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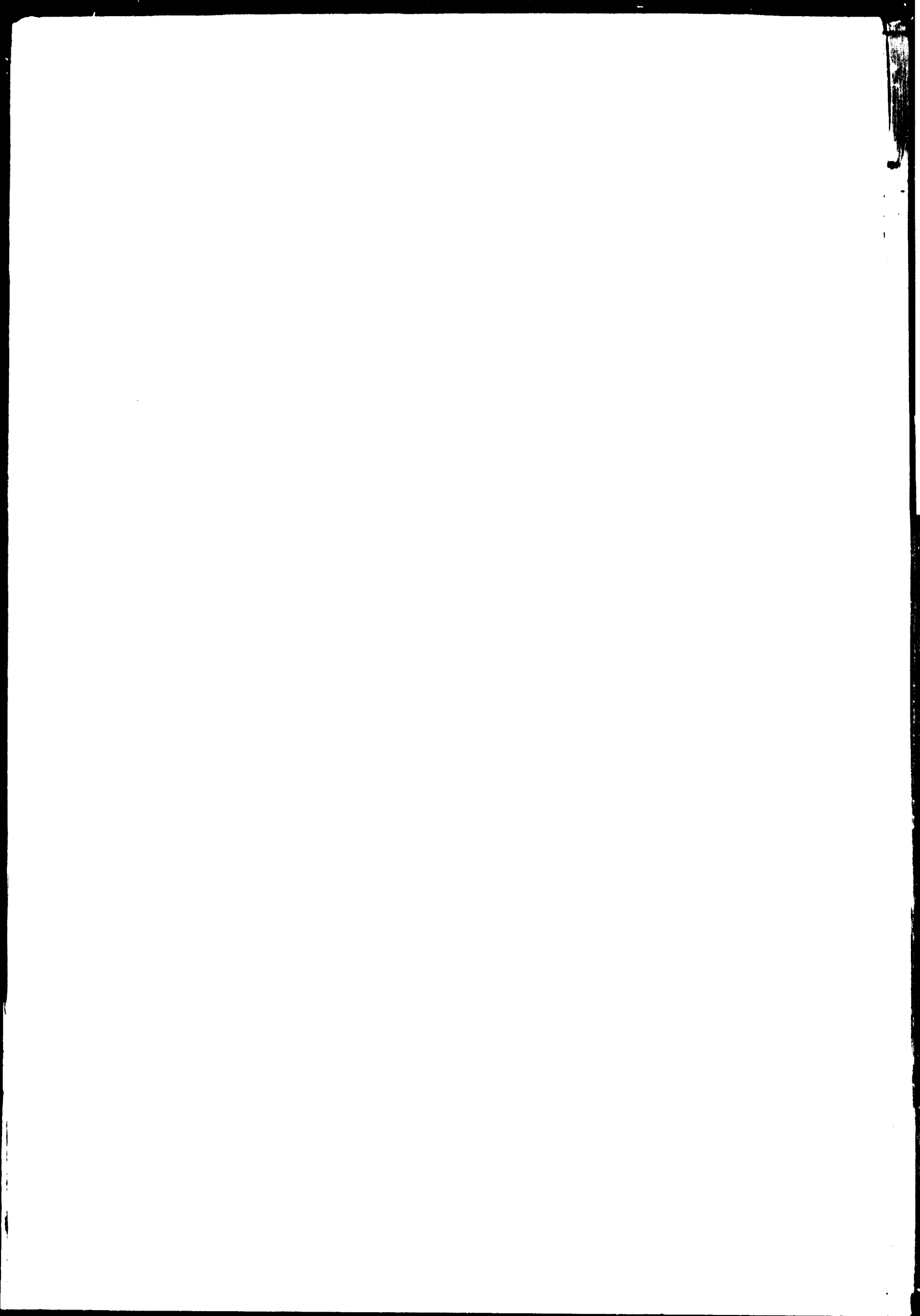
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R & D in Pakistan

By Kamal M. Habib

of textiles increased from 90 million square yards in 1949/1950 to 741 million square yards in 1963/1964 and is at present over 800 million square yards. The preoccupation with production left certain weak links in the research and development sector as, for instance, in prospecting for petroleum, the establishment of steel plants and the manufacture of fertilizers.

