from time to time.
ANNEX XIII

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EASTERN ECONOMIST, Annual Number 1970.


Table 1. Estimated R & D expenditure: Central, State & Private Sectors, in millions of rupees

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Expenditure</td>
<td>% to total</td>
<td>Expenditure</td>
<td>% to total</td>
<td>Expenditure</td>
</tr>
<tr>
<td>(a) Central Sector (incl. Universities)</td>
<td>276.6</td>
<td>96.0</td>
<td>791.2</td>
<td>93.0</td>
<td>1109.9</td>
</tr>
<tr>
<td>(b) State Sectors</td>
<td>10.0</td>
<td>3.5</td>
<td>35.1</td>
<td>4.1</td>
<td>119.9</td>
</tr>
<tr>
<td>(c) Private Sectors</td>
<td>1.5</td>
<td>0.5</td>
<td>24.3</td>
<td>2.9</td>
<td>98.5</td>
</tr>
<tr>
<td>Total</td>
<td>288.1</td>
<td>100.0</td>
<td>850.6</td>
<td>100.0</td>
<td>1328.3</td>
</tr>
</tbody>
</table>

Note: 1. Out of 520 R & D Institutions/Units under the State Governments, who were asked to supply data, only 232 (i.e. about 45%) have furnished the information. The figures for 1968-69, 1969-70 and 1970-71 have been estimated proportionately. As regards the earlier years, the figures have been estimated on the basis of the data contained in the 103rd Report of the Estimates Committee on the Ministry of Education (1965-66).
2. Data for the private sector is incomplete. This also includes 50% of the expenditure of Co-operative Research Associations under CSIR, the remaining 50% being grant from the CSIR, which is covered in CSIR expenditure.

Source: India, Cabinet Secretariat, Committee on Science and Technology: Report on Science and Technology 1970.

Table 2. R & D expenditure in India in relation to GNP, in millions of rupees

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>R &amp; D expenditure and GNP</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(a) Total GNP at current prices</td>
<td>126 000</td>
<td>217 990</td>
<td>302 320</td>
<td>330 740</td>
<td>348 930</td>
</tr>
<tr>
<td>(b) R &amp; D expenditure</td>
<td>290</td>
<td>850</td>
<td>1 330</td>
<td>1 460</td>
<td>1 690</td>
</tr>
<tr>
<td>(c) R &amp; D as % of GNP</td>
<td>0.23</td>
<td>0.39</td>
<td>0.44</td>
<td>0.44</td>
<td>0.48</td>
</tr>
</tbody>
</table>

* For 1958-59, figure relates to NNP (net national product) instead of GNP

Note: GNP figures up to 1965-66 have been taken from the Economic Survey 1969-70 issued by the Government of India (pp. 61-62). GNP figure for 1968-69 has been obtained from the National Income Unit of the Central Statistical Organization. GNP for 1969-70 has been estimated on the basis of expected growth rate of economy at 5.5% over 1968-69 as given in the Planning Commission’s Annual Plan document 1969-70 (page 1), coupled with a price rise of 3.7% (index of wholesale prices for 1968-69: 165.4 and for 1969-70: 171.5, with 1961-62 = 100). For the year 1970-71 GNP has been estimated assuming a growth rate of 5.5% and the same price level as for 1969-70 in accordance with the assumptions made in the Fourth Five Year Plan document.

Source: India, Cabinet Secretariat, Committee on Science and Technology: Report on Science and Technology 1970.
Table 3. R & D expenditure in the Central Sector in relation to total expenditure of the Central Government, in millions of rupees

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>R. E. a</td>
<td>R. E. b</td>
<td>R. E. c</td>
<td>R. E. d</td>
<td>R. E. e</td>
</tr>
<tr>
<td>Central Sector (Excl. Railways)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a) Expenditure/Estimates</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Revenue</td>
<td>6 750</td>
<td>20 010</td>
<td>26 790</td>
<td>29 350</td>
<td>31 030</td>
</tr>
<tr>
<td>Capital outlay</td>
<td>2 760</td>
<td>5 310</td>
<td>3 070</td>
<td>6 470</td>
<td>6 930</td>
</tr>
<tr>
<td>Total</td>
<td>9 510</td>
<td>25 320</td>
<td>29 860</td>
<td>35 860</td>
<td>37 960</td>
</tr>
<tr>
<td>b) R &amp; D expenditure</td>
<td>272.5</td>
<td>778.7</td>
<td>1 089</td>
<td>1 208.4</td>
<td>1 423.9</td>
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<td>c) Percentage of (b) to (a)</td>
<td>2.86</td>
<td>3.08</td>
<td>3.65</td>
<td>3.37</td>
<td>3.75</td>
</tr>
<tr>
<td>Central Sector (Railways)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ordinary working expenses</td>
<td>2 760</td>
<td>4 860</td>
<td>6 370</td>
<td>6 830</td>
<td>7 010</td>
</tr>
<tr>
<td>Capital account</td>
<td>1 260</td>
<td>2 450</td>
<td>1 210</td>
<td>1 250</td>
<td>1 500</td>
</tr>
<tr>
<td>(a) Total</td>
<td>4 020</td>
<td>7 310</td>
<td>7 580</td>
<td>8 080</td>
<td>8 510</td>
</tr>
<tr>
<td>b) R &amp; D expenditure</td>
<td>4.1</td>
<td>12.5</td>
<td>20.9</td>
<td>23.3</td>
<td>25.0</td>
</tr>
<tr>
<td>c) Percentage of (b) to (a)</td>
<td>0.10</td>
<td>0.17</td>
<td>0.28</td>
<td>0.29</td>
<td>0.29</td>
</tr>
<tr>
<td>Central Sector (Total)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(a) Expenditure/Estimates</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Revenue</td>
<td>9 510</td>
<td>24 870</td>
<td>33 160</td>
<td>36 180</td>
<td>38 040</td>
</tr>
<tr>
<td>Capital outlay</td>
<td>4 020</td>
<td>7 760</td>
<td>4 280</td>
<td>7 720</td>
<td>8 430</td>
</tr>
<tr>
<td>Total</td>
<td>13 530</td>
<td>32 630</td>
<td>37 440</td>
<td>43 900</td>
<td>46 470</td>
</tr>
<tr>
<td>b) R &amp; D expenditure</td>
<td>276.6</td>
<td>791.2</td>
<td>1 109.9</td>
<td>1 231.7</td>
<td>1 448.9</td>
</tr>
<tr>
<td>c) Percentage of (b) to (a)</td>
<td>2.04</td>
<td>2.42</td>
<td>2.96</td>
<td>2.80</td>
<td>3.12</td>
</tr>
</tbody>
</table>

Note: Figures relating to Revenue expenditure, Capital outlay and working expenses (Railways) were taken from report on Currency & Finance - 1962 and RBI Bulletin April 1970 and May 1970. Figures for Revenue and Capital outlay for 1968-69 are actuals and 1969 are revised estimates.

Source: India, Cabinet Secretariat, Committee on Science and Technology: Report on Science and Technology 1970.

a. R.E. Revised estimates
b. B.E. Budget estimates
Table 4. Expenditure in Central Sector, in millions of rupees

