

of equipment and high average salaries of trained workers who are scarce in this field in India. At the Indian Institute of Petroleum the high cost is also ascribed to the high remuneration of the foreign scientists. In some of the old-established laboratories like the Central Fuel Research Institute, the National Chemical Laboratory, the Central Leather Research Institute, the Central Building Research Institute, and the National Physical Laboratory, the cost per scientist is comparatively low (less than Rs. 30,000 per annum), while in a few laboratories like the National Metallurgical Laboratory this figure is somewhat high due to heavy expenditure on pilot plants. It appears that in the laboratories engaged in the fields in which there is an abundance of trained workers and low cost chemicals and equipment, the cost per scientist is low. The figures for cost per scientist calculated in respect of the national laboratories will help any organization in the country to gain an idea of the expenditure required for setting up a laboratory in any of the mentioned fields of work.

Research Output

In the absence of a suitable measure of research output a study has been made of the research papers produced in different laboratories during the past ten years. In some of the developed laboratories the number of papers has gone down during the past five years or so, due to greater emphasis on the exploitation of the research results in industry. The work in national laboratories is

responsible for the framing of many specifications by the Indian Standards Institution in recent years.

Perspective Plan

The Council of Scientific and Industrial Research is drawing up a perspective plan for the expenditure of laboratories in future, in the Fourth (1966-71) and Fifth (1971-76) Five Year Plan periods, on the basis of information gathered for the study referred to here. While arriving at the future estimates of different items, salaries to scientific personnel, salaries to administrative personnel, expenditure on chemicals, equipment, capital equipment, etc., for different laboratories, the rate of growth which was registered during the period 1954-63 will be taken into consideration. In most of the cases it will be assumed that these rates will continue in future, especially due to the under-developed nature of the country, though in a few cases it is necessary to take a view of the future rate of growth on *a priori* consideration. It has been found that most of the developed laboratories have been showing stationary rates of growth during the past ten years or so, particularly for the items of a recurring nature—these rates of growth will be assumed for the future also. For items of a capital nature it is really not possible to have a uniform rate of growth. The investigation also raises the problem of the size of the laboratory, interbalancing of resources and the organizational pattern of research—these are being studied.

THE GULLAND LABORATORY: ARTHUR D. LITTLE, LTD.

IN Britain more than 99 per cent of scientific and technical research is carried out by the universities, industrial laboratories, and the co-operative research associations. Since the War, however, research undertaken by an independent organization on behalf of a client or sponsor on a cost basis has begun to make its mark in Great Britain. This type of research is known as 'sponsored' or 'contract' research, these terms having originated in the United States where the selling of research facilities by independent organizations has reached tremendous proportions since the early 1940's.

The rapid development of sponsored research in the United States since the War was due partly to the realization of the importance of research to industry in the immediate post-war years and partly to the American point of view that industry—and not the Government—should be responsible for its own research and development. This combination of factors created a need for facilities to provide industry with a confidential service offering scientific, technical and economic assistance. This need was met by the setting up of the non-profit-distributing research institutes, some of which are now world famous. In addition to these non-profit institutes there is a host of commercial laboratories in the United States undertaking contract research, but only Arthur D. Little, Inc., in Cambridge, Mass., is comparable in size with the non-profit research institutes.

Established in 1886, Arthur D. Little, Inc., is now an international organization, employing a staff of about 1 400 and offering research, development, engineering and management services to industry, governments and banks throughout the world. There are offices and laboratories in many cities in the United States, and in Europe, Canada and Mexico. It has carried out some 70,000 projects during its seventy-eight years of operation.

In Great Britain the advance of sponsored research has been less spectacular than in the United States but nevertheless significant. One of the newest laboratories of this type is the Arthur D. Little Research Institute, which

was formed in 1956 at Inveresk, near Edinburgh, in the laboratories previously operated by the Institute of Seaweed Research. It is a non-profit-distributing organization, which works in association with, but is not a part of, Arthur D. Little, Inc., of Cambridge, Mass. It is unique in undertaking only oriented long range research, which is aimed at finding new spheres for possible exploitation by industry and is not normally concerned with sponsors' immediate problems. Present fields of investigation include the chemistry of cellulose and other polysaccharides, synthetic carbohydrate chemistry, organic sulphur and phosphorus chemistry, biochemistry and biophysics, synthetic high polymer research, metallurgy and various aspects of physical chemistry.

With the growing realization that research is of vital importance to industrial progress and increased productivity, there is now a demand in Great Britain for the full range of services offered by Arthur D. Little, Inc., in the United States. Consequently, in 1963, Arthur D. Little, Ltd., a wholly owned British subsidiary of Arthur D. Little, Inc., was activated to put the full resources of Arthur D. Little, Inc., at the disposal of firms in Britain. The London office of the new Company is specializing in technical, economic and management services for industrialists who require up-to-date knowledge of technology, markets and industrial trends. Such services include guidance in increasing production, diversification, evaluation of research and development, etc.

At Inveresk, the Gulland Laboratory, originally used by the Institute of Seaweed Research as a semi-technical laboratory, has been rebuilt and equipped by Arthur D. Little, Ltd., to provide facilities for applied research in chemistry and allied sciences, including food technology, pharmacology, and new product development. Unlike the Research Institute, the new building, with a laboratory space of 4,500 sq. ft., is equipped for short-term, confidential work for clients.

The redesigned Gulland Laboratory was officially opened on July 1 by Lord Todd, professor of organic chemistry in the University of Cambridge.