Research organizations and councils

The Department of Scientific and Industrial Research had its birth in pre-partition India during the Second World War. Research Councils (The Indian Council of Agricultural Research and the Indian Council of Medical Research) trace their histories back as far as 1912 and 1929, respectively.



The Author: Kamal M. Habib is the Director of the Scientific Information Division, Pakistan Atomic Energy Commission. He was formerly the associate co-editor of the Pakistan Journal of Scientific and Industrial Research and editor of Science and Industry. He has written numerous articles, including "The Way: The Pakistan Council of Scientific and Industrial Research, the First Fourteen Years" published in Industrial Research and Development News, Vol. II, No. 2, pp. 44-47 and "The Chemical Industry of Pakistan: Development, Orientation, Current Trends" published in Industrial Research and Development News, Vol. III, No. 2, pp. 15-18.

sectors, namely, industry, agriculture and service (infrastructure), has yet to be achieved.

The report of the Scientific Commission in 1960 represented a turning point in the evolution of research and development (R & D) in Pakistan. It was this report that suggested the integration of research laboratories functioning as disjointed and scattered units. Among the other measures recommended were:

- Provision of facilities for the research organizations and the utilization of the results of their research for over-all development;
- Provision of increased incentives for scientists;
- Closer liaison among the constituent Research Councils.



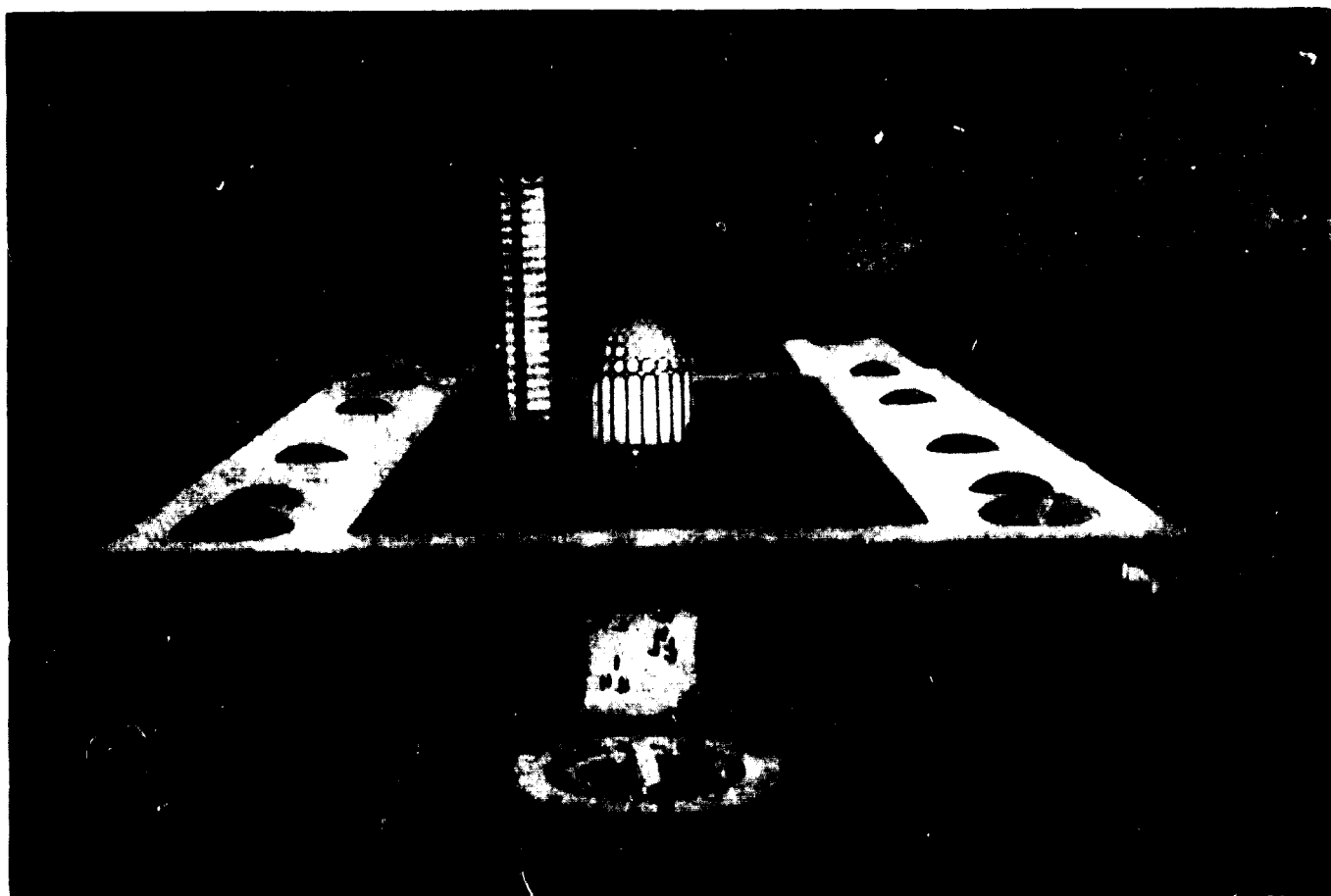
The crude fractionating column of the Karachi refinery opened in 1962. The present capacity is 2.1 million tons of crude oil