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Expenditure</td>
<td>% to total</td>
<td>Expenditure</td>
<td>% to total</td>
<td>Expenditure</td>
</tr>
<tr>
<td>A. Major Organizations</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Department of Atomic Energy (R &amp; D)</td>
<td>77.59</td>
<td>28.1</td>
<td>200.51</td>
<td>25.3</td>
<td>253.66</td>
</tr>
<tr>
<td>2. Council of Scientific &amp; Industrial Research</td>
<td>50.99</td>
<td>18.4</td>
<td>141.39</td>
<td>17.9</td>
<td>188.99</td>
</tr>
<tr>
<td>3. Defence Research &amp; Development Organization</td>
<td>15.00</td>
<td>5.4</td>
<td>97.30</td>
<td>12.3</td>
<td>141.20</td>
</tr>
<tr>
<td>4. Indian Council of Agricultural Research</td>
<td>37.23</td>
<td>13.5</td>
<td>64.10</td>
<td>8.1</td>
<td>126.51</td>
</tr>
<tr>
<td>5. Indian Council of Medical Research</td>
<td>5.05</td>
<td>1.8</td>
<td>10.50</td>
<td>1.3</td>
<td>16.41</td>
</tr>
<tr>
<td>Total 'A'</td>
<td>185.86</td>
<td>67.2</td>
<td>513.80</td>
<td>64.9</td>
<td>726.77</td>
</tr>
<tr>
<td>B. Ministries</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Education &amp; Youth Servicesb</td>
<td>30.68</td>
<td>11.1</td>
<td>83.13</td>
<td>10.5</td>
<td>103.27</td>
</tr>
<tr>
<td>2. Petroleum &amp; Chemicals and Mines &amp; Metals</td>
<td>8.88</td>
<td>3.2</td>
<td>73.59</td>
<td>9.3</td>
<td>93.42</td>
</tr>
<tr>
<td>3. Tourism &amp; Civil Aviation</td>
<td>17.82</td>
<td>6.5</td>
<td>31.82</td>
<td>4.0</td>
<td>44.13</td>
</tr>
<tr>
<td>4. Health, Family Planning &amp; WHUD</td>
<td>5.33</td>
<td>1.9</td>
<td>19.39</td>
<td>2.5</td>
<td>35.08</td>
</tr>
<tr>
<td>5. Food &amp; Agriculture</td>
<td>5.25</td>
<td>1.9</td>
<td>9.69</td>
<td>1.2</td>
<td>29.83</td>
</tr>
<tr>
<td>6. Information and Broadcasting &amp; Communications</td>
<td>1.38</td>
<td>0.5</td>
<td>2.52</td>
<td>0.3</td>
<td>4.32</td>
</tr>
<tr>
<td>7. Railways</td>
<td>4.06</td>
<td>1.5</td>
<td>12.51</td>
<td>1.6</td>
<td>20.94</td>
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<tr>
<td>8. Irrigation &amp; Power</td>
<td>4.19</td>
<td>1.5</td>
<td>19.40</td>
<td>2.5</td>
<td>17.70</td>
</tr>
<tr>
<td>9. Dept. of Statistics</td>
<td>8.58</td>
<td>3.1</td>
<td>17.26</td>
<td>2.2</td>
<td>23.60</td>
</tr>
<tr>
<td>10. Foreign Trade</td>
<td>4.55</td>
<td>1.6</td>
<td>8.07</td>
<td>1.0</td>
<td>9.57</td>
</tr>
<tr>
<td>11. Steel &amp; Heavy Engg.</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1.30</td>
</tr>
<tr>
<td>Total 'B'</td>
<td>90.73</td>
<td>32.8</td>
<td>277.37</td>
<td>35.1</td>
<td>383.15</td>
</tr>
<tr>
<td>Grand Total Central Sector (A+B)</td>
<td>276.59</td>
<td>100.0</td>
<td>791.18</td>
<td>100.0</td>
<td>1109.22</td>
</tr>
</tbody>
</table>

a. Projected on the basis of data available from 1968-69 and earlier years.

b. 50% of the total expenditure under UGC for higher education and research in science and 10% of the total expenditure under IIT's have been estimated as research expenditure in these calculations. Increase in the figures as compared to the previous report is due to inclusion of the expenditure relating to the Survey in India.

c. As the data for 1969-70/1970-71 is not available for these Ministries, the figures have been taken at the same level as 1968-69 some of which also relate to the previous years where data for 1968-69 has not been received. Besides, in some cases, figures for total expenditure are incomplete as data for all the institutions under the concerned Ministries has not been received.

Source: India, Cabinet Secretariat, Committee on Science and Technology: Report on Science and Technology, 1970.
Table 5. Total number of scientific/technical personnel employed in R & D Establishments

<table>
<thead>
<tr>
<th></th>
<th>1958-59</th>
<th>1968-69</th>
<th>1969-70</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>(a) Major Organizations under the Central Government</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(i) CSIR</td>
<td>3 512</td>
<td>8 848</td>
<td>9 515</td>
</tr>
<tr>
<td>(ii) DAE</td>
<td>1 067</td>
<td>7 209</td>
<td>7 854</td>
</tr>
<tr>
<td>(iii) DRDO</td>
<td>1 500</td>
<td>7 550</td>
<td>7 550*</td>
</tr>
<tr>
<td>(iv) ICAR</td>
<td>1 500</td>
<td>7 820</td>
<td>7 820*</td>
</tr>
<tr>
<td>(v) ICMR</td>
<td>1 001</td>
<td>1 221</td>
<td>1 585</td>
</tr>
<tr>
<td></td>
<td></td>
<td>8 580</td>
<td>32 648</td>
</tr>
<tr>
<td></td>
<td></td>
<td>34 324</td>
<td></td>
</tr>
<tr>
<td><strong>(b) Other Central Ministries</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>8 344</td>
<td>20 818</td>
<td>22 550</td>
</tr>
<tr>
<td><strong>Total Central Government</strong></td>
<td>16 924</td>
<td>53 466</td>
<td>56 874</td>
</tr>
<tr>
<td><strong>(b) Universities</strong></td>
<td>2 600</td>
<td>7 778</td>
<td>8 205</td>
</tr>
<tr>
<td><strong>(d) State Governments</strong></td>
<td>1 000</td>
<td>10 115</td>
<td>11 357</td>
</tr>
<tr>
<td><strong>(e) Private Sector</strong></td>
<td>200</td>
<td>2825</td>
<td>3 147</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>20 724</td>
<td>74 184</td>
<td>79 583</td>
</tr>
</tbody>
</table>

* Complete data for 1969-70 has not been received and as such 1968-69 figures have been repeated.

**Notes:**
1. Data relates to information so far received in the CoST Secretariat and in some cases the figures are incomplete. In the case of several departments under the Central Government such as ICAR, CSIR, DRDO, etc., laboratory assistants and technicians below the level of undergraduates in science and diploma holders in engineering/technology have also been included.
2. The manpower for 1968-69/1969-70 under universities, item (c), has been computed from UGC data on the assumption that entire number of university professors and readers and 50% of the lecturers in universities and 10% other senior teachers and 5% of lecturers in the affiliated colleges are engaged in the R & D work. The manpower for 1958-59 has been computed assuming the same rate of growth approximately as under the Central Sector.
3. Out of 520 R & D institutions/units under the State Governments, who were asked to supply data, only 232 (i.e. about 45%) have furnished the information. The figures for 1968-69 and 1969-70 have been estimated proportionately.

**Source:** India, Cabinet Secretariat, Committee on Science and Technology: Report on Science and Technology 1970.
### Table 6. Number of Universities, Institutions deemed to be Universities under Section 3 of the UGC Act, 1956, and constituent and affiliated Colleges

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Universities</td>
<td>33</td>
<td>45</td>
<td>64</td>
<td>71</td>
<td>79</td>
</tr>
<tr>
<td>2. Institutions deemed to be universities</td>
<td>-</td>
<td>2</td>
<td>9</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>3. Colleges by types:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a) Arts, Science &amp; Commerce</td>
<td>783</td>
<td>1161</td>
<td>2002</td>
<td>2902&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2982</td>
</tr>
<tr>
<td>b) Engineering/Technology</td>
<td>49</td>
<td>76</td>
<td>103</td>
<td>106</td>
<td>135</td>
</tr>
<tr>
<td>c) Medicine</td>
<td>51</td>
<td>80</td>
<td>123</td>
<td>141&lt;sup&gt;b&lt;/sup&gt;</td>
<td>141&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td>d) Agriculture</td>
<td>24</td>
<td>37</td>
<td>54</td>
<td>54</td>
<td>75&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>e) Veterinary Science</td>
<td>14</td>
<td>18</td>
<td>20</td>
<td>21</td>
<td>21&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td>f) Law</td>
<td>27</td>
<td>40</td>
<td>70</td>
<td>66</td>
<td>66&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td>g) Teachers' Training</td>
<td>75</td>
<td>125</td>
<td>193</td>
<td>202</td>
<td>202&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td>h) Physical Education</td>
<td>2</td>
<td>5</td>
<td>7</td>
<td>7</td>
<td>7&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td>Total (Colleges)</td>
<td>1025</td>
<td>1542</td>
<td>2572</td>
<td>2899</td>
<td>3725</td>
</tr>
</tbody>
</table>

*Source: University Grants Commission, India, Pocket Book of University Education. 1969.*

