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Scientific research crisis in Europe

Report[1]
Committee on Culture, Science and Education
Rapporteur: Mr Pierre GREGOIRE, Luxembourg

1. 1958 - 10th Session - First part

A. Draft Recommendation

The Assembly,

Noting the shortage of scientists and technologists in Western countries and the disturbing repercussions which might ensue;

Adopting the conclusions of the report presented by the Cultural Committee on the subject of scientific research,

Recommends that the Committee of Ministers of the Council of Europe and the Council of Ministers of 0. E. E. C:

1. Ensure that the scientific and technological potential of each country is increased by putting into practice as soon as possible the suggestions of their experts, in particular those of Working Party No. 25 of 0. E. E. C;

2. Arrange for European co-ordination and harmonisation of national efforts in the field of scientific research and applied technology;

3. Advise it, at the forthcoming Session, of the action taken in this recommendation and the results achieved.

B. Explanatory Memorandum

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1. There have for some time been persistent reports from all Western countries of a shortage of scientists and technologists—a shortage that coincides with a marked speeding-up of technical reorganisation and changes as a result of the development of electronics and automation. An article published in a Swiss paper began as follows: " The fact is too well-known for it to be necessary to dwell upon it again here; the Western world is suffering from a dangerous shortage of technicians. There can be no doubt that this shortage is an obstacle to technical progress. Even more serious is the fact that those who are in charge of world developments have either chosen to proffer advice or feel that the new achievements are beyond them; nor have they any clear idea of what the consequences of those achievements may be. " André Chavanne writes in the review Industries Atomiques: " One of the characteristic features of the development of modern research laboratories is the systematic use of industrial apparatus. The days are gone when scientists were themselves obliged to make, with the help of a large quantity of brass, glass and even platinum, the instruments they needed, which, reverently exhibited in collectors' show-cases, now appear to the younger generation as amusing relics. Of the few craftsmen's workshops set up at the end of the 19th century to manufacture prototypes or very small sets of scientific apparatus, some have disappeared, others, thanks to highly skilled craftsmen and enterprising managerial staff, have now become large factories producing such articles as high precision machine-tools. Nowadays laboratory supplies are obtained from specialised firms, with the exception of a few prototypes designed and built by the research workers themselves: no less than the makers of giant accelerators and' power batteries, precision laboratories working on minute quantities of radio-elements are excellent customers for such firms... As a result of an enquiry carried out among professors and industrialists in Switzerland, we found that the delay in that country in the use of nuclear energy for peaceful purposes, an unfortunate outcome of over-expansion, is largely due to a shortage of technologists... " Technical reorganisation will be intensified, if research of all kinds is pursued in accordance with the European tradition, for Europe has hitherto been the cradle of scientific research. The machine, supervised by man, will be replaced by a technical and electrical nervous system able to carry out certain intellectual operations. Achievements in this field are truly amazing. What has been achieved in various industrial sectors sounds like something out of the" Arabian Nights "; an automatic machine, for instance, covering an area as large as that of a football field, carries out 540 different operations and is supervised by a single worker. A production-line turning out 1,000 wireless sets a day is supervised by two men. Formerly 200 workmen were required to produce the same amount. At the Esso Petroleum Co.'s works in England, 18 people (working in shift-teams of 6) look after the distilling of 24,000 tons of petroleum a day (one-third of the aggregate quantity consumed daily in Great Britain). The Rock Island Refining Co., U. S. A., employs in its completely automatised refineries, a total of 12 people as against the 800 who formerly worked there. The same applies to automation in administrative work. The calculating machine of the English firms of Lyons does the work of 300 people, works out and records weekly salaries of 10,000 people, checks stocks in the main stores and at branches and prepares the details of orders. In the same way, the machines used by the big firms in the United States do bookkeeping and accounting and draw attention to goods which are proving hard to sell and to the purchasing needs in stores stocking several thousand different articles. The calculating machine of the U. S. Steel Co. of Pittsburgh has 5,400 valves; in addition to working out in a few hours the salaries of 27,000 employees and preparing the pay envelopes, it records applications for leave and absences (it performs 1,900 additions and 750 multiplications a second), and then communicates the results of its calculations to typewriters registering 600 strokes a minute. Unfortunately, Europe is in danger of losing her traditional lead, since the shortage of technicians is already hindering industrial development. A study of this question was published conséquence regrettable de la surexpansion, est dû surtout à la pénurie de techniciens... » Le rythme des transformations ira en s'accélérant, si les recherches effectuées dans tous les domaines répondent à la tradition européenne, l'Europe ayant été, jusqu'ici, le berceau des recherches scientifiques. Le nouveau progrès technique remplacera la machine, surveillée par l'homme, par un système nerveux technique et électrique qui exécutera certaines opérations intellectuelles. Les réalisations dans ce domaine sont ahurissantes. Les réalisations dans différents secteurs industriels nous donnent l'impression des contes des mille et une nuits, ainsi par exemple une machine automatique, s'étendant sur une place égale à celle d'un terrain de football, effectue 540 opérations et est surveillée par un seul ouvrier. Une chaîne de fabrication produit 1.000 postes de T. S. F. par jour, étant surveillée par deux hommes. Auparavant 200 ouvriers étaient nécessaires pour la même production. Chez la Esso Petroleum Co en Angleterre, 18 personnes (par équipes de 6) dirigent la distillation de 24.000 tonnes de pétrole par jour (1/3 de la consommation de la Grande-Bretagne). La compagnie américaine des pétroles Rock Island Refining Co emploie, dans ses raffineries complètement automatisées, 12 employés au lieu de 800 personnes qui y travaillaient auparavant. Il en est de même quant à l'automation du travail administratif. La machine à calculer de la firme anglaise Lyons remplace 300 employés, calcule et enregistre les salaires hebdomadaires de

