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Factors of Industrial Development*

AMONG the duties charged on the Economic Advisory Council is that of considering the possibilities of new industrial development and particularly the measures which could be taken to foster the growth of new industries, whether they arise as the result of the application of the creative discoveries of modern science or not. The growing burden of the unemployment problem and the seriousness of the general economic position has induced the Council to pay particular attention to the relation of research to industrial development. It is at last being realised that industrial research is an important factor in the unemployment situation, and one that tends to create employment or at least to compensate for the displacement of employment in other fields as a result of increased mechanical efficiency or other changes.

It is probable that we have reached the end of an era in which the creative discoveries of science as applied in the electrical industries, automobiles, radio and the cinema, have found employment for millions and absorbed in productive work a large proportion of the increasing population of the world for whom under the old conditions no work could have been found. The advent of power production has already closed that era and brought new problems, the solution of which so far has eluded mankind. In the new era, scientific and industrial research are of equal importance as assisting to develop that flexibility which is essential if modern industry is to deal with problems of the magnitude of that of unemployment; and in equipping the nation to deal with the dislocation and reorganisation inseparable from the dynamics of industry or society.

In March 1931 the Economic Advisory Council appointed a Committee to consider broadly the position of industrial research in Great Britain, and in particular whether the proposal to establish a new central national research organisation would facilitate the promotion of industrial development as a means of providing additional employment. The report of this Committee gives a valuable survey of the existing organisation of industrial research in Great Britain with the definite object of discovering any overlapping which could be prevented by further co-ordination, or any gaps which should be filled either by

* Economic Advisory Council. Report of the Committee on New Industrial Development. Pp. 29. (London: H.M. Stationery Office, 1932.) 6*d*. net.

the development of existing organisations or by the creation of some new body, as was urged by Mr. A. P. M. Fleming in a paper before the Department of Industrial Co-operation at the British Association centenary meetings last year.

The major part of the survey of existing resources is devoted to a critical review of the Department of Scientific and Industrial Research and its research establishments, including the research associations, and the report places the responsibility for much of the prestige of this young Department on the exceptional combination of scientific attainments, administrative ability, zeal, persuasiveness and sympathetic understanding of the point of view of business possessed by those at the head of its staff. This is a tribute worth noting in view of a common tendency particularly in official circles to deny the possibility or existence of such combination of scientific attainment and administrative ability. With regard to the permanent institutions of the Department, the Committee comments on the absence from the National Physical Laboratory of any dubious schemes designed purely to be impressive, and it considers that the Laboratory has developed as an organic structure in response to clearly defined needs and purposes. Similarly such primary needs of the community as food, fuel, water-supply and buildings appear to be adequately covered by the other research establishments of the Department, and the work carried out by the Bridge Stress Research Committee, the Steel Structures Research Committee and the Locomotive Experimental Station Inquiry Committee is regarded as evidence of the ability of the Department to improvise a temporary special organisation to meet the need for special scientific investigation in any field of industry.

Commenting on the Research Associations scheme, the Committee points out that the Advisory Council which adopted the scheme deliberately rejected the idea of forming one central institution to which industries could turn for assistance in research, and suggests that experience has confirmed the view that a research association which a particular industry controls, for which it feels responsible and in which it takes a pride, is able to contribute to the development of mutual understanding between men of science and industrialists in a way that would not be open to a central institution. Moreover, the Research Associations have made discoveries of financial importance and have to a remarkable extent converted the British manufacturer from an attitude of scepticism to one of appreciation of the potentialities of scientific research. They have also established special departments for development work designed to assist in testing the results of their investigations on a practical scale, and it is clear that the Committee has formed a very high opinion of the merits of the Research Associations scheme.

Without detracting from the praise deservedly extended to many of these Associations, it is possible to feel that the Committee on Industrial Development is a little unduly optimistic about both their achievements and future prospects. Few of the Associations are self-supporting, and in fewer still has there been any sign that the industry as a whole is prepared to shoulder the full burden of financial responsibility of its research needs. In consequence, there is uncertainty about the continuance of the Associations, and the initiation of large scale development work is a much less simple problem than that confronting the research departments of large units of progressive industry, such as the General Electric Co., Metropolitan-Vickers, and Imperial Chemical Industries.