### Table 7. University Enrolment and Population, 1967-68

<table>
<thead>
<tr>
<th>State</th>
<th>University enrolment</th>
<th>Mid-year estimated population 1967 in 000's</th>
<th>No. of students per million of population 1967</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Andhra Pradesh</td>
<td>113389</td>
<td>40703</td>
<td>2786</td>
</tr>
<tr>
<td>2. Assam</td>
<td>65666</td>
<td>14292</td>
<td>4595</td>
</tr>
<tr>
<td>3. Bihar</td>
<td>160800</td>
<td>53771</td>
<td>2991</td>
</tr>
<tr>
<td>4. Gujarat</td>
<td>117442</td>
<td>24504</td>
<td>4793</td>
</tr>
<tr>
<td>5. Jammu &amp; Kashmir</td>
<td>17657</td>
<td>3885</td>
<td>4545</td>
</tr>
<tr>
<td>6. Kerala</td>
<td>138695</td>
<td>19790</td>
<td>7008</td>
</tr>
<tr>
<td>7. Madhya Pradesh</td>
<td>121720</td>
<td>37864</td>
<td>3215</td>
</tr>
<tr>
<td>8. Maharashtra</td>
<td>240694</td>
<td>46478</td>
<td>5179</td>
</tr>
<tr>
<td>9. Mysore</td>
<td>118100</td>
<td>27322</td>
<td>4323</td>
</tr>
<tr>
<td>10. Orissa</td>
<td>38794</td>
<td>20200</td>
<td>1920</td>
</tr>
<tr>
<td>11. Punjab&lt;sup&gt;a&lt;/sup&gt;</td>
<td>141737</td>
<td>26210</td>
<td>5408</td>
</tr>
<tr>
<td>12. Rajasthan</td>
<td>57201</td>
<td>24166</td>
<td>2367</td>
</tr>
<tr>
<td>13. Tamil Nadu</td>
<td>140429</td>
<td>37505</td>
<td>3744</td>
</tr>
<tr>
<td>14. Uttar Pradesh</td>
<td>467137</td>
<td>84917</td>
<td>5501</td>
</tr>
<tr>
<td>15. West Bengal</td>
<td>234572</td>
<td>41438</td>
<td>5661</td>
</tr>
<tr>
<td>16. Delhi</td>
<td>44939</td>
<td>3654</td>
<td>12298</td>
</tr>
<tr>
<td>17. Other Union territories&lt;sup&gt;b&lt;/sup&gt;</td>
<td>3609</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td><strong>All India</strong></td>
<td>2218972</td>
<td>510308</td>
<td>4340</td>
</tr>
</tbody>
</table>

*Source: University Grants Commission, India, Pocket Book of University Education. 1969.*

<sup>a</sup> Including Haryana State
<sup>b</sup> Students enrolled in colleges in Union territories have been included in the universities to which they are affiliated.

---

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### Table 8: Growth of University Enrolment 1950-51 to 1968-69

<table>
<thead>
<tr>
<th>Year</th>
<th>Enrolment*</th>
<th>Increase over the preceding year</th>
<th>% increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>1950-51</td>
<td>396 745</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1951-52</td>
<td>459 024</td>
<td>62 279</td>
<td>15.7</td>
</tr>
<tr>
<td>1952-53</td>
<td>512 853</td>
<td>53 829</td>
<td>11.7</td>
</tr>
<tr>
<td>1953-54</td>
<td>580 218</td>
<td>67 365</td>
<td>13.1</td>
</tr>
<tr>
<td>1954-55</td>
<td>651 479</td>
<td>71 261</td>
<td>12.3</td>
</tr>
<tr>
<td>1955-56</td>
<td>712 697</td>
<td>61 218</td>
<td>9.4</td>
</tr>
<tr>
<td>1956-57</td>
<td>769 468</td>
<td>66 771</td>
<td>8.0</td>
</tr>
<tr>
<td>1957-58</td>
<td>827 341</td>
<td>57 873</td>
<td>7.5</td>
</tr>
<tr>
<td>1958-59</td>
<td>928 622</td>
<td>101 281</td>
<td>12.2</td>
</tr>
<tr>
<td>1959-60</td>
<td>997 137</td>
<td>68 515</td>
<td>7.4</td>
</tr>
<tr>
<td>1960-61</td>
<td>1 034 934</td>
<td>37 797</td>
<td>3.8</td>
</tr>
<tr>
<td>1961-62</td>
<td>1 155 380</td>
<td>120 446</td>
<td>11.6</td>
</tr>
<tr>
<td>1962-63</td>
<td>1 272 666</td>
<td>117 286</td>
<td>10.2</td>
</tr>
<tr>
<td>1963-64</td>
<td>1 384 697</td>
<td>112 031</td>
<td>8.8</td>
</tr>
<tr>
<td>1964-65</td>
<td>1 528 227</td>
<td>143 530</td>
<td>10.4</td>
</tr>
<tr>
<td>1965-66</td>
<td>1 728 773</td>
<td>200 546</td>
<td>13.1</td>
</tr>
<tr>
<td>1966-67</td>
<td>1 949 012</td>
<td>220 239</td>
<td>12.7</td>
</tr>
<tr>
<td>1967-68</td>
<td>2 218 972</td>
<td>269 960</td>
<td>13.9</td>
</tr>
<tr>
<td>1968-69</td>
<td>2 473 264</td>
<td>254 292</td>
<td>11.4</td>
</tr>
</tbody>
</table>

The enrolment in 1967-68 in the university departments and colleges maintained directly by universities was 257 530. About 86.6% of the total enrolment was in affiliated colleges.

* Inclusive of enrolment in intermediate classes under the Boards of Intermediate Education.

*Source: University Grants Commission, India, Pocket Book of University Education, 1969.*

### Table 9: Postgraduate and Research Enrolment 1957-58 & 1968-69

<table>
<thead>
<tr>
<th>Faculty</th>
<th>Postgraduate</th>
<th></th>
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<tbody>
<tr>
<td></td>
<td>1957-58</td>
<td>1968-69</td>
<td>Index 1957-58 = 100</td>
</tr>
<tr>
<td></td>
<td>Enrolment</td>
<td>Index 1968-69</td>
<td>Enrolment 1957-58</td>
</tr>
<tr>
<td>1. Arts</td>
<td>23 567</td>
<td>78 335</td>
<td>325</td>
</tr>
<tr>
<td>2. Science</td>
<td>7 545</td>
<td>30 317</td>
<td>404</td>
</tr>
<tr>
<td>3. Commerce</td>
<td>3 678</td>
<td>12 065</td>
<td>327</td>
</tr>
<tr>
<td>4. Education</td>
<td>7 777</td>
<td>1 942</td>
<td>237</td>
</tr>
<tr>
<td>5. Engineering/Technology</td>
<td>599</td>
<td>3 216</td>
<td>531</td>
</tr>
<tr>
<td>6. Medicine</td>
<td>1 325</td>
<td>4 190</td>
<td>323</td>
</tr>
<tr>
<td>7. Agriculture</td>
<td>366</td>
<td>3 551</td>
<td>984</td>
</tr>
<tr>
<td>8. Veterinary Science</td>
<td>27</td>
<td>523</td>
<td>1 937</td>
</tr>
<tr>
<td>9. Law</td>
<td>414</td>
<td>1 076</td>
<td>269</td>
</tr>
<tr>
<td>10. Others</td>
<td>-</td>
<td>244</td>
<td>-</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>38 298</strong></td>
<td><strong>135 459</strong></td>
<td><strong>355</strong></td>
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</table>

Table 10. Breakdown, by Scientific Disciplines, of Students in Higher Education

<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
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</thead>
<tbody>
<tr>
<td>1. NATURAL SCIENCE</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Number</td>
<td>478 702</td>
<td>565 254</td>
<td>654 899</td>
<td>737 858</td>
<td>802 369</td>
</tr>
<tr>
<td>% women</td>
<td>15.4</td>
<td>17.1</td>
<td>17.0</td>
<td>17.0</td>
<td>15.8</td>
</tr>
<tr>
<td>% of total</td>
<td>31.3</td>
<td>32.7</td>
<td>33.6</td>
<td>33.2</td>
<td>32.4</td>
</tr>
<tr>
<td>2. TECHNOLOGY</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number</td>
<td>78 114</td>
<td>85 555</td>
<td>95 422</td>
<td>104 266</td>
<td>101 389</td>
</tr>
<tr>
<td>% women</td>
<td>1.1</td>
<td>1.0</td>
<td>1.0</td>
<td>1.2</td>
<td>1.0</td>
</tr>
<tr>
<td>% of total</td>
<td>5.1</td>
<td>4.9</td>
<td>4.9</td>
<td>4.7</td>
<td>4.1</td>
</tr>
<tr>
<td>3. MEDICINE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number</td>
<td>61 742</td>
<td>70 088</td>
<td>77 286</td>
<td>83 422</td>
<td>90 470</td>
</tr>
<tr>
<td>% women</td>
<td>23.3</td>
<td>23.9</td>
<td>24.2</td>
<td>24.4</td>
<td>24.4</td>
</tr>
<tr>
<td>% of total</td>
<td>4.0</td>
<td>4.0</td>
<td>4.0</td>
<td>3.3</td>
<td>3.6</td>
</tr>
<tr>
<td>4. AGRICULTURE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number</td>
<td>49 939</td>
<td>57 447</td>
<td>59 488</td>
<td>58 249</td>
<td>59 710</td>
</tr>
<tr>
<td>% women</td>
<td>0.3</td>
<td>0.2</td>
<td>0.3</td>
<td>0.1</td>
<td>0.3</td>
</tr>
<tr>
<td>% of total</td>
<td>3.3</td>
<td>3.4</td>
<td>3.0</td>
<td>2.6</td>
<td>2.4</td>
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<tr>
<td>5. SOCIAL SCIENCES AND HUMANITIES</td>
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<td></td>
<td></td>
</tr>
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<td>Number</td>
<td>859 730</td>
<td>950 429</td>
<td>1 061 917</td>
<td>1 235 177</td>
<td>1 419 335</td>
</tr>
<tr>
<td>% women</td>
<td>24.2</td>
<td>25.4</td>
<td>25.8</td>
<td>25.8</td>
<td>23.0</td>
</tr>
<tr>
<td>% of total</td>
<td>56.3</td>
<td>55.0</td>
<td>54.5</td>
<td>55.6</td>
<td>57.4</td>
</tr>
<tr>
<td>6. TOTAL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number</td>
<td>1 528 227</td>
<td>1 728 773</td>
<td>1 949 012</td>
<td>2 218 972</td>
<td>2 473 264</td>
</tr>
<tr>
<td>% women</td>
<td>19.5</td>
<td>20.6</td>
<td>20.8</td>
<td>21.1</td>
<td>19.3</td>
</tr>
</tbody>
</table>

