SCIENCE AND INDUSTRY IN THE NEXT FIFTY YEARS

FAWLEY FOUNDATION LECTURE OF THE UNIVERSITY OF SOUTHAMPTON

IN the first Fawley Foundation Lecture, entitled "Science and Industry—the Pattern of the Future", delivered in the University of Southampton on May 20, Sir Harold Hartley sought to give a broad picture of changes in the relations of science and industry during the past fifty years and to forecast the way in which they might co-operate to serve the material needs of the world in the next half-century. The great scientific discoveries of around 1900, he said, not only set the stage for the great advances of the next half-century but also contributed to a recognition of the vital part science has to play in industry. Up to 1914, research in Britain was still concentrated in the universities; now great industrial laboratories are contributing not merely to industrial advance but also to advances in fundamental science. Stressing both the magnitude of the increase in expenditure on research since 1900 and the reciprocal influence of science and industry, Sir Harold referred to the contributions which techniques developed in industrial research have made to scientific advance and to the way in which fundamental studies in industrial laboratories have led to important technological advances. He gave as examples the production of such man-made fibres as nylon and 'Terylene', the studies of the influence of traces of impurities on the electrical resistance of semiconductors which have produced the transistor, and those of the crystallization of graphite which have led to the production of nodular cast iron that is tough and can be machined and cast.

Besides this, the past fifty years have witnessed changes in the nature of industry itself, through the mechanization of the production line, with automatic and quality controls, the more scientific processing of raw materials and the introduction of synthetic materials which might replace, or be complementary to, the natural products and used in conjunction with them. These conditions have contributed to the rise of chemical engineering, complementary to the old branches of engineering, and Sir Harold stressed here Britain's need not only for chemical engineers but also for more scientific workers and engineers of all types. He thought that it is a great advantage of a university like Southampton, in close touch with local industries and also with the schools, in which the choice of a career is so often made, that it can recruit and train its students to meet the needs of industry.

Proceeding to forecast the world's needs by A.D. 2000, Sir Harold accepted an increase of 35 per cent in the world's population to 3,250 million on the assumption that Asiatic countries would develop a policy to limit the growth of population. Feeding this population at an adequate standard would require an increase in food production of about two-thirds, or a little more than 1 per cent a year. Sir Harold also assumed a 350 per cent increase in industrial output, with a 125 per cent increase in the consumption of energy and a 300 per cent increase in that of raw materials.

After a rather cursory review of the growing-points of science, in which he stressed the importance of classical physics, geophysics, metal physics and biophysics, the possibilities of radiochemical developments, of studies of the rates and mechanism of chemical reactions and of structural studies of complex organic molecules, and the bearing of genetics and pest control on food supply, Sir Harold discussed the limiting factors likely to determine the pattern of agricultural and industrial development. First, he stressed the importance of water supply and resources, including the treatment of effluents as well as irrigation and, in particular, the probability that in certain large areas multi-purpose water schemes providing power and irrigation as well as flood-control are likely to determine the pattern of development. He anticipated no global shortage of energy by A.D. 2000, though the availability of energy may well determine where development will occur. By A.D. 2000 he anticipated a demand for energy equivalent to 7,500 million tons of coal. At present 18 per cent of energy is consumed as electricity, and he thought that by A.D. 2000 hydroelectric plants and nuclear power stations might well supply the bulk of it. By then liquid fuel requirements might be met partly by oil from shale or coal, petroleum being kept for special purposes. With regard to metals and minerals, while the world is rich in iron and aluminium, the increased industrial production which he forecast would greatly increase our consumption of metals; and, apart from great economy in use and increased recovery of scrap, a formidable task of intensive search for new ore deposits, improved metallurgical methods and conservation would confront us. Sir Harold calculated, moreover, that to provide the nitrogenous fertilizers required by agriculture to feed a population of 3,250 million would involve an extra 25 million tons of steel for constructional purposes and an energy consumption equivalent to 125 million tons of coal.

Such demands come on top of any of those made by the changes in industrial production which he forecast; only intensive agricultural research could reduce the demand and open up new means of supply, possibly by novel methods such as photosynthesis or microbiological processes. Sir Harold placed his main hope of curbing our prodigal use of resources in the work of organizations like the Food and Agriculture Organization of the United Nations and in the plans for technical and economic assistance being worked out under the Colombo Plan, the Point Four plan of the United States and under the United Nations Specialized Agencies. He said little of the educational effort required in the backward countries before we can hope to implement such plans and eliminate the waste of resources where it is most prevalent; and while recognizing the importance of an ecological approach to the use and development of world resources, he set out only the material tasks that confront science and industry in the next fifty years.