The Commission also took due consideration of the fact that "a number of important branches of science are either completely ignored in the universities or are very weakly represented". Among these were bacteriology, mycology, entomology, physiology and marine biology. Today, disciplines such as computer technology, oceanography, inorganic fibre technology, cybernetics, aerospace and engineering technology are indispensable to the integrated growth of national industry. Moreover, planned R & D not only assists industry to grow but also to generate new industries. There is an urgent need for the establishment of research associations in Pakistan, particularly in the more developed industries, such as textiles and jute. To date, research in this sub-sector has been carried out by the Central Cotton and Jute Committees. The formation of The Pakistan Pharmaceuticals Manufacturers' Association is a good augury, but work on the standardization of drugs, research into domestic medicinal resources and manufacturing techniques has not yet been undertaken. A stimulus to the formation of research associations in Pakistan might be provided by effecting changes in the taxation system and by initiating awards for research and industry.

The Government considered this question on the basis of the recommendations of the Scientific Commission of Pakistan when the National Science Council was formed, in 1961, with the following functions:

- The preparation of plans for R & D, indicating the problems for research in fields approved by the National Five-Year Plans and suggestions for priorities;
- Scrutiny of the programmes of the constituent Research Councils for purposes of budgetary clearance by the Ministries of the Central Government;
- Assessment of the results of R & D and of measures recommended for the utilization of these results;
- Liaison with scientific bodies in other countries and with international scientific organizations;
- Elimination, as far as possible, of duplication in the research programmes of the member Councils.

Two ancillary organizations are at present being operated by the Government. These are the Central Testing Laboratories and the Pakistan Standards Institution. These bodies, together with the proposed



The Pakistan Institute of Science and Technology, Rawalpindi

Institute of Physics and National Standards, should lead to the improvement of product quality. The Pakistan Standards Institution maintains divisions concerned with setting specifications in the mechanical and civil engineering, textiles, chemicals and agricultural sectors, besides operating a metric system cell. It also set up a division for the certification of trade marks in 1963.

The Third Five Year Plan fixed the target of a GNP of 62,765 million Pakistani rupees; but expenditure on R & D, taking into account all the government-sponsored research organizations, is barely 0.13 per cent of this amount. It has now been decided to increase this proportion to 2 per cent, which would, in turn, represent a ninefold increase; that is, 574 million Pakistani rupees a year. However, increased investment on R & D does not necessarily lead to a corresponding increase in the GNP. Investment of this kind must be justified by the implementation of its results, and this is not possible unless various research organizations and the private and public sectors are regarded as a whole, and there is free exchange and co-operation between them.

Communication of research results

A meeting point for the divergent streams of research is required. Since educational institutions in Pakistan are now receiving higher grants for research schemes, it might be feasible for the Government to co-opt an advisory board for relations with universities, in which the National Science Council and the member Councils and other organizations co-opted under the aegis of the Ministry of Education and Science, could function.

One of the most important factors in the smooth transformation of a process from the bench to manufacture is documentation, but in all developing countries this is a bottleneck.

One way PCSIR seeks to deal with this problem is through the publication of a series of monographs and the quarterly, *Pakistan Science Abstracts*.