Table 11. Stock of Scientists, Engineers and Medical Personnel

<table>
<thead>
<tr>
<th>Category</th>
<th>Stock at the end of the year</th>
<th>Growth factor</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Science Graduates</td>
<td>66 900</td>
<td>114 400</td>
<td>185 800</td>
</tr>
<tr>
<td>Science Post-graduates</td>
<td>17 000</td>
<td>30 000</td>
<td>51 400</td>
</tr>
<tr>
<td>Engineers and Technologists (Degree)</td>
<td>21 600</td>
<td>37 500</td>
<td>62 200</td>
</tr>
<tr>
<td>Engineers and Technologists (Diploma)</td>
<td>31 500</td>
<td>46 800</td>
<td>75 000</td>
</tr>
<tr>
<td>Medical Graduates</td>
<td>18 000</td>
<td>29 000</td>
<td>41 600</td>
</tr>
<tr>
<td>Medical Licentiates</td>
<td>33 000</td>
<td>35 000</td>
<td>34 000</td>
</tr>
<tr>
<td>All Scientific and Technical Persons</td>
<td>188 000</td>
<td>292 700</td>
<td>450 000</td>
</tr>
</tbody>
</table>

1. Growth factor is the ratios of the stocks or the outputs as the case may be (1960 to 1950 and 1970 to 1960 respectively)
a. Estimates

Table 12. Stock of Scientists by Category

<table>
<thead>
<tr>
<th>Category</th>
<th>At the end of the year</th>
<th>Growth factor</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Graduates in General Science</td>
<td>60 000</td>
<td>102 900</td>
<td>165 600</td>
</tr>
<tr>
<td>Graduates in Agricultural Science</td>
<td>6 700</td>
<td>10 100</td>
<td>15 700</td>
</tr>
<tr>
<td>Graduates in Veterinary Science</td>
<td>200</td>
<td>1 400</td>
<td>4 500</td>
</tr>
<tr>
<td>Post-graduates in</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mathematics</td>
<td>3 900</td>
<td>6 500</td>
<td>10 700</td>
</tr>
<tr>
<td>Statistics</td>
<td>200</td>
<td>600</td>
<td>1 500</td>
</tr>
<tr>
<td>Physics</td>
<td>3 000</td>
<td>4 800</td>
<td>7 500</td>
</tr>
<tr>
<td>Chemistry</td>
<td>4 700</td>
<td>7 000</td>
<td>10 700</td>
</tr>
<tr>
<td>Geo-Sciences</td>
<td>400</td>
<td>1 000</td>
<td>2 000</td>
</tr>
<tr>
<td>Geography</td>
<td>900</td>
<td>2 300</td>
<td>4 700</td>
</tr>
<tr>
<td>Zoology</td>
<td>1 100</td>
<td>2 100</td>
<td>3 500</td>
</tr>
<tr>
<td>Botany</td>
<td>1 200</td>
<td>2 100</td>
<td>3 700</td>
</tr>
<tr>
<td>Agriculture</td>
<td>1 000</td>
<td>2 000</td>
<td>3 700</td>
</tr>
<tr>
<td>Social Sciences</td>
<td>500</td>
<td>1 400</td>
<td>3 000</td>
</tr>
<tr>
<td>Other Sciences</td>
<td>100</td>
<td>200</td>
<td>400</td>
</tr>
</tbody>
</table>

1. Growth factor is the ratios of the stocks or the outputs as the case may be (1960 to 1950 and 1970 to 1960 respectively)
a. Estimates
### Table 13. Stock of Engineers by Category

<table>
<thead>
<tr>
<th>Category</th>
<th>1950</th>
<th>1955</th>
<th>1960</th>
<th>1965</th>
<th>1970&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Growth Factor&lt;sup&gt;1&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1950-60</td>
<td>1960-70</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Civil Degree</td>
<td>7 400</td>
<td>12 500</td>
<td>21 300</td>
<td>34 200</td>
<td>50 900</td>
<td>2.9 (2.4)</td>
</tr>
<tr>
<td>Civil Diploma</td>
<td>17 700</td>
<td>24 300</td>
<td>38 400</td>
<td>62 400</td>
<td>86 900</td>
<td>2.2 (2.3)</td>
</tr>
<tr>
<td>Elec. Degree</td>
<td>3 300</td>
<td>6 300</td>
<td>10 600</td>
<td>20 800</td>
<td>39 900</td>
<td>3.2 (3.8)</td>
</tr>
<tr>
<td>Elec. Diploma</td>
<td>4 100</td>
<td>6 600</td>
<td>10 800</td>
<td>26 000</td>
<td>53 900</td>
<td>2.6 (5.0)</td>
</tr>
<tr>
<td>Mech. Degree</td>
<td>4 100</td>
<td>7 600</td>
<td>12 800</td>
<td>25 700</td>
<td>50 700</td>
<td>3.1 (4.0)</td>
</tr>
<tr>
<td>Mech. Diploma</td>
<td>5 900</td>
<td>9 000</td>
<td>14 500</td>
<td>33 800</td>
<td>77 800</td>
<td>2.5 (5.4)</td>
</tr>
<tr>
<td>Chem. Degree</td>
<td>2 200</td>
<td>3 000</td>
<td>4 400</td>
<td>5 900</td>
<td>10 000</td>
<td>2.0 (2.3)</td>
</tr>
<tr>
<td>Chem. Diploma</td>
<td>60</td>
<td>180</td>
<td>300</td>
<td>410</td>
<td>900</td>
<td>5.0 (3.0)</td>
</tr>
<tr>
<td>Mining Degree</td>
<td>200</td>
<td>500</td>
<td>900</td>
<td>2 000</td>
<td>2 900</td>
<td>4.5 (3.2)</td>
</tr>
<tr>
<td>Mining Diploma</td>
<td>350</td>
<td>390</td>
<td>750</td>
<td>1 880</td>
<td>2 500</td>
<td>2.1 (3.3)</td>
</tr>
<tr>
<td>Metall. Degree</td>
<td>600</td>
<td>800</td>
<td>1 300</td>
<td>2 400</td>
<td>4 900</td>
<td>2.2 (3.8)</td>
</tr>
<tr>
<td>Metall. Diploma</td>
<td>220</td>
<td>300</td>
<td>330</td>
<td>360</td>
<td>700</td>
<td>1.5 (2.1)</td>
</tr>
<tr>
<td>Electron/Comm. Deg.</td>
<td>400</td>
<td>700</td>
<td>1 300</td>
<td>2 400</td>
<td>6 300</td>
<td>3.3 (4.8)</td>
</tr>
<tr>
<td>Electron/Comm. Dip.</td>
<td>230</td>
<td>540</td>
<td>910</td>
<td>1 530</td>
<td>2 500</td>
<td>4.0 (2.7)</td>
</tr>
<tr>
<td>Auto. Degree</td>
<td>10</td>
<td>100</td>
<td>250</td>
<td>380</td>
<td>500</td>
<td>25.0 (2.0)</td>
</tr>
<tr>
<td>Auto. Diploma</td>
<td>350</td>
<td>840</td>
<td>1 600</td>
<td>2 210</td>
<td>3 300</td>
<td>4.6 (2.1)</td>
</tr>
<tr>
<td>Aero. Degree</td>
<td>90</td>
<td>150</td>
<td>240</td>
<td>370</td>
<td>700</td>
<td>2.7 (2.9)</td>
</tr>
<tr>
<td>Aero. Diploma</td>
<td>30</td>
<td>60</td>
<td>80</td>
<td>100</td>
<td>100</td>
<td>2.7 (1.3)</td>
</tr>
<tr>
<td>Tech. Degree</td>
<td>2 900</td>
<td>5 100</td>
<td>7 400</td>
<td>9 200</td>
<td>12 700</td>
<td>2.6 (1.7)</td>
</tr>
<tr>
<td>Tech. Diploma</td>
<td>2 100</td>
<td>3 800</td>
<td>6 000</td>
<td>8 600</td>
<td>13 100</td>
<td>2.9 (2.2)</td>
</tr>
<tr>
<td>Other Engrs. Degree</td>
<td>400</td>
<td>750</td>
<td>1 710</td>
<td>3 350</td>
<td>5 900</td>
<td>4.3 (3.5)</td>
</tr>
<tr>
<td>Other Engrs. Diploma</td>
<td>460</td>
<td>790</td>
<td>1 330</td>
<td>1 610</td>
<td>2 700</td>
<td>2.9 (2.0)</td>
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<td>All Engrs. Degree</td>
<td>21 600</td>
<td>37 500</td>
<td>62 200</td>
<td>106 700</td>
<td>185 400</td>
<td>2.9 (3.0)</td>
</tr>
<tr>
<td>All Engrs. Diploma</td>
<td>31 500</td>
<td>46 800</td>
<td>75 000</td>
<td>138 900</td>
<td>244 400</td>
<td>2.4 (3.3)</td>
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</tbody>
</table>