The Committee is accordingly unconvinced that an important gap exists in our existing arrangements for industrial research, which would be filled by the creation of a new national research organisation to draw up programmes of research into the application in industry of ideas, inventions, or processes at present undeveloped and likely to remain undeveloped, and to institute the necessary researches. While admitting that notably in the older industries, much research which might usefully be pursued is at present left undone, the Committee suggests that the need would be met by the Department of Scientific and Industrial Research establishing a branch for the purpose of initiating the stimulation of research in such industries, and directs attention to the readiness of the Department to create organisations of its own in important industrial fields where it recognises the existence of a need for research.

The proposal for the creation of a new central research organisation rests on a distinction drawn by its supporters between research directed to the improvement of existing industries and that directed to the creation of new industries, the latter being normally responsible for increasing employment. While it is undoubtedly true that the application of scientific discoveries resulting

in the creation of new industries has given employment to millions, under modern conditions the displacement effects are becoming more serious, so that rise of a new industry frequently means the contraction of an older established one. So far as employment is concerned, the national importance of scientific research as a factor in determining the rise of new industries lies rather in the consequent ability of the nation to minister to the new needs, thus giving employment to some or all of those inevitably displaced by the disappearance of needs to which the older industries ministered. In the minds of certain leaders of industry, such as Sir Harry McGowan, to judge from his presidential address last year to the Society of Chemical Industry, there are even doubts whether violent fluctuations caused in industry by, among other factors, the sudden exploitation of a scientific discovery, are really beneficial; and in the type of planning towards which the world is tending, provision for fundamental research and the deliberate exploitation of its results either by the State or by industry seems essential.

Apart from this factor, it is at least open to doubt whether the distinction drawn between the two types of research is valid and whether scientific research can be directed specifically to the creation of new industries. We are still without a real technique of discovery, and important industrial developments as often as not are based on purely fortuitous discoveries. In general, the fundamental discoveries have resulted from patient and disinterested investigations, the quest of truth for its own sake. Where scientific research has produced striking results from its direct application to industrial purposes we have entirely different conditions: a mass attack by a team of specialists on a clearly defined objective in a field where a considerable body of accumulated knowledge already exists.

The Committee refers to the work of the Fuel Research Board on the economical extraction of oil from coal as an example of the ability of the Department of Scientific and Industrial Research to take the initiative in problems of this type as they arise, and accordingly it considers that here again the proposed new body would be likely in practice, by confusing purposes and distracting effort, to injure rather than forward the cause of scientific research in industry. Even in regard to large scale tests the requirements of development research appear to be sufficiently covered by the machinery of the Department of Scientific and Industrial Research, although the Committee recommends that it is desirable that there should be at the disposal of the Government a small fund capable of being readily used for research developments, and that provision should continue to be made in the Department's annual estimates for such a sum for expenditure on research developments or unforeseen requirements.

The report of the Committee makes a convincing case for the adequacy of the existing Government organisation for the promotion of industrial research, which may be readily accepted without suggesting that the position is entirely satisfactory. The real trouble is that indicated in the last annual report of the Department. While the existing organisation is adequate and sufficiently flexible to meet the varied needs, there is not yet a sufficient general acceptance in industry of the fundamental importance of research as a fixed charge comparable with obsolescence, insurance, etc., and an essential factor in progress. The work of the Department is limited by the extent to which a scientific outlook prevails in industry, and the real task is one of educating industry to use the facilities already available rather than to create a new organisation with ill-defined objectives and probable overlapping with the functions of existing organisations. It is only as this task of education, both in industry and in public affairs, is tackled with real energy and efficiency that we can hope to close those gaps which exist in our national organisation of research or secure the full utilisation of the facilities already available.