10.000 personnes, contrôle l'état des réserves dans les dépôts centraux et dans les succursales et prépare l'analyse des commandes» De même, les machines des grandes sociétés commerciales des États-Unis effectuent la comptabilité et attirent l'attention sur la marchandise qui se vend difficilement, sur la nécessité de l'achat dans des dépôts contenant plusieurs milliers d'articles différents. La machine à calculer de la U. S. Steel Co à Pittsburgh contient 5.400 lampes et non seulement elle calcule en quelques heures les salaires de 27.000 employés et prépare les enveloppes contenant les salaires, mais elle enregistre les demandes de congés et les absences (elle effectue 1.900 additions et 750 multiplications ou divisions à la seconde), puis elle communique les résultats de son travail aux machines à écrire qui font 600 frappes à la minute. Malheureusement, l'Europe risque de perdre son ancien rang, puisque la pénurie fait obstacle, en ce moment déjà, au développement industriel. Une étude y relative, publiée en janvier in January 1957, by the European Productivity Agency of 0. E. E. C.[2] The introduction to this piece of research ends with the following words: " The proportion of the world's basic scientific discoveries which emanated from Europe was felt to be decreasing rather rapidly, while that from the U. S. S. R. was on the upsurge, and there were signs of similar developments elsewhere. Scientific discovery in the U. S. was deemed to be increasing but perhaps at a slower rate than was apparent during the last few decades."

2. Although a large-scale enquiry was carried out by 0. E. E. C. over several years and the immediate findings summarised in a useful report[3], no very exact statistical data are available. Nevertheless, some figures can be cited to illustrate the position. Whilst there are about 700,000 experienced engineers and technicians in the Soviet Union, the United States of America can muster only 500,000; moreover, against an apparent annual increase of 70,000 in the Soviet Union, the corresponding figure is only 22,000 for the United States of America. Let us look at the question from another angle: whilst the number of technical science students in the Soviet Union is 320 per million inhabitants, it is 156 for the United States and only 67 for Western Europe. In Germany, there will be a shortage of 41,000 engineers by 1970. In order to make good this shortage, it would be necessary to increase the number of engineering students by 60 % and the number of electrical science students by 100 %. In a detailed report Senator Jackson gives the following reply to those who cast doubts on the substantial extent of Soviet studies: " Although there is some doubt whether the number of scientists and engineers is larger in the United States than in the Soviet Union, there is no doubt that educational establishments in the Soviet Union are now granting more diplomas to scientists and engineers than do the colleges and universities in the United States... It is thought in some quarters that there is already an over-production of scientists and engineers in the Soviet Union and that many of them are employed in other fields. Although the training of scientists and engineers in Russia is comparable to the best that America can offer, there are weaknesses in the Soviet educational system... There are also weaknesses in the United States, due to the lack of competent science teachers in the secondary schools, to the falling away in the enrolment incidence between university and the college and to the habit of some capable students of giving up after entering college. " The Massachusetts Institute of Technology conducted an enquiry lasting two years into science education in Russia. The man responsible for the enquiry drew the conclusion that scientific training in the U. S. S. R. was, in general, excellent in the universities, but far below the Western level in the technical schools. An impressive testimony to the high quality of Soviet scientific studies has been just published. In February 1957 Dr. Edward Teller, a physicist of world-wide fame, who played a leading part in the production of the H-Bomb, stated that the United States could no longer maintain the lead in the applied sciences. In a address to the " Air Force Association Jet Age Conference " in Washington, he said, " in ten years " time from now the best scientists will be in Russia.

