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Chapter 17: SCIENTIFIC RESEARCH

During 1961—69, important activities undertaken by the Council of Scientific and Industrial Research (CSIR), which was constituted for the main purpose of promotion, guidance and coordination of scientific and industrial research were the establishment of National Institute of Oceanography, a Regional Research Laboratory at Bhubaneswar, National Geophysical Research Institute, Structural Engineering Research Centre, and Industrial Toxicology Research Centre. In addition, three cooperative research associations for textiles and one for tea were supported. Six national laboratories initiated during the Second Plan period were fully equipped and staffed. They are the National Aeronautical Laboratory, Central Scientific Instruments Organisation, Central Mechanical Engineering Research Institute, Central Indian Medicinal Plants Organisation, Indian Institute of Petroleum and Central Public Health Engineering Research Institute. CSIR laboratories have been able to work out methods for the use of waste mica for insulation bricks, manufacture of optical glass which is a strategic material, protein food based on oil cakes and cereals, baby food, coinage and ferro-alloys, carbon rods and slabs, ion exchange resins, ceramic capacitors, and hard and soft fentes.

17.2. The Directorate General of Technical Develop--coent (DGTD) has made a review of import substitution. It has been estimated that a saving of about Rs. 211 crores in foreign exchange has been effected during 1961—67 by taking measures such as substitution of imported raw materials, components and spare parts by indignously manufactured materials and change-over of production of chemicals and chemical products from intermediates to their production from basic raw materials.

17.3. Activities of the Department of Atomic Energy (DAE) became part of Plan programmes in 1961. Its objectives are to develop the use of atomic energy for the production of electric power and evolve new uses of stable and radioactive isotopes for agriculture, biology, medicine and industry. Three experimental nuclear reactors were built; the last one Zerlina attained criticality in 1961. The Department set up a 5.5 Mev Van-de Graff accelerator, commissioned a plutonium recovery plant, produced and marketed isotopes and labelled compounds, fabricated nuclear instruments and counting systems and high vacuum equipment plant for freezing of blood plasma, and sold electronic components. DAE has also prepared project reports and undertaken the construction of nuc'ear power stations. The first of these of ;80 MW capacity at Tarapur has been commissioned in 1969. In 1961, the Department was made responsible for promotion of research in the peaceful uses of outer space. A base for space research has now been built up with the setting up of an equatorial rocket launching station at Thumba. A space science and technology centre at Veli Hill near Thumba is expected to be completed during 1970-71.

17.4. Under the Ministry of Education (Scientific Surveys and Development Division), the Survey of India is responsible for topographical studies and basic maps There are necessary for the various tasks, such as irrigation and power projects and mineralogical exploration. The Botanical and Zoological surveys in addition to classification of flora and fauna have helped exploitation of some plant and animal products. Under the Survey of India, a Photo Interpretation Institute was set up in Dehradun in 1966 and a Pilot Production and Training Centre at Hyderabad in 1967.

17.5 Table 1 shows outlays and expenditure on "Scientific Research" in CSIR, the Department of Atomic Energy (Research and Development) and the Ministry of Education (Scientific Surveys and Development Division)

Table 1 : Outlay andExpenditure on Scientific Research
(Rs. crores)

Sl. No.		plan	non-plan	total
(0)	(1)	(2)	(3)	(4)
1	third plan	71.49	73.00	144.49
2	1966-69 (estimate)	47.15	83.44	130.59
3	fourth plan	140.26	198.32	338.58

17.6. Research and Development (R and D) activities are also carried out under the auspices of various departments of Government and other agencies— Government and non-Government. Sometimes their outlays are part of the

allocation for major research activities This is true of agriculture university education, communications, medical care, meteorology, geology and industrial production. Research and Development is also an important activity of the Ministry of Defence. Estimates of the Fourth Plan outlays for R and D under the Central Sector for agriculture, university education and health, including family planning, are of the order of Rs. 55 crores, Rs. 10 crores and Rs. 22 crores respectively. These are dealt with in the respective chapters.

17.7. The Committee on science and technology which is an advisory body to the Cabinet has brought out Report on Science and Technology, 1969. According' to this report the total expenditure for scientific research and development under Central, State and private sectors in the country has increased from Rs. 27 crores in 1958-59 to about Rs. 136 crores in 1969-70. In terms of GNP it has increased from 0.21 % to 0.43%. This is expected to rise to about 0.5% at the end of the Fourth Plan. About 94% of the expenditure on R and D is incurred directly and/or supported by the public sector in one way or the other while the share of the private sector is of the order of 6 % only. Even in the public sector, 4 organisations (the CSIR, the DAE the Defence R and D organisation and the ICAR) account for about 68% of the total expenditure on R and D in the Central sector. The scientific and technical manpower employed on R and D has increased from about 18,000 in 1958-59 to about 62,000 in 1968-69 in the Centra.1, State, and private sectors. It has been noticed that there has been some imbalance of the spending on R and D in certain sectors, as for example, in the development of natural resources and training of scientific and technical manpower of high quality, due attention has not been paid, while these sectors are vital for the balanced growth of science and technology leading to economic growth. One of the possible reasons of the imbalanced growth is the lack of central authority to study and decide Inter se allocation in various areas of scientific and technological activities.