Despite the fact that new industries are not in general created by direct scientific discoveries, long range fundamental research is of prime importance to the nation, and at the present time the declared policy of the Committee of the Privy Council to concentrate available funds on the work of the most immediate practical value to industry tends to create a dangerous gap. It is the long range type of research that is most liable to be neglected by industry, and the present report has little to say on the manner in which the task of education is to be undertaken or the serious danger the situation represents to posterity. Admittedly the available facilities are not yet being fully utilised, and the stability of certain features of the national organisation such as the Research Associations is uncertain. We cannot, for example, regard the position as satisfactory

when an industry representing £500,000,000 of invested capital has difficulty in providing the sum of £21,000 required to maintain a Government grant of £5,000 to its research association, and this in spite of the successful conclusion of researches on insulating oils and buried cables which at an aggregate cost of about £27,000 have resulted in total savings to the industry of at least £300,000 a year as well as adding something like £4,000,000 to the value of the existing cables.

Important sections of industry still notoriously owe their difficulties less to economic conditions than to the past neglect of scientific methods and research. The Report of the Committee on New Industrial Development underlines once more the necessity for a more widespread and intensive educational campaign to demonstrate both the capacity of scientific research to provide, not the ready-made solution of industrial difficulties but the technique of solution, and the ability of the scientific worker to co-operate in the conduct not merely of the investigations themselves but also of those administrative problems involving scientific and technical factors which abound everywhere in industry and the State to-day. It is only as a result of such an educational effort that we can expect to find alike in industry and in the State a scientific outlook in high places which will make possible the statesmanlike planning and utilisation of our full resources, whether of the Department of Scientific and Industrial Research, of industry or of the universities, and the prosecution of industrial and scientific research in all its varied phases from the fundamental or long range scientific research to the semi-technical scale in a measure commensurate with national needs.

Himalayan Exploration

The Italian Expedition to the Himalaya, Karakoram and Eastern Turkestan (1913–1914). By Filippo De Filippi. With Chapters by G. Dainelli and J. A. Spranger. Pp. xvi+528+20 plates. (London: Edward Arnold and Co., 1932.) 50*s*. net.

WE expect this production will rank as one of the most elaborate books of travel published, both as regards letterpress and the three hundred illustrations, not to mention maps and mountain panoramas. It is indeed worthy of such a leader as Cav. Filippo De Filippi, so well known as a traveller and explorer in the Himalayas, which he first visited as a member of H.R.H. the Duke of the Abruzzi's celebrated expedition to the Baltoro glacier in 1909, of which the author was also the chronicler.

The expedition occupied from August 1913 until December 1914. It was originally described in the Italian edition published in 1923 of which this is mainly a translation, but has been treated by the author as a new and revised edition. This has given him an opportunity of referring to expeditions which have taken place since the original was issued. He has also added a general chapter on the scientific results which have been only partly published in detail up to date. Two additional chapters have also been added by Prof. Giotto Dainelli and Mr. J. A. Spranger. The author remarks in the preface: "I do not know if any other trans-continental expedition has ever been organised through such difficult regions, crossing vast desert tracts devoid of sustenance for man and beast; with so extensive and complex a programme of scientific research, requiring not only a considerable company of trained workers but also very cumbersome equipment, including quantities of the most delicate instruments, which had to be transported with infinite precautions and needed unremitting care and supervision." This quotation will give some idea of what had to be accomplished over, perhaps, the most difficult country in the world.

The expedition was essentially a scientific one, and had for its object investigations into geology, glaciology and morphology, anthropology, meteorology, and, above all, the author was interested in gravimetric measurements and the deviation of the plumb-line with the view of investigating conditions of isostasy "when expertly carried out in the heart of the Himalayas and Karakoram, where great altitude and various practical difficulties had combined, up till now, to prevent the making of such delicate observations." A further object was to make systematic observations for terrestrial magnetism, and finally, the exploration and mapping of the eastern end of the Karakoram and its unknown glaciers.

It was certainly an ambitious programme, which so far as we know, was efficiently carried out, though the detailed scientific accounts are not yet completed. Cav. De Filippi took with him a carefully selected band of Italian experts with Commander (now Admiral) Prof. Alberto Alessio, as second in command. Col. Henry Wood, R.E., of the Survey of India and Mr.