3. The position is somewhat disturbing, especially when we consider the growing needs in all the provinces freshly opened up to conquest by scientific and technical progress. These needs may not for the moment appear equally serious in all countries, because the shortage is so to speak masked in certain areas; but it will soon make itself felt, when an attempt is made to raise the general standard of living. This steady improvement will, indeed, cause European countries to move in a kind of vicious circle; to raise the standard of living they must improve their security: to strengthen their security, they must achieve technical progress; to do this, they need an ever larger supply of scientifically trained man power; to train that man power, they need the necessary teaching staff. In the above-mentioned report Senator Jackson estimated the shortage of scientific educators and teachers in the United States at 180,000. The figures are similar, proportionately, for each of the European countries. Now, that is the whole problem— the problem in short, of the position offered in different countries to scientific and technical manpower, engineers, scientists and research workers. It is undeniable that the salaries paid, especially in the public sector, to qualified technicians and technologists at all levels are inadequate when compared with what can be earned in industry [4]. The result is a kind of

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2. Scientific Manpower for Applied Research—Shortage of Research Workers: How to Train and Use them.
3. The problem of scientific and technical manpower in Western Europe, the United States and Canada, cf. Doc. AS/ Cult (9) 3.

desertion, a flight from public service; another result is that the scientific and technical teaching body comes nowhere near meeting present needs. Hence there is a notable lack of trained youth to fill existing vacancies, even in industry. The figures published by 0. E. E. C. in the enquiry mentioned above are alarming, for the word " shortage " recurs with depressing regularity in all the tables showing the situation in different countries. A study made by Working Party No. 25 of the Council of 0. E. E. C. and completed towards the end of 1957 comes to the same conclusions, which are summed up in the following paragraphs: " The growing shortage of highly qualified engineers and scientists has led most countries of Western Europe to pay more attention to manpower problems. Although it is generally understood that this shortage will become more serious and that the difficulty of recruiting technical staff will be an obstacle to technical progress, it must be emphasised that the problem is not a transient one that can be resolved by a few years of sustained effort. The demand for scientists and engineers will continue to grow, for the increase is due to radical changes in the structure of our society. It is therefore necessary to find longterm as well as immediate solutions; teaching methods must be permanently changed to enable future needs to be met."

4. The feeling of disquiet induced by the recognition of these facts is bound to develop into anxiety, when we consider the repercussions which this shortage will have outside Europe, especially in the overseas countries and continents which form, so to speak, a geographical and cultural extension of Europe... Since we must bring technical and scientific aid to the underdeveloped countries, we obviously need a reserve of technicians and technologists to take up senior posts in Africa and Asia. But how is Europe to make her presence felt in those vitally important regions, when there is a shortage in our own countries. Though, in a report on " Robots and Men " Aldous Huxley was able to say that, thanks to the technological progress so passionately condemned by Tolstoi and Gandhi, roughly a third of the 2,500 million inhabitants of the earth enjoy unprecedented prosperity and longevity, and the remaining two-thirds manage to keep alive (albeit, in poverty) for about thirty years on an average, the responsibility of the over-developed countries is clearly to provide effective aid for those two-thirds. That aid should be not only financial but also educational and instructional in the widest sense of the words, by the loan, among other things, of a fairly large number of experts, technologists and instructors. As an example we may mention Germany, which, in a long-term project, aims to place thirty thousand highly skilled men at the disposal of countries where there is a shortage of technicians. The absence of Europe, at a critical stage and turning-point in the history of the under-developed countries, will leave a free hand to nations well supplied with technical staff and scientific research workers. In that case the anti-European forces will decide the ultimate fate of the Asian and African nations. Here the political side of the question becomes only too clear; and our disturbing predicament makes itself doubly felt.

5. With the scientific and technical deficit so plain, it only remains for us to sound the alarm and rouse public opinion as best we can, in the hope that all the interested bodies and responsible authorities will become aware of the danger of our position in relation to that of the anti-European forces. Our task, then, is no longer to expound the seriousness of the situation in every detail— that will be up to the experts, who will study the problem from the scientific point of view, applying the methods of the exact sciences—but to draw certain practical, political conclusions of concern to the Council of Europe. This must be done first from a European point of view and later from the standpoint of the ascendancy of our cultural ideas and activities.