1. Growth Factor is the ratios of the stocks or the outputs as the case may be (1960 to 1950 and 1970 to 1960 respectively)
a. Estimates

*Source: Technical Manpower. 1970, XII No. 6,3.*

### Table 14. Output of Scientists, Engineers and Medical Personnel

<table>
<thead>
<tr>
<th>Category</th>
<th>Output during</th>
<th>Growth Factor&lt;sup&gt;1&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1950</td>
<td>1955</td>
</tr>
<tr>
<td></td>
<td>1950-60</td>
<td>1960-70</td>
</tr>
<tr>
<td>Science (Graduates)</td>
<td>10 728</td>
<td>17 158</td>
</tr>
<tr>
<td>Science (Post-graduates)</td>
<td>1 579</td>
<td>3 285</td>
</tr>
<tr>
<td>Engg. &amp; Tech. (Graduates)</td>
<td>2 000</td>
<td>3 017</td>
</tr>
<tr>
<td>Engg. &amp; Tech. (Dip.)</td>
<td>2 478</td>
<td>4 500</td>
</tr>
<tr>
<td>Medical (Graduates)</td>
<td>1 557</td>
<td>2 743</td>
</tr>
</tbody>
</table>

1. Growth Factor is the ratios of the stocks or the outputs as the case may be (1960 to 1950 and 1970 to 1960 respectively)
a. Estimates

*Source: Technical Manpower. 1970, XII No. 6,4.*
### Table 15. Output of Scientists and Engineers by Category

<table>
<thead>
<tr>
<th>Category</th>
<th>1950</th>
<th>1955</th>
<th>1960</th>
<th>1965</th>
<th>1970&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Growth Factor&lt;sup&gt;1&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1950-60</td>
<td>1960-70</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>SCIENCE</strong></td>
<td></td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>Bachelor Degree</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gen. Science</td>
<td>9,628</td>
<td>15,964</td>
<td>22,693</td>
<td>38,150</td>
<td>60,000</td>
<td>2.4</td>
</tr>
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<td>Vet. Science</td>
<td>100</td>
<td>289</td>
<td>814</td>
<td>1,030</td>
<td>950</td>
<td>8.1</td>
</tr>
<tr>
<td>Ag. Science</td>
<td>1,000</td>
<td>905</td>
<td>1,990</td>
<td>5,560</td>
<td>4,700</td>
<td>2.0</td>
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<tr>
<td>Master Degree</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ag. Science</td>
<td>154</td>
<td>197</td>
<td>488</td>
<td>1,197</td>
<td>1,500</td>
<td>3.2</td>
</tr>
<tr>
<td>Mathematics</td>
<td>281</td>
<td>757</td>
<td>1,016</td>
<td>1,883</td>
<td>2,700</td>
<td>3.6</td>
</tr>
<tr>
<td>Statistics</td>
<td>30</td>
<td>100</td>
<td>258</td>
<td>358</td>
<td>380</td>
<td>8.6</td>
</tr>
<tr>
<td>Physics</td>
<td>222</td>
<td>454</td>
<td>736</td>
<td>1,388</td>
<td>2,000</td>
<td>3.3</td>
</tr>
<tr>
<td>Chemistry</td>
<td>346</td>
<td>582</td>
<td>1,081</td>
<td>1,943</td>
<td>2,900</td>
<td>3.1</td>
</tr>
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<td>Geo. Science</td>
<td>67</td>
<td>117</td>
<td>300</td>
<td>514</td>
<td>550</td>
<td>4.5</td>
</tr>
<tr>
<td>Geography</td>
<td>157</td>
<td>299</td>
<td>674</td>
<td>1,036</td>
<td>1,200</td>
<td>4.3</td>
</tr>
<tr>
<td>Zoology</td>
<td>128</td>
<td>252</td>
<td>429</td>
<td>760</td>
<td>1,200</td>
<td>3.4</td>
</tr>
<tr>
<td>Botany</td>
<td>97</td>
<td>251</td>
<td>414</td>
<td>702</td>
<td>1,250</td>
<td>4.3</td>
</tr>
<tr>
<td>Social Science</td>
<td>90</td>
<td>254</td>
<td>424</td>
<td>868</td>
<td>1,000</td>
<td>4.7</td>
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<tr>
<td>Others</td>
<td>7</td>
<td>22</td>
<td>50</td>
<td>74</td>
<td>175</td>
<td>7.1</td>
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<tr>
<td><strong>ENGINEERING</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Civil Degree</td>
<td>712</td>
<td>1,310</td>
<td>1,964</td>
<td>2,515</td>
<td>3,250</td>
<td>2.8</td>
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<tr>
<td>Civil Diploma</td>
<td>740</td>
<td>1,736</td>
<td>3,870</td>
<td>6,222</td>
<td>4,700</td>
<td>5.2</td>
</tr>
<tr>
<td>Elec. Degree</td>
<td>450</td>
<td>716</td>
<td>923</td>
<td>2,320</td>
<td>4,000</td>
<td>2.1</td>
</tr>
<tr>
<td>Elec. Diploma</td>
<td>430</td>
<td>674</td>
<td>1,403</td>
<td>4,279</td>
<td>5,900</td>
<td>3.3</td>
</tr>
<tr>
<td>Mech. Degree</td>
<td>397</td>
<td>937</td>
<td>1,311</td>
<td>3,136</td>
<td>5,000</td>
<td>3.3</td>
</tr>
<tr>
<td>Mech. Diploma</td>
<td>399</td>
<td>620</td>
<td>1,835</td>
<td>5,931</td>
<td>8,800</td>
<td>4.6</td>
</tr>
<tr>
<td>Chem. Degree</td>
<td>130</td>
<td>174</td>
<td>344</td>
<td>472</td>
<td>900</td>
<td>2.6</td>
</tr>
<tr>
<td>Chem. Diploma</td>
<td>45</td>
<td>32</td>
<td>10&lt;sup&gt;b&lt;/sup&gt;</td>
<td>9</td>
<td>150</td>
<td>0.2</td>
</tr>
<tr>
<td>Mining Degree</td>
<td>51</td>
<td>54</td>
<td>171</td>
<td>253</td>
<td>150</td>
<td>3.4</td>
</tr>
<tr>
<td>Mining Diploma</td>
<td>44</td>
<td>14</td>
<td>188</td>
<td>199</td>
<td>100</td>
<td>4.3</td>
</tr>
<tr>
<td>Metall. Degree</td>
<td>47</td>
<td>51</td>
<td>139</td>
<td>320</td>
<td>575</td>
<td>3.0</td>
</tr>
<tr>
<td>Metall. Diploma</td>
<td>10</td>
<td>19</td>
<td>10&lt;sup&gt;b&lt;/sup&gt;</td>
<td>9</td>
<td>100</td>
<td>1.0</td>
</tr>
<tr>
<td>Electron./Comm. Degree</td>
<td>22</td>
<td>52</td>
<td>179</td>
<td>265</td>
<td>475</td>
<td>8.1</td>
</tr>
<tr>
<td>Electron./Comm. Diploma</td>
<td>36&lt;sup&gt;b&lt;/sup&gt;</td>
<td>86</td>
<td>81</td>
<td>129</td>
<td>250</td>
<td>2.3</td>
</tr>
<tr>
<td>Auto. Degree</td>
<td>24&lt;sup&gt;c&lt;/sup&gt;</td>
<td>23</td>
<td>25</td>
<td>29</td>
<td>35</td>
<td>1.0</td>
</tr>
<tr>
<td>Auto. Diploma</td>
<td>75&lt;sup&gt;b&lt;/sup&gt;</td>
<td>145</td>
<td>131</td>
<td>167</td>
<td>275</td>
<td>1.7</td>
</tr>
<tr>
<td>Aero. Degree</td>
<td>24&lt;sup&gt;c&lt;/sup&gt;</td>
<td>3</td>
<td>6</td>
<td>26</td>
<td>100</td>
<td>0.3</td>
</tr>
<tr>
<td>Aero. Diploma</td>
<td>10</td>
<td>40</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Growth Factor is the ratios of the stocks or the outputs as the case may be (1960 to 1950 and 1970 to 1960 respectively)
   a. Estimates
   b. Output in the next year
   c. Output in 1952.