17.8. The CSIR has given greater attention to purposeful research and development programmes especially those which could be completed within the Fourth Plan period. Meetings have been held with groups of industries such as Chemicals, Electronics, Instruments and Drugs and Pharmaceuticals Industries and more meetings are being convened. The user Government Departments have been consulted for suggestions and detailed programmes of the laboratories formulated and screened by a Working Group with nine expert committees. The priority projects identified by the Working Group relate to technologies for special glass and ceramics, non-ferrous metals like magnesium, special batteries required by defence, high polymers and synthetic fibres, biochemicals, materials for electronic industries such as pure silicon synthetic quartz crystals and special classes of ferrites. Food research; mining and mineral beneficiation, tropicalisation, welding technology and design of microwave towers, reactor pressure vessels, grain storage structures and studies on antifertility agents are other important subjects engaging attention. Further, a central machinery for providing guidelines to CSJR laboratories has been set up under the chairmanship of the Member (Industry), Planning Commission. Three priority areas have been identified : steel, chemicals and instruments and sub-groups are engaged in identifying important problems for research and development in these areas. While the laboratories will provide experimental and pilot plant data to entrepreneurs, consulting engineering firms could be engaged for design engineering and feasibility reports. In special cases such design cells may be set up in the laboratories for themselves or for groups of laboratories in the same field. Where the integration of several disciplines is required, more than one CSIR laboratory in association with industry and outside agencies would cooperate on selected projects. CSIR's outlays are given below :

Table 2 : Outlay and Expenditure for Schemes of Council of Scientific and Industrial Rsearch
(Rs. crores)

Sl. No.	plan	non-plan	total
(0) (1)	(2)	(3)	(4)
1 third Plan	33.04	25.34	58.38
2 1966—69	20.90	33.65	54.55
3 fourth Plan	50.00	71.12	121.12

17 9. There is sometimes avoidable duplication in the research work of different laboratories within CSIR as well as between laboratories of other Central agencies and those of CSIR. Projects of regional laboratories are required to be examined to avoid overlapping of research work. Some of the projects in national laboratories which have been in hand for quite some time need to be reviewed in order to decide whether it would be useful to continue with them. A review should be made of field stations with a view to rationalising their work and making them more effective.

17 10. The atomic energy programmes provide for building of nuclear power stations, development of ancillary technologies based on indigenous resources and production of special materials, fuels and equipment. The Fourth Plan programme of the Department under Research and Development Sector would increase the component of indigenous expertise and materials in the nuclear power projects. Other important activities during this period will be setting up of a reactor research centre with prototype fast breeder reactor at Kalpakkam and a variable energy cyclotron for nuclear research at Calcutta. The reactor research centre will intensify efforts on thorium utilisation. The variable energy cyclotron v/ill provide facilities for research in nuclear physics and isotope production. Advanced rockets would be developed for space research, particularly dealing with meteorology and diverse fields of equatorial

aeronomy. Work will be conducted in the development of a satellite launcher for a medium altitude scientific satellite. This is proposed to be launched from a new range on the east coast. Research and Development work will be undertaken for the use of synchronous satellites for providing direct broad cast television reception. This work is being undertaken in collaboration with other Departments of Government (All India Radio, P and T Department, Defence Research and Development Organisation and Council of Scientific and Industrial Research). Work on application of radiation in food preservation, biological research medical research and treatment and in industrial processes is also being conducted under the aegis of DAE as well as other Ministries. Development work on such applications will be conducted in a co-ordinated manner. DAE's outlays and expenditure have been as under :

Table 3 : Outlay and Expenditure for Schemes of Department of Atomic Energy
(Rs. Crores)

Sl. No.		plan	non-plan	total
(0)	(1)	(2)	(3)	(4)
1	third plan	33.10	30.40	63.50
2	1966—69	23.87	32.73	56.60
3	fourth plan	67.48	93.15	160.63

17.11. The Survey of India will continue the existing work on the systematic preparation of maps as a prerequisite for formulating schemes of hydel power, irrigation, flood control, mineral development and utilisation of forest resources. The facilities at the Photo Interpretation Institute at Dehradun and the Pilot Production and Training Centre at Hyderabad will be strengthened and consolidated. Botanical and Zoological Surveys will study the flora and fauna not yet covered. Field stations will be established in the Andamans and at Jodhpur. Survey organisation will take-up joint projects and joint expeditions where possible.

17.12. Outlays and expenditure in the Ministry of Education (Scientific Surveys and Development Division) are given below :

Table 4 : Outlay and Expenditure for Schemes of Scientific Surveys and Development Division
(Rs. crores)

Sl.No.		plan	non-plan	total
(0)	(1)	(2)	(3)	(4)
1	third plan	5.35	17.26	22.61
2	1966--69	2.38	17.06	19.44
3	fourth plan	22.78	4.05	56.83

17.13. Inventions reported by various research laboratories and institutions were licensed by the National Research Development Corporation (NRDC) to various industrial units. By March 1969 effective licences issued were 761. Of these 141 had gone into production. These include important items such as infant food protein isolate carboxy methyl cellulose, silver mica capacitors, and T.V. receivers. Total value of production based on processes licensed by NRDC during 1961—69 was about Rs. 25 crores. The gross receipts of royalties and premia on the processes licensed has increased from Rs. 3.5 lakhs in 1961-62 to Rs. 16.9 lakh in 1968-69. The NRDC will lay greater stress on its development activity and setting up of prototype or pilot plant in collaboration with industry or on its own. The Corporation will select from the laboratory processes those that are promising for upscaling and carry out techno-economic appraisal of such processes with the assistance of industrial consultants. Since entrepreneurs are willing to take up the processes only after their feasibility has been established, some enterprise capital is required for this purpose. A sum of Rs. 2 crores has been provided for to meet such expenditure. Some of the major projects proposed to be taken up for such studies in association with industrial consultants are on silicon carbide and lindane.

17.14. It is necessary that projects of an applied nature should have specified objectives and time schedules and be started with an initial idea of the benefits in relation to their costs. With increasing expenditure on R and D, evaluation of programme and results becomes important. Periodic evaluation will have to be undertaken at different levels.