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SCIENTIFIC AND INDUSTRIAL RESEARCH IN GREAT BRITAIN

THE uniformity with which recent reports on scientific and industrial research have insisted that provision for scientific research in Britain was dangerously small before the outbreak of the present War has been taken in some quarters as a disparagement of British achievements. Only the most desultory reading of the reports in question could afford any support for that contention; on the contrary, there is general agreement as to the ability of scientific men in Great Britain and the merits of their achievement, as emphatically as there is agreement that the *per capita* appropriation in Great Britain, both for industrial and for public research, has been far below that in the United States of America and the U.S.S.R. It was a disappointing feature of the report of the Larke Committee on Industry and Research that it provided such meagre information under this head, but there can be no doubt that, had such information been incorporated in that report, it would have corroborated the evidence submitted by the Parliamentary and Scientific Committee.

In a particular field this is well illustrated by the report on methods of building in the United States recently issued by the Ministry of Works. This report of a mission appointed by the Minister of Works in July 1943 shows that the building industry in the United States is considerably ahead of that in Great Britain, not so much in the quality or organization of its research as in the scale on which it is prosecuted, the use made of scientific personnel in the industry and the effectiveness with which the results of research are disseminated. There is no doubt as to the appreciation in the United States of the results of British research and of some features of its organization, such as the Building Research Station. None the less, the main burden of this report is similar to that of all the more important recent general reports: more generous endowment and vigorous prosecution of research, the wider employment of scientific personnel at all stages in industry, and more effective means to secure that the results of research are made known in ways that facilitate their utilization in industry. A further special illustration is to be found in Dr. F. King's recent paper on "Petroleum Refining—A Chemical Industry", read on February 4 before the Society of Chemical Industry, when he powerfully urged the importance of expanding the petroleum refining industry in Great Britain by an adequate research and development policy, so as to provide the basic raw materials for a new chemical industry in the manufacture of solvents, plastics and fibres.

This neglect of new discovery was one of the main reasons for the relative decline in British technical efficiency in the inter-war period, and there is little, if any, dissent from the view that it is essential to remedy this position so that the country may be able to hold its own after the War in the general technical progress. There is now general agree-

ment as to the necessity for a marked expansion in the scope of technical and natural scientific research at the universities and other public institutions, as well as in the facilities for training scientific personnel for such work and for industrial research, and probably also that such expansion should be achieved by a suitable increase of the Parliamentary Votes for that purpose; but there is as yet some uncertainty as to how best research should be stimulated in industry itself.

That is one reason behind the controversy at present proceeding as to the suitability of the patent law system of Great Britain under present conditions and the question of compulsory licensing. The question was raised broadly by Dr. P. Dunsheath in his Atkinson Memorial Lecture and, apart from the suggestion that the present system does not really encourage research and development, the discussion has been linked up, on one hand with the wider question of the control of industry by the State, and on the other with the question of the manner in which the State should encourage research by the remission of taxation. The way in which this question is related to that of obsolescence was well put in an article in *The Round Table*, and superficial discussion may easily tend to blame the patent law system or industry itself for shortcomings which are due primarily to an archaic taxation system, out of harmony with the facts and requirements of modern life. The question whether the State should support, without further regulation, research carried on by private firms, either directly by subsidies or tax remission or indirectly by placing at the disposal of industry the facilities of, or results obtained by, public research institutions, has been examined by Dr. T. Balogh in an article in the *Bulletin of the Institute of Statistics, Oxford*. This illustrates the theoretical character of some of the discussions of this subject from the economic point of view. It may be generally conceded that the State's duty in the encouragement of research and development is primarily to foster self-help, under fair conditions, and not in the main to do the job itself; to favour enterprise of the right kind; and to lend public aid where private effort is insufficient. That the imperative task of research is not to maintain particular industries in a particular state of employment or profits, but to increase the national income, even at the cost of very radical adjustments in the structure of industry and employment, and in the use which is made of the nation's total resources, is much more likely to be challenged from the scientific and technical side of industry.

Dr. Balogh follows Dr. C. G. Paterson in arguing that modern development has changed the whole technical and economic background of the patent law system of Great Britain, and that this has not been explicitly recognized either by a re-organization of scientific research or by patent law. He concludes tentatively against subsidies to private investment in plant of existing types without adequate safeguards. While research into new methods or products may be stimulated in this way, as the new and more efficient methods resulting lead

to a potential increase in the national real income and in the international competitive capacity of the country, the danger remains that the effectiveness of the new discovery will be either sterilized or used for the purpose of undue monopoly gains. Measures must, he urges, be taken to safeguard the interests of the community and against retardation of progress.

Dr. Balogh has thus really established the case for reform of the principles of inland revenue, but he goes on to expound the view that, as matters stand in Britain, the State must assume the main burden of increased research, and in the main the expansion of research should be undertaken by the universities or other public institutions. He appears to have in mind particularly the establishment of technical institutions on the lines of the Massachusetts Institute of Technology or of the Continental high schools; but since he suggests that the results of such research should be available on a licence basis to industry, presumably he does not favour a policy of full publication. Stimulus to public and private research in conditions which exclude a misdirection and misuse of the results should, in Dr. Balogh's opinion, be one of the main tasks of reconstruction, but his suggestions are likely to bring him under heavy fire from both the industrial and the scientific sides if they are seriously pressed.