Notes: 1. Data on the output of "Other Engineers" and Technologists is not completely available.
   Engineers: Ministry of Education
4. The output of Engineers with combined Electrical Mechanical Engineering Course has been added half and half
to Electrical Engineers and Mechanical Engineers for 1950 and 1955.

### Table 16. Growth of National Income, Population and Expenditure on Education 1950-51 to 1967-68

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total National Income</strong> (Rs. in millions)</td>
<td>95300</td>
<td>99800</td>
<td>133080</td>
<td>200800</td>
<td>205860</td>
<td>279220</td>
</tr>
<tr>
<td><strong>Total Population</strong> (in thousands)</td>
<td>361130</td>
<td>395900</td>
<td>439235</td>
<td>482849</td>
<td>494781</td>
<td>519749</td>
</tr>
<tr>
<td><strong>Total Expenditure on Education</strong> (Rs. in millions)</td>
<td>1143.8</td>
<td>1896.6</td>
<td>3448.8</td>
<td>5309.9</td>
<td>6000.0</td>
<td>7600.0</td>
</tr>
<tr>
<td><strong>National Income per capita</strong> (Rs.)</td>
<td>264</td>
<td>252</td>
<td>307</td>
<td>420</td>
<td>421</td>
<td>543</td>
</tr>
<tr>
<td><strong>Expenditure on Education per capita</strong> (Rs.)</td>
<td>3.2</td>
<td>4.8</td>
<td>7.8</td>
<td>11.0</td>
<td>12.1</td>
<td>14.6</td>
</tr>
<tr>
<td><strong>Percentage of Expenditure on Education to National Income</strong></td>
<td>1.2</td>
<td>1.9</td>
<td>2.4</td>
<td>2.6</td>
<td>2.9</td>
<td>2.7</td>
</tr>
</tbody>
</table>

*Figures relate to 31 March of the year.*

**Source:** Selected educational and related statistics at a glance. Education Division, Planning Commission. 1969. p.1.

### Table 17. Budgeted Expenditure on Education, Scientific Departments and Total Budget by Centre and States and Union Territories (Rs in millions)

<table>
<thead>
<tr>
<th>Year</th>
<th>Centre Education &amp; Scientific Research</th>
<th>Total Budget</th>
<th>Centre Education &amp; Scientific Research</th>
<th>Total Budget</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Education</td>
<td>Scientific Research</td>
<td>Total</td>
<td>Education</td>
</tr>
<tr>
<td>1950-51</td>
<td>32.3</td>
<td>43.5</td>
<td>75.8</td>
<td>3854.3</td>
</tr>
<tr>
<td></td>
<td>(0.8)</td>
<td>(1.1)</td>
<td>(1.9)</td>
<td>(15.4)</td>
</tr>
<tr>
<td>1955-56</td>
<td>142.3</td>
<td>89.2</td>
<td>231.5</td>
<td>4953.5</td>
</tr>
<tr>
<td></td>
<td>(2.9)</td>
<td>(1.8)</td>
<td>(4.7)</td>
<td>(16.9)</td>
</tr>
<tr>
<td>1960-61</td>
<td>437.9</td>
<td>213.6</td>
<td>651.5</td>
<td>9530.4</td>
</tr>
<tr>
<td></td>
<td>(4.6)</td>
<td>(2.2)</td>
<td>(6.8)</td>
<td>(19.2)</td>
</tr>
<tr>
<td>1961-62</td>
<td>513.3</td>
<td>262.2</td>
<td>775.5</td>
<td>10619.9</td>
</tr>
<tr>
<td></td>
<td>(4.8)</td>
<td>(2.5)</td>
<td>(7.3)</td>
<td>(20.6)</td>
</tr>
<tr>
<td>1962-63</td>
<td>500.2</td>
<td>303.6</td>
<td>803.8</td>
<td>13416.0</td>
</tr>
<tr>
<td></td>
<td>(3.7)</td>
<td>(2.3)</td>
<td>(6.0)</td>
<td>(20.1)</td>
</tr>
<tr>
<td>1963-64</td>
<td>570.8</td>
<td>355.7</td>
<td>926.5</td>
<td>16728.6</td>
</tr>
<tr>
<td></td>
<td>(3.4)</td>
<td>(2.1)</td>
<td>(5.5)</td>
<td>(20.3)</td>
</tr>
<tr>
<td>1964-65</td>
<td>806.1</td>
<td>377.8</td>
<td>1183.9</td>
<td>18367.7</td>
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<tr>
<td></td>
<td>(4.4)</td>
<td>(2.0)</td>
<td>(6.4)</td>
<td>(20.5)</td>
</tr>
<tr>
<td>1965-66</td>
<td>938.6</td>
<td>433.2</td>
<td>1371.8</td>
<td>20188.5</td>
</tr>
<tr>
<td></td>
<td>(4.6)</td>
<td>(2.2)</td>
<td>(6.8)</td>
<td>(20.1)</td>
</tr>
<tr>
<td>1966-67</td>
<td>735.7</td>
<td>462.3</td>
<td>1198.0</td>
<td>22664.1</td>
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<td></td>
<td>(3.3)</td>
<td>(2.0)</td>
<td>(5.3)</td>
<td>(19.5)</td>
</tr>
<tr>
<td>1967-68</td>
<td>1027.1</td>
<td>585.2</td>
<td>1612.3</td>
<td>25007.5</td>
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<td></td>
<td>(4.1)</td>
<td>(2.3)</td>
<td>(6.4)</td>
<td>(20.8)</td>
</tr>
<tr>
<td>1968-69</td>
<td>1093.1</td>
<td>648.4</td>
<td>1741.5</td>
<td>26221.3</td>
</tr>
<tr>
<td></td>
<td>(4.2)</td>
<td>(2.5)</td>
<td>(6.7)</td>
<td>(21.4)</td>
</tr>
</tbody>
</table>

Note: Figures in parentheses indicate percentage to the total Budget.

**Source:** Selected educational and related statistics at a glance. Education Division, Planning Commission. 1969. p.19.
Table 18. Area, Population and Density of Population

<table>
<thead>
<tr>
<th>State/Union Territory</th>
<th>Area in sq. kilometres</th>
<th>Population 1971</th>
<th>Density of population per sq. km.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>INDIA</strong></td>
<td>3 268 090</td>
<td>546 955 945</td>
<td>182</td>
</tr>
<tr>
<td><strong>States</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Andhra Pradesh</td>
<td>275 244</td>
<td>43 394 951</td>
<td>157</td>
</tr>
<tr>
<td>Assam</td>
<td>99 714</td>
<td>14 857 314</td>
<td>149</td>
</tr>
<tr>
<td>Bihar</td>
<td>174 008</td>
<td>56 387 296</td>
<td>324</td>
</tr>
<tr>
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a. As on 1-1-1966.
b. Provisional figures of the 1971 census as announced by the Registrar-General and Census Commissioner for India.
Table 19. Annual Population Projections –
India, States and Union Territories – 1961 to 1981
(figures in thousands)

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Source: Selected educational and related statistics at a glance.
## Table 20. Population Projection, 1961 to 1981 (in thousands)

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**Source:** Report on the Population Projections worked out under the guidance of the Expert Committee set up by the Planning Commission under the Chairmanship of the Registrar General, India, 1968. pp.77-80.

