

CONSEIL DE L'ATLANTIQUE NORD
NORTH ATLANTIC COUNCIL

NATO UNCLASSIFIED
and
PUBLIC DISCLOSED

EXEMPLAIRE
COPY

377
N°

ORIGINAL: ENGLISH
26th November, 1956

~~NATO CONFIDENTIAL~~
DOCUMENT
C-M(56)128

RECRUITMENT AND TRAINING OF SCIENTISTS,
ENGINEERS AND TECHNICIANS IN NATO COUNTRIES
AND THE SOVIET UNION

Report by Robert Major, Consultant to the Committee of Three

I. INTRODUCTION

1. During the last decades it has become ever clearer that in modern society science and technology and their application provide the way to industrial growth and a higher standard of living. They are factors of rapidly growing importance for economic and military strength.

2. The rôle of science and its application for military purposes was clearly demonstrated during the last world war, and during the last decade its growing impact on all aspects of modern life has been evident. There can be no doubt that the rôle of science and technology will be even more significant in the coming years which are now so often referred to as "the atomic age" or the years of "the second industrial revolution".

3. There should thus be every reason for nations to study how science and technology can best be stimulated and how results achieved can be used in the life of the nation to increase production and improve economic, and thereby also political, as well as military strength.

4. Much has been done in this field in the Western world. However, it has now become evident that many of the steps which have been taken have been of a too short-term character. The fundamental and long-term task of building up the educational systems so that the future needs for scientists, engineers and technicians can be met, has not been taken seriously enough in all countries. The shortcomings in this field have been clearly illustrated recently through the publication of the book "Soviet Professional Manpower", a thorough study of the whole educational system of the USSR. The education of scientists and engineers in the Soviet Union has advanced rapidly since the war, and in 1955 they educated as many students in this field as all NATO countries combined. And the rate of increase is higher in the Soviet Union than in the NATO countries.

5. Whether leadership in science and technology is allowed to shift from West to East will depend upon whether the Western countries are able to meet this challenge. This has lately become clear to more and more individuals, but it has probably not yet sunk into the minds of all persons having immediate influence on developments in NATO countries.

N.A.T.O. UNCLASSIFIED
~~NATO CONFIDENTIAL~~

DECLASSIFIED - PUBLIC DISCLOSURE / DECLASSIFIE - MISE EN LECTURE PUBLIQUE

II. THE SITUATION IN NATO COUNTRIES AND THE USSRA. NATO Countries

6. It is difficult to give a brief and at the same time complete picture of the education of scientists, engineers and technicians in NATO countries, as conditions vary so much from country to country. However, in Table 1, a survey of the numbers of scientists and engineers educated in NATO countries in 1955 is given. This is based on information collected by the OEEC. It should be noted that the figures are not absolutely consistent as the degrees are not all exactly the same in quality.

7. In Table 1 and in this report as a whole the term scientist is used for a person trained at a University in the basic science subjects, having at least a Bachelor's or equivalent degree. The term engineer is used for a person having at least a Bachelor's or equivalent degree in applied science from a University or an Institute of Technology (f.i. Grandes Ecoles, Technische Hochschulen or equivalent institutions).

8. From Table 1 it will be seen that in NATO countries, in 1955, there were educated approximately 35,600 scientists and 39,300 engineers making a total of approximately 74,900. One striking feature is that the number educated per capita varies by as much as a factor of more than 10 from the country with the highest education per capita to the country with the lowest (i.e. from USA to Turkey).

9. Compared with 1938, the annual number of the above-mentioned degrees has been increased by from 150 to 250% in member countries. Even this increase has, however, not been enough to meet the rapidly growing demand and in most countries there is today a definite shortage in most branches. This shortage is strongest in the highly industrialised countries like the USA, Canada, England, etc., and less severe in other countries. In Germany, where conditions have been somewhat extraordinary since the war, there is also a shortage in most branches and specifically in semi-professional manpower. Italy and Greece are the only countries reporting a surplus of this type of personnel. This surplus is greater for scientists than for engineers.

10. The reasons for the shortages are partly lack of training facilities and partly lack of recruitment of new students. In the USA, the recruitment problem has been dominant. In this country where the education of scientists and engineers - thanks to the GI Bill - reached a peak in 1950, the output decreased by about 50% until 1954, but is now picking up again. In most other countries there are difficulties both with teaching facilities and the recruitment of students. One of the main reasons for the difficult recruitment situation is the lack of science teachers. Research and industry have attracted such a great proportion of this personnel that it has been impossible to fill vacancies for teachers specifically in the Secondary Schools, and this has had a serious repercussion on the recruitment of students for science and engineering.