The report on scientific industrial research which has been issued by the London Chamber of Commerce* may well be open to a similar type of criticism, at least as regards its chief new proposal for a central research board, both on the grounds of the practicability of finding the type of personnel necessary, and on the desirability or feasibility of the kind of direct control suggested. Much of the report, it is true, is not new. Reiterating that while the inventive genius and scientific knowledge of Great Britain are second to none, financial policy has put us behind others in the adequate provision of equipment for research, facilities for scientific and technical instruction, and such rewards to successful men of science as would ensure a sufficient supply of men of the first quality, the London Chamber of Commerce concludes that there are three essentials to stimulate research into full and fruitful activity.

Of these three essentials, two are in line with the recommendations of earlier reports, namely, a far greater stream of money flowing into research, and a larger, better trained and better paid personnel. The third, and foremost, is new, namely, centralized and planned direction through a central research board. This proposal has something in common with Lord Samuel's subsequent suggestion at the annual luncheon of the Parliamentary and Scientific Committee that the Lord President of the Council should exercise the functions of Minister of Science in the Cabinet.

Lord Samuel's suggestion is admittedly vague and might not in fact amount to much more than Dr. Dunsheath's proposal for a central co-ordinating secretariat and information service: The London

* Report of the London Chamber of Commerce on Scientific Industrial Research. Pp. 16. (London: 69 Cannon Street, 1944.)

Chamber of Commerce bases its proposal on the view that the support which has been forthcoming both from industry and from the Government for the fundamental type of research carried out by the research associations in Great Britain is insufficient to ensure either in quality or quantity the necessary measure of success. An attempt is made in the report to distinguish between 'fundamental' research and 'pure' research, aimed at the increase of natural knowledge for the sake of increasing knowledge and not for any particular industrial objective. The latter type of research, which in practice is hard to differentiate from long-range research on major technical problems, is regarded as an enterprise which should be financed by the nation, and should be carried on in the universities, though the desirability of close relations between industry and the universities in fundamental research, whether prosecuted in industry or at the universities, is recognized and welcomed.

The main purpose of the London Chamber of Commerce in urging the creation of a central research board to act as a co-ordinating and directing body for all research organizations and to form a link between the Government and the research activities of the country at large is to strengthen the present cohesion of our structure of research. The Advisory Council of the Department of Scientific and Industrial Research is not constituted, nor would its present terms of reference enable it to act, in the way and for the purposes now envisaged. A central research board, for example, should have as a primary function the encouragement of private firms to make available to industry at large, through the board, those discoveries which they did not feel it necessary to retain for their exclusive use. The board should accordingly be empowered to make grants, free of income tax, to private firms for such discoveries as are surrendered to the board, and these payments would be designed to encourage firms to complete lines of investigation which they might otherwise abandon as too remote from the problems of their own industries.

A second function of the proposed central research board would be to ensure that adequate facilities are available in every research association for private work, under conditions which would create confidence, on behalf of small firms. It is also proposed that the board should have the right to intervene and require research associations, in consideration of the public funds placed at their disposal, to undertake fundamental research in directions which it judges to be in the national interest, and to require greater activity on the part of those research associations which, in the opinion of the board, are proving unequal to their responsibilities. It should be the further duty of the board to consider the effect upon trade and industry as a whole of discoveries of a fundamental nature, and to direct the use of those discoveries so that they may be of the maximum advantage to the nation.

The duties of the board would not end here. With regard to the fundamental research carried on in the universities, the board would have the function of

ensuring that the results of such research would be applied in the shortest possible time. Scientific men in particular may well begin to wonder what manner of men they may be who will constitute the board, and they will be glad to learn that a highly qualified secretariat is recommended to assist in handling the complex problems involved. Again, it is suggested that the Board of Trade or the Department of Overseas Trade should place before the central research board any facts bearing on the loss of markets by British products, at home or abroad, due to poor quality or high price, and the board should take up the matter with the research associations and with individual firms.

Within its charter a central research board should have the same freedom of action as the British Broadcasting Corporation, under the ægis of, and presumably responsible to, the Lord President of the Council. Five industrialists, with practical experience, four men of science, and three representatives of labour, with a whole-time highly salaried chairman, and the full-time, expert secretariat already mentioned, are suggested as constituting such a board. Alternatively, the Council of the Department of Scientific and Industrial Research might be reconstituted on similar lines and its terms of reference widened to permit it to discharge the functions proposed. The present functions of the Advisory Council for Scientific and Industrial Research might then be discharged by a committee of the board. Finally, the question is raised for consideration whether a central research board should delegate its functions concerned with the universities to the University Grants Committee, or to a separate body concerned with research only, leaving the University Grants Committee to continue to function as at present with regard to all funds not specifically earmarked for research.