## Table 20a. Distribution of the Active Population by Sex

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**Source:** Census of India, Paper No. 1 of 1962.
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<td>&quot;</td>
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<td>3 862</td>
<td>4 812</td>
<td>5 731</td>
<td>4 476</td>
</tr>
<tr>
<td>Castorseed</td>
<td>&quot;</td>
<td>103</td>
<td>125</td>
<td>107</td>
<td>121</td>
<td>111</td>
</tr>
<tr>
<td>Sesameum</td>
<td>&quot;</td>
<td>445</td>
<td>467</td>
<td>318</td>
<td>445</td>
<td>415</td>
</tr>
<tr>
<td>Rapeseed and mustard</td>
<td>&quot;</td>
<td>762</td>
<td>860</td>
<td>1 347</td>
<td>1 568</td>
<td>1 572</td>
</tr>
<tr>
<td>Linseed</td>
<td>&quot;</td>
<td>367</td>
<td>420</td>
<td>398</td>
<td>438</td>
<td>352</td>
</tr>
<tr>
<td>Cotton (lint)</td>
<td>'000 bales⁹</td>
<td>2 875</td>
<td>3 949</td>
<td>5 293</td>
<td>5 454</td>
<td>5 270</td>
</tr>
<tr>
<td>Jute (dry fibre)</td>
<td>&quot;</td>
<td>3 309</td>
<td>4 232</td>
<td>4 134</td>
<td>6 320</td>
<td>3 052</td>
</tr>
<tr>
<td>Mesta (dry fibre)</td>
<td>&quot;</td>
<td>N.A.</td>
<td>1 162</td>
<td>1 129</td>
<td>1 272</td>
<td>907</td>
</tr>
<tr>
<td>Tea</td>
<td>'000 tonnes</td>
<td>275</td>
<td>285</td>
<td>321</td>
<td>385</td>
<td>380</td>
</tr>
<tr>
<td>Coffee</td>
<td>&quot;</td>
<td>25</td>
<td>34</td>
<td>43</td>
<td>58</td>
<td>73</td>
</tr>
<tr>
<td>Rubber</td>
<td>&quot;</td>
<td>14</td>
<td>23</td>
<td>25</td>
<td>65</td>
<td>71</td>
</tr>
<tr>
<td>Coconut</td>
<td>crore nuts⁴</td>
<td>358</td>
<td>423</td>
<td>464</td>
<td>532</td>
<td>N.A.</td>
</tr>
</tbody>
</table>

a. Partially revised estimates  
b. Final estimates  
c. 180 kgs each.  
d. Crore = 10 million  
N.A. Data not available  
Table 22. Index Numbers of Agricultural Production, 1960-61 to 1968-69
(Base - Agricultural year 1949-50 = 100)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Coffee</td>
<td>236.4</td>
<td>230.4</td>
<td>237.7</td>
<td>255.5</td>
<td>269.0</td>
<td>282.1</td>
<td>347.2*</td>
<td>254.2*</td>
<td>321.7*</td>
</tr>
<tr>
<td>Rubber</td>
<td>167.0</td>
<td>180.0</td>
<td>209.4</td>
<td>239.0</td>
<td>286.0</td>
<td>316.0</td>
<td>343.7</td>
<td>404.7</td>
<td>445.5</td>
</tr>
<tr>
<td>Cotton</td>
<td>202.1</td>
<td>174.9</td>
<td>199.8</td>
<td>208.6</td>
<td>219.0</td>
<td>183.7</td>
<td>191.8</td>
<td>210.3</td>
<td>203.2</td>
</tr>
<tr>
<td>Jute</td>
<td>125.3</td>
<td>192.7</td>
<td>165.0</td>
<td>184.3</td>
<td>183.9</td>
<td>135.6</td>
<td>162.5</td>
<td>191.1</td>
<td>92.6</td>
</tr>
<tr>
<td>Tea</td>
<td>120.9</td>
<td>133.4</td>
<td>130.5</td>
<td>130.4</td>
<td>140.2</td>
<td>137.9</td>
<td>141.5</td>
<td>144.8</td>
<td>142.8</td>
</tr>
<tr>
<td>All Cereals</td>
<td>138.3</td>
<td>143.1</td>
<td>135.9</td>
<td>141.4</td>
<td>154.5</td>
<td>124.2</td>
<td>129.5</td>
<td>164.2</td>
<td>165.7</td>
</tr>
<tr>
<td>All Foodgrains</td>
<td>137.1</td>
<td>140.3</td>
<td>133.6</td>
<td>136.5</td>
<td>150.8</td>
<td>120.9</td>
<td>123.8</td>
<td>159.0</td>
<td>157.5</td>
</tr>
<tr>
<td>All Pulses</td>
<td>129.0</td>
<td>121.5</td>
<td>117.9</td>
<td>102.9</td>
<td>126.1</td>
<td>98.3</td>
<td>85.2</td>
<td>123.5</td>
<td>102.3</td>
</tr>
<tr>
<td>All Commodities</td>
<td>142.2</td>
<td>144.8</td>
<td>139.6</td>
<td>143.1</td>
<td>159.4</td>
<td>132.1</td>
<td>131.6</td>
<td>161.0</td>
<td>158.7</td>
</tr>
</tbody>
</table>

* Based on provisional estimates.

Note: The indices for 1965-66 to 1967-68 are generally based on partially Revised Estimates, while those for 1968-69 are generally based on Final Estimates. The indices for these years are, therefore, subject to revision.


Table 23. Index Numbers of Industrial Production
(Base: 1960 = 100)

<table>
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<tr>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>General index</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>157.8a 168.5a + 6.8</td>
</tr>
<tr>
<td>(All industries)</td>
<td>100.0</td>
<td>153.6</td>
<td>152.4</td>
<td>151.4</td>
<td>161.1</td>
<td>158.1b 168.5b</td>
<td>- 0.8</td>
<td>+ 6.4 - 5.6 + 3.9 + 5.6</td>
</tr>
<tr>
<td>General engineering</td>
<td>13.66</td>
<td>233.3</td>
<td>199.4</td>
<td>188.2</td>
<td>195.6</td>
<td>189.8</td>
<td>200.5</td>
<td>-14.5 - 5.6 + 3.9 + 5.6</td>
</tr>
<tr>
<td>(Excl. electrical engineering)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.4 - 7.8 + 9.5 + 7.3</td>
</tr>
<tr>
<td>Metal products</td>
<td>2.51</td>
<td>205.6</td>
<td>208.4</td>
<td>192.1</td>
<td>181.2</td>
<td>181.9</td>
<td>199.2</td>
<td>+ 1.4 - 7.8 - 5.7 - 9.5</td>
</tr>
<tr>
<td>Non-electrical machinery</td>
<td>3.38</td>
<td>316.0</td>
<td>291.2</td>
<td>299.3</td>
<td>327.6</td>
<td>316.2</td>
<td>339.3</td>
<td>- 7.8 + 2.8 + 9.5 + 7.3</td>
</tr>
<tr>
<td>Transport equipment</td>
<td>7.77</td>
<td>206.3</td>
<td>156.6</td>
<td>138.6</td>
<td>142.9</td>
<td>137.4</td>
<td>140.6</td>
<td>-24.2 - 11.4 + 3.1 + 2.3</td>
</tr>
<tr>
<td>Electrical engineering</td>
<td>3.05</td>
<td>204.4</td>
<td>225.1</td>
<td>243.4</td>
<td>277.5</td>
<td>262.8</td>
<td>312.9</td>
<td>+10.1 + 8.1 +14.0 +19.1</td>
</tr>
<tr>
<td>Chemicals</td>
<td>7.26</td>
<td>153.9</td>
<td>168.4</td>
<td>172.2</td>
<td>197.4</td>
<td>185.4</td>
<td>212.2</td>
<td>+ 9.4 + 2.3 +14.6 +14.3</td>
</tr>
<tr>
<td>Non-ferrous metals</td>
<td>1.15</td>
<td>152.1</td>
<td>167.5</td>
<td>204.0</td>
<td>238.5</td>
<td>244.3</td>
<td>253.4</td>
<td>-10.1 +21.8 +16.9 + 3.7</td>
</tr>
<tr>
<td>Iron and steel (basic industries)</td>
<td>6.23</td>
<td>185.3</td>
<td>193.6</td>
<td>177.7</td>
<td>185.4</td>
<td>176.6</td>
<td>204.7</td>
<td>+ 4.5 - 8.2 + 4.3 +15.9</td>
</tr>
<tr>
<td>Jute textiles</td>
<td>3.97</td>
<td>120.3</td>
<td>100.4</td>
<td>104.1</td>
<td>96.4</td>
<td>105.0</td>
<td>73.4</td>
<td>-16.8 + 3.7 - 7.4 -30.1</td>
</tr>
<tr>
<td>Cotton textiles</td>
<td>21.18</td>
<td>111.7</td>
<td>106.5</td>
<td>104.9</td>
<td>111.7</td>
<td>112.3</td>
<td>110.7</td>
<td>- 4.7 - 1.5 + 6.5 - 1.4</td>
</tr>
</tbody>
</table>

a. Crude.
b. Seasonally adjusted.