Status of R & D

In certain fields, R & D has reached a highly advanced level, as in the gamma-irradiation technique applied to agriculture, reactor technology and in the

construction of nuclear power stations (one at Karachi is nearing completion and a second, with a 200 MW capacity, is planned at Rooppur, East Pakistan). In other spheres, such as polymer technology, the metallurgical industry and chemical intermediates, it lags behind. R & D must also seek solutions to problems such as:

- The constant water shortage on the Makran coast in West Pakistan (where one desalination plant is being established and two more are planned);
- Dependence on the rainfall in East Pakistan during the monsoon period to provide water for the dry season;
- Afforestation and soil stabilization in West Pakistan;
- Waterlogging and salinity of the soil;
- The ability of jute to compete with other fibres, notably polypropylene;
- Preparation of the geotectonic maps of both provinces.

To cite one instance, irrigation research in East Pakistan alone poses a great challenge. Only 1,700 million acres of the arable land is irrigated in that province compared with 27 million acres in West Pakistan. When the Tarbela dam, one of the largest embankment dams in the world, is completed by the end of the Fourth Five Year Plan (1975), there should be 115 million acre feet of water available annually in West Pakistan by 1985. It has also been found possible to increase water supplies during the dry season in East Pakistan by studies of soil permeability and ground water velocity by the application of radioisotope techniques, by measuring the water's natural tritium content and thus determining its age and allied parameters.

Jute retting, the process in which jute is submerged in stagnant water for eighteen to twenty days in order to release the fibres, has shown that, with the addition of urea in a solution containing the *Corchorus olivarius* variety of jute, the fibres are released in only ten days. Further work on the mechanism of retting through micro-organism culture is in progress. If the results of these investigations are translated into practice, increased productivity should result, particularly as the jute retting season in East Pakistan lasts for only two months.

The introduction of R & D into agriculture has brought some pleasant surprises. The target for wheat production in 1969-1970, according to the revised Third Five Year Plan, was about 5,464 million tons. However, with the development of the Mexi-Pak wheat variety, containing a gene that renders the plant insensitive to the sunligh., a production of 6.5 million tons resulted in 1968. For 1969, the yield is estimated at 7 million tons, almost double the 1951 production figure. The increase in the production

of rice has been no less dramatic, because of the introduction of the IR 5 and IR 8 rice varieties, which were developed at the International Rice Research Institute, Los Banos, Philippines. The gamma-radiation technique, when applied to cereal crops, should, in the long run, also produce drought- and pest-resistant varieties. The CO-547 and CO.L. 54 sugar-cane varieties have, together with several Ishurdi varieties from East Pakistan, increased the cane yield throughout Pakistan. Work on sunflower-seed oil is also in progress and should aid in offsetting the vegetable-oil shortage in the country.

It is evident from the foregoing three examples that the agricultural sector, which contributes the largest share of the GNP, has felt the impact of R & D. It is mainly through the R & D work in agronomy that the country will in the next three to four years, produce 2.5 million tons of ammonium sulphate and 550,000 tons of triple superphosphate each year. East Pakistan will also have a nitrogen, potash and calcium (NPK) fertilizer manufacturing plant.

PCSIR has undertaken the classification of medicinal flora in Pakistan and instituted pharmacological studies on natural drugs. The establishment of the National Health Laboratories and the Natural Drugs Research and Development Institute at Islamabad and Chittagong should provide further impetus to the R & D work in the drugs industry.

Researchers

The majority of scientists in Pakistan find employment with private concerns but, in most of them, the manufacturing processes are already established so that the function of a scientist is, at best technological. As a result, the private sector offers little scope for the application of fresh ideas. When research associations are formed, however, the danger that a large number of technical personnel will be misemployed will be reduced. There are bright spots like the Tarbela dam, which, it is expected, will employ 1,000 engineers during construction, and the opening of more colleges. The Government is also considering the establishment of a scientific service.

All too often, in developing countries, scientists who return from study abroad and have handled sophisticated equipment must deal with relatively commonplace problems that have little to do with their fields of research. As a result, they are over-qualified for the work that they do, and their training and experience are not exploited as there are too few jobs requiring their qualifications. This situation cannot be expected to change overnight; indeed, it is likely to persist for years to come.

Such problems are not peculiar to Pakistan; they are endemic to all developing countries, and no integrated R & D planning will be possible unless the thought processes of scientists, their fields of special interest and their aptitudes have been taken into account.





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