With regard to finance, the report considers that the universities should maintain a far larger staff than at present of graduates and of skilled laboratory technicians, and recommends a substantial increase in the number of research fellowships at the universities. The whole of the present annual Treasury grant to the universities would be quite inadequate to enable them to carry on the research which the London Chamber of Commerce regards as essential; indeed it strongly supports the Parliamentary and Scientific Committee in its recommendation that a sum of £10,000,000 should be spent over the first five post-war years in equipping and enlarging the university laboratories, apart from carrying out the expansion of the technical and art colleges on a programme estimated before the War to cost £12,000,000. The report urges, however, that all applications for research grants should come to the proposed central research board and be made by it to the Government, and that similarly all grants made by the Government should pass through its hands.

With regard to the research associations, the report advocates a compulsory levy, where necessary, on each industry for which a research association is thought appropriate. Again, the report is in agreement with the view of the Federation of British

Industries that all expenditure on research and development should be chargeable against revenue, either immediately or over the commercial life of any asset created. It also urges that the cost of pilot plant, as well as of laboratory buildings and equipment, should be chargeable against revenue.

The London Chamber of Commerce is impressed with the need for attracting to a scientific career a larger percentage than at present of men with first-class brains, and urges the up-grading of salaries offered to scientific men in industry, the research associations and the universities. Reference is also made to the importance of technical education and of much more generous endowment of the technical colleges; while finally, the importance of publicity is stressed. Individual undertakings must be made more research conscious, including employers, shareholders and workers alike. The report expresses the belief that there are resources of inventiveness and ingenuity among the people of Great Britain generally which skilful propaganda could assist in tapping.

In the main, the London Chamber of Commerce has merely restated the arguments for the expansion of our research effort on lines urged by the Federation of British Industries, the Parliamentary and Scientific Committee, and other bodies and individuals, with the specific exception of its proposal for a central research board. On this proposal two main comments may be made: first, the organization indicated may prove too rigid and demand too much of the individuals constituting the board, which scarcely seems to fit the machinery of government; and secondly, there is no apparent provision for seeing that research is prosecuted in the biological and social sciences in comparison with the physical sciences to the extent required to maintain a better balance in the advancing front of science. That there is need of some further measure of co-ordination of our research effort is scarcely questioned; but the manner in which that can best be planned or controlled without detriment to the internal discipline or freedom of science is a matter for serious discussion.

Here the report does well to raise the question of the adequacy of the University Grants Committee in regard to research purposes, as was done in the report of the Parliamentary and Scientific Committee. The question is also discussed in a recent memorandum on "The Development of Science" issued by the Association of Scientific Workers, which suggests that to assure adequate financial resources for fundamental scientific research and the wise use of those increased resources, a university council, reporting, for example, to the Lord President of the Council, like the Scientific Advisory Committee, should be formed to extend the functions of the University Grants Committee. It should be competent to discuss in detail all questions of university policy, and, without impairing the independence of the individual universities, it would provide a democratic machinery by which the universities as a whole could take the guidance of their future into their own hands, and the Association suggests that a body of the type

indicated in the memorandum should achieve a greatly increased measure of self-government of university science by university men of science.

By and large, the stimulation and endowment of fundamental research on an adequate scale is the first and main problem. Opinion may well be reserved as to how far, or how soon, the creation of a university council of the type suggested is likely to proceed without some external stimulus or some far-reaching university reforms; and if university co-operation has not been particularly marked in the past, the capacity of scientific workers to co-operate even within a limited field of science has not been so successful that the prospect of increased self-government will make any pronounced appeal to them or to the community. The first step may well have to be taken by the Government, following the lead given by some such body as the Parliamentary and Scientific Committee. The adequate endowment and prosecution of industrial research should follow from such steps, once fundamental research has been adequately planned and endowed, and given right relations between the State and industry. The discussions which are already proceeding as to the mechanism of State control, the relations between enterprise and planning, between taxation policy and the encouragement of development and research, and between patent law and industrial research are all to be welcomed as contributing to this end. If such discussions can be kept clear of faction or prejudice, and pressed home to lay bare the fundamental issues, they can do much to indicate the right lines on which the organization of research should proceed in Great Britain. They will suggest conditions likely to stimulate creative thought and invention, and also ensure, not merely that the maximum social use is made of advancing scientific knowledge, but also that adequate effort is concentrated in those fields where social needs, instead of financial or other sectional interests, show it is likely to yield the maximum advantage to the community.

WORK OF IMPERIAL CHEMICAL INDUSTRIES, LTD.

THE record of British industrial achievement during the War remains to be written. A veil of secrecy conceals most of it, and it is only here and there and at rare intervals that a small part of the veil is lifted. Such an occasion was Lord McGowan's speech at the Glasgow Chamber of Commerce recently, when, for the first time during the War, he recorded some of the work of Imperial Chemical Industries, Ltd., emphasizing the fact that it was only a small part of the company's activities of which he could speak. The system of private enterprise on which he said Britain's national greatness had so largely been built had been criticized and misrepresented, and it was the duty of British industry to answer vague innuendo with definite fact and record of real achievement. Especially was it a duty owed to the workers and management class who, so far as