<table>
<thead>
<tr>
<th>Year</th>
<th>Gross national product (Rs. million)</th>
<th>Net national product (Rs. million)</th>
<th>Per capita net national product (Rs.)</th>
<th>Index numbers of net national product (Base: 1960-61 = 100)</th>
<th>Index numbers of per capita net national product (Base: 1960-61 = 100)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>At current prices</td>
<td>At 1960-61 prices</td>
<td>At current prices</td>
<td>At 1960-61 prices</td>
<td>At current prices</td>
</tr>
<tr>
<td>1960-61</td>
<td>140100</td>
<td>140100</td>
<td>132740</td>
<td>133080</td>
<td>306.7</td>
</tr>
<tr>
<td>1961-62</td>
<td>148790</td>
<td>145820</td>
<td>149280</td>
<td>150670</td>
<td>316.0</td>
</tr>
<tr>
<td>1962-63</td>
<td>158320</td>
<td>149500</td>
<td>160690</td>
<td>162120</td>
<td>327.0</td>
</tr>
<tr>
<td>1963-64</td>
<td>181140</td>
<td>157920</td>
<td>171220</td>
<td>176890</td>
<td>366.9</td>
</tr>
<tr>
<td>1964-65</td>
<td>211960</td>
<td>169190</td>
<td>200870</td>
<td>207450</td>
<td>420.2</td>
</tr>
<tr>
<td>1965-66</td>
<td>217710</td>
<td>160370</td>
<td>205730</td>
<td>216450</td>
<td>420.0</td>
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<tr>
<td>1966-67</td>
<td>249990</td>
<td>162470</td>
<td>236510</td>
<td>255730</td>
<td>471.2</td>
</tr>
<tr>
<td>1967-68</td>
<td>293420</td>
<td>176320</td>
<td>279010</td>
<td>297250</td>
<td>542.3</td>
</tr>
<tr>
<td>1968-69</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>168300</td>
<td>-</td>
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</tbody>
</table>

Annual growth rate during Third Plan: 9.2, 2.8, 9.1, 2.5, 6.6, 0.1

### Table 25. Index Numbers of Exports (Base: $1958 = 100$)

<table>
<thead>
<tr>
<th>Class of Commodities</th>
<th>Volume Index</th>
<th>Unit Value Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food</td>
<td>114</td>
<td>112</td>
</tr>
<tr>
<td>Beverages and tobacco</td>
<td>64</td>
<td>106</td>
</tr>
<tr>
<td>Crude materials (inedible, except fuel)</td>
<td>160</td>
<td>150</td>
</tr>
<tr>
<td>Mineral fuels, lubricants, etc.</td>
<td>88</td>
<td>66</td>
</tr>
<tr>
<td>Animal and vegetable oils and fats</td>
<td>16</td>
<td>25</td>
</tr>
<tr>
<td>Manufactured goods</td>
<td>136</td>
<td>146</td>
</tr>
<tr>
<td>Machinery and transport equipment</td>
<td>1266</td>
<td>1393</td>
</tr>
<tr>
<td>Miscellaneous manufactured articles</td>
<td>182</td>
<td>218</td>
</tr>
<tr>
<td>General</td>
<td>119</td>
<td>122</td>
</tr>
</tbody>
</table>

### Index Numbers of Imports (Base: $1958 = 100$)

<table>
<thead>
<tr>
<th>Class of Commodities</th>
<th>Volume Index</th>
<th>Unit Value Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food</td>
<td>231</td>
<td>207</td>
</tr>
<tr>
<td>Beverages and tobacco</td>
<td>22</td>
<td>43</td>
</tr>
<tr>
<td>Crude materials (inedible, except fuel)</td>
<td>138</td>
<td>145</td>
</tr>
<tr>
<td>Mineral fuel, lubricants, etc.</td>
<td>92</td>
<td>99</td>
</tr>
<tr>
<td>Animals and vegetable oils and fats</td>
<td>251</td>
<td>581</td>
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<tr>
<td>Chemicals</td>
<td>367</td>
<td>490</td>
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<tr>
<td>Manufactured goods</td>
<td>82</td>
<td>79</td>
</tr>
<tr>
<td>Machinery and transport equipment</td>
<td>103</td>
<td>121</td>
</tr>
<tr>
<td>Miscellaneous manufactured articles</td>
<td>87</td>
<td>347</td>
</tr>
<tr>
<td>General</td>
<td>149</td>
<td>166</td>
</tr>
</tbody>
</table>

*Average of 10 months from June 1966 to March 1967. The figures for April and May 1966 are excluded as they are not comparable with those for post-evaluation period.

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</tr>
<tr>
<td>Australia</td>
<td><em>Publications</em>: Educational Supplies Pty. Ltd., Box 33, Post Office. Brookvale 2100, N.S.W.</td>
</tr>
<tr>
<td>Austria</td>
<td>Verlag Georg Fromme &amp; Co., Arbeiterstrasse 17, 1051 WIEN.</td>
</tr>
<tr>
<td>Bolivia</td>
<td>Libreria Universitaria, Universidad San Francisco Xavier, apartado 212, SUCRE.</td>
</tr>
<tr>
<td>Brazil</td>
<td>Fundacao Getulio Vargas, Secretaria de Publicacoes, caixa postal 11100 Prada de Botafogo 188,</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>Hemus, Kantora Literatura, b.d. Rousky 6, SOFIJA.</td>
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<td>Burma</td>
<td>Trade Corporation n. o, 320-322 Merchant Street, RANOUNG.</td>
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<td>Cameroon</td>
<td>Librairie Richard, B.P. 4017, YAOUNDE.</td>
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<td>Information Canada, OTTAWA (Ont.).</td>
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<td>Cyprus</td>
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<td>Colombia</td>
<td>Libreria Bucolica Galeria, avenida Jimenez de Quaneda 8-40, apartado aereo 49-56, BOGOTA;</td>
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<td>Czechoslovakia</td>
<td>Publiskaiony Republic of, P.O. Box 1722, NICOMA.</td>
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<td>Denmark</td>
<td>Ejnar Munksgaard Ltd., 6 Nørregaard, 1165 KØBENHAVN K.</td>
</tr>
<tr>
<td>Egypt</td>
<td>Egyptian Kairasso, 2 Keskaskii, HELLENE.</td>
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<td>National Comission for Unesco, B.P. 2966, ADDIS ABABA.</td>
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<td>Alatemiririn Kirjakauppa, 2 Keskaskii, HELLENE.</td>
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<td>Indonesia P.T., D.II, San Ratuangie 37, DJAKARTA.</td>
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<td>Iran</td>
<td>Iran Commission nationale iranienne pour l'UNESCO, 1154, avenue Roosevelt, B.P. 1333, TIENIFAN</td>
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<td>Ireland</td>
<td>The National Press, 2 Wellington Road, Ballsbridge, DUBLIN 4.</td>
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<td>Israel</td>
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<td>Sangaster's Book Stores Ltd., P.O. Box 366, 101 Water Lane, KINGSTON.</td>
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<td>Sennin, Maruzen Co. Ltd., P.O. Box 9050, Tokyo International, TOKYO.</td>
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<tr>
<td>Kenya</td>
<td>The ESS Ltd., P.O. Box 21657, NAIROBI.</td>
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<td>Kashmir Republic</td>
<td>Librarie Albert Portail, 14, avenue Bouloche, PINON-PINN.</td>
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<tr>
<td>Kuwait</td>
<td>The Kuwait Bookshop Co. Ltd., P.O. Box 2043, KUWAIT.</td>
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<td>Libya</td>
<td>Cole &amp; Yance Bookshops Ltd., P.O. Box 356, MONROVIA.</td>
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<td>Mauritius</td>
<td>Nakanda Co. Ltd, 30 Bourbon Street, PORT-Louis.</td>
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<td>Monaco</td>
<td>British Library, 39, boulevard des Moulines, MONTE-CARLO.</td>
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<td>New Zealand</td>
<td>Reprex S.A.R.L., B.P. 1572, NOUVELLE.</td>
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<td>Niger</td>
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<td>Norway</td>
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