6. If we wish, to rectify the position quickly— though it is actually a long-term problem— we must, after we have roused European public opinion, try to persuade all the Governments to make certain changes in the scientific and technical spheres. The first step will be for all countries to make an effort to improve both the recruitment of scientific and technical staff and the adaptation of existing manpower to new demands.

7. There are, of course, ways and means of bringing about an improvement; they may only be palliatives, but it is certainly worth while listing them briefly, since they point in the direction which should be followed at national level. All the publications related to this problem [5] take up these proposals in turn, emphasising their importance and urgency. Reduced to the simplest terms, they may be summarised as follows:

7.1. retain experienced technologists beyond the fixed retiring age;

7.2. provide for exemption or useful occupation of scientists, technologists, engineers and technical manpower called up for military service

7.3. encourage women to engage in scientific work;

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4. It is interesting to note that scientists in the U.S.S.R. including the members of the Academy of Sciences, are placed by reason of their high salaries at the top of the social scale.

5. cf. O.E.E.C. Reports mentioned above; Shortage of Engineers and Scientists, in International Labour Review, published monthly by the International Labour Office, Geneva, December 1957.

7.4. make much more rational use of highly qualified technical and scientific staff;

7.5. make the latest technical equipment available to such staff;

7.6. attract young people to the technical sciences and the scientific professions by means of a continuous and intelligent publicity campaign;

7.7. enable talented workers to raise their intellectual and technical ability by means of courses;

7.8. find the best way of solving through scholarships, loans and other incentives, the economic difficulties which, in all countries, beset young people without private means;

7.9. reform teaching methods;

7.10. speed up the training of instructors;

7.11. assure collaboration in research between public and private sectors by setting up Government-industry groups;

7.12. improve scientific education, while insisting on the importance of modern languages;

7.13. improve the organisation of university curricula;

7.14. arrange for post-graduate training;

7.15. contribute to all cultural funds for assisting scientific research.

8. Nevertheless, at a time when the institution of the Common Market and Euratom calls for increased efforts in the technical and scientific fields, the problem ought to be tackled on an international scale by pooling the necessary funds, and by means of continuous co-operation in research, the systematic co-ordination of effort and exchange of research workers and students; a co-ordinating body should be set up and the administration of international research improved.

9. Pioneer bodies already exist, namely:

9.1. the European Nuclear Research Centre, established in 1954 by international agreement;

9.2. the European Agency for Nuclear Energy, set up in 1957 in the wider context of 0. E. E. C.

10. The best survey of the measures which should be contemplated is perhaps contained in the Jackson Report referred to above. That Report advocates inter alia:

10.1. establishing a talent development programme, designed to produce annually a certain number of Doctors of Science, with research experience in the fields of vital importance for social, economic and cultural progress;

10.2. increasing the number and variety of Summer Study Institutes, in order to extend the influence of outstanding scholarly talent in fields now hampered by a shortage of teachers.

10.3. expanding international exchange programmes for the exchange of scientists, engineers and advanced students and, in this connection, entering into agreements for the mutual recognition of equivalent degrees;

10.4. sponsoring and financing additional important co-operative trading and research projects which particularly lend themselves to international action;

10.5. setting up a European wide " employment clearing house " for scientists and engineers;

10.6. recommending that industry give greater support to academic institutions by making scientists and engineers in its employ available for teaching in secondary schools and universities and by helping to sponsor and staff summer teaching and research institutes.

11. Following the Recommendations made by the Parliamentary Conference, the activities of N. A. T. 0. in the field of international scientific co-operation have led to the setting up of a Science Committee [6]; this, in turn, raises the question of assigning tasks according to competence and geographical scope among the various international organisations. It also remains to be established to what extent the plans to solve the problem within the Atlantic Community might prejudice similar strictly European arrangements.

6. cf. Doc. AS/Cult (9) 17.

12. Among European projects one worthy of particular attention is that recently put forward by M. de Rougemont, Director of the European Cultural Centre, Geneva, namely to set up a scientific research centre in Europe modelled on national bodies designed to guide and finance scientific research, such as the C. N. R. S. [7]It is clear that the future Council of Europe Cultural Fund could be used to finance the setting up of such an institution.

13. All organisations which have hitherto studied the problem of the shortage of scientific and technical personnel from the respective points of view of their own interests have come to the conclusion that no fundamental change can be made without a sustained campaign to draw the attention of public opinion to the seriousness of the situation. It is largely up to the Council of Europe to achieve this by holding a debate which would concentrate on the most serious danger that threatens us: the scientific decadence of Europe. The new technical progress will, of course, result in arresting the decline of the Western countries, caused by a marked lack of adequate power resources, and in providing the peoples of Europe with a powerful means of combating stagnation or decline in their standard of living. We should not, however, close our eyes to the dangers that might ensue. Let the voice of authority sound the necessary warning note. In he Figaro, Francois Mauriac has written: " We should not be so alarmed at whatever divides the U. S. S. R. from the U. S. A. as at that which is common to them. Their ideological differences are perhaps less terrifying than their agreements on the scale of human values. Their technocracies, which appear at first sight to be utterly opposed to each other, are both pushing mankind towards dishumani-sation. Man, who is treated as a means and not as an end still remains the primary condition of their conflicting cultures..." In 1956 the Director of the International Labour Office, M. R. A. Morse, in the reports he presented to the 39th International Labour Conference at Geneva, observed that technological progress has serious repercussions on social relations, gave rise to new problems and trends and to a chain-reaction which might increase the danger. We are under the influence of that tension caused by technical progress which might bring about the disintegration of society. And Aldous Huxley, in the report mentioned above, was not afraid to say that the fact that mankind could not survive without advanced technology did not mean that Tolstoi was entirely wrong. Each victory over Nature inevitably strengthened the position of the governmental minority. The modern oligarchs were incomparably better equipped than their predecessors. Thanks to finger-prints, punched cards and I. B. M. machines, they knew practically everything about everybody. Thanks to wireless, aeroplanes, motor-cars and the immense arsenal of modern weapons, they could almost instantaneously apply force wherever it was needed. Thanks to mass media, they could bully, persuade, hypnotise, lie (or supress the truth) on a national and even world-wide scale. Thanks to hidden microphones and the gentle art of wire-tapping, their spies were ubiquitous. Thanks to their control of production and distribution, they could reward the faithful with jobs and stipends and punish the discontented by unemployment and privation. If we looked, for example, at the history of the French Revolution and at the dictatorship of Napoleon, we were constantly surprised at the inefficiency of the Governments of yore. Until quite recently the few existing freedoms had been ensured not by constitutional guarantees but by the backward state of technology and the fortunate ineffectiveness of the ruling minority. In the West our guarantees of personal freedom, won at the expense of great sacrifice, had not so far been too badly handled by technological progress. It was true that applied science had put more power into the hands of the small ruling minority, but the law had protected the vast majority of the citizens, who, to strengthen their security, had created co-operatives in the form of trade unions or vast power systems through political channels in order to counterbalance the might of the large industrialists, Government officials and Army leaders, who possessed, controlled or directed the resources of modern technology. In countries like Russia or Nazi Germany the masses, deprived of the protection of the law, had been incapable of creating or maintaining their own defence; in this the predictions of Tolstoi had been completely realised. Every victory over nature had at the same time been a victory of the few over the many.

14. Mass production, the report continued, entailed complications and demanded financial means in proportion. As a result, the resources fell more and more exclusively into the hands of those who held the financial power and those who manipulated political power; in a word, " big business " and " big government ". The world had never been in greater need that it is today of the ancient wisdom about the need for " Eternal Vigilance." We might here note a development that had been foreseen neither by Ruskin nor William Morris, by Tolstoi or Gandhi, nor even by the majority of the philosophers and socioloists of modern times, who viewed with dismay the growing dependence of man on the machine as the producer of the necessary and the superfluous, the dispenser of recreation, the manufacturer of synthetic works of art and of tin or plastic substitutes for the immortal products of manual skill. There is certainly a European reply to this threat. It was perhaps hinted at by Henri Massis when he wrote: " The machines of America will not restore us our soul, but once Europe has recovered its own soul its heritage of genuine humanism and Christianity may show America that she has still to acquire a wisdom which derives from the sure values of faith and reason, a spiritual and

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7. cf. Summary of the main features of National Research Councils for pure and applied science, Doc. AS/Cult (9) 40.

religious life to the measure of divine law." Thus, despite our material weakness it is perhaps we, the men of the West, who hold the key to the future. Provided, however, that we do our utmost to eliminate our all too obvious weaknesses and turn them into strength, without in the process abandoning our intellectual and spiritual values, as varied as they are fecund, which have made—and will, we hope, continue to make—• the greatness of the West.