11. It has so far been impossible to get an overall view of the output of technicians in the various countries. In this field the training follows patterns which are so different that figures might also be very misleading. Technicians seem, however, to be in short supply in all the heavy industrialised countries, and these deficits seem to follow the shortage of engineers.

TABLE 1

EDUCATION OF SCIENTISTS AND ENGINEERS IN
NATO COUNTRIES IN 1955

Figures give number of persons taking Bachelor's or approximately equivalent degree in pure science (scientists) and in applied technological sciences (engineers) in 1955.

Because of the variation in the qualities of degrees the figures must be considered as approximations only.

Country	Population in thousands	Number of Degrees			Total No. of Degrees per Mill. inhab.
		Scientists	Engineers	Total	
Belgium	8.800	282	411	693	79
Denmark ⁽¹⁾	4.380	58	433	491	112
France	43.000	1.614	4.158	5.772	134
Germany	47.700	1.705	3.269	4.974	104
Greece ⁽¹⁾	8.220	270	305	575	70
Iceland	150	?	?	?	-
Italy	47.220	2.320	2.320	4.640	98
Luxembourg	300	?	?	?	-
Netherlands ⁽¹⁾	10.550	434	681	1.115	106
Norway	3.370	82	428	510	151
Portugal	8.060	?	?	?	-
Turkey ⁽¹⁾	23.200	124	448	572	25
United Kingdom	50.950	5.096	2.986	8.082	159
NATO Europe ⁽²⁾	247.390	11.849	14.985	26.834	
NATO Europe	255.900	12.000	15.200	27.200	106
Canada	15.000	753	1.505	2.258	151
USA	161.100	22.866	22.589	45.455	282
NATO North America	176.100	23.619	24.094	47.713	271
TOTAL NATO	432.000	35.619	39.294	74.913	173

(1) Figures for 1953.

(2) Excluding Iceland, Luxembourg and Portugal.

12. As pointed out, the shortage of scientists and engineers is most severe in the most industrialised countries which, at the same time, are the countries with the highest education per capita. This shows that in countries undergoing a rapid industrialisation, long-term steps to build out the educational facilities and to stimulate recruitment have on the whole been taken too late.

B. USSR

13. A comprehensive study of the educational system in the USSR, called "Soviet Professional Manpower", written by Mr. Nicholas DeWitt, and sponsored by the National Academy of Sciences and the National Science Foundation in Washington, was published in 1955. This study provides an up-to-date account of the organization, the functioning and the size of the Russian educational system.

14. During the last 25 years it has been a firm policy of the USSR to build out the educational system of the country. During these years the enrolment in primary and secondary schools has increased from about 10 to 30 millions, and in the higher educational establishments from approximately 180,000 to nearly 1,900,000. More than 5 per cent of the gross national product are being used for the needs of education, and in 1953 approximately 40 per cent of the university or equivalent degrees were in the field of education. A great part of the students are ploughed back into teaching positions, thus making the rapid growth of the educational system possible.

15. The Russian educational system is claimed to be a system for the masses, but is, in effect, quite selective. A hard competition prevails at all levels. Of pupils entering the primary and secondary schools only 20% succeed in graduating. Of these approximately 30% get access to higher education of whom only 60% succeed in graduating.

16. The recruitment of students does not seem to create problems. This is, no doubt, partly due to the considerable incentives for students specifically in the fields of science and engineering. All education is tuition-free, and in addition there is an elaborate system of living-allowance scholarships for the successful students. The size of scholarships depends upon the achievements of the student and also upon the field of study. Scholarships for studies within the fields of science and engineering are thus higher than in other branches, and students in these fields can expect positions with high salaries and prestige. In 1953, as much as 38% of all university or equivalent degrees were taken by scientists and engineers.

17. The education of scientists and engineers has increased considerably during the last years, and is at present as follows:

<u>Year</u>	<u>Engineers</u>	<u>Scientists</u>
1954	53,000	12,000
1955	60,000	approx. 15,000
1956	70,000	?

18. A characteristic Soviet feature is the high percentage of women taking professional degrees. This percentage increased during the thirties, and in 1938 the proportion of women among students in all fields was 43%. This percentage has later increased and was in 1954 approximately 50%. The percentage of women is highest in the fields of education and health. In 1938

DECLASSIFIED - PUBLIC DISCLOSURE / DECLASSIFIE MISE EN LECTURE PUBLIQUE

the percentage of women studying engineering was 28%, and in 1940 approximately 20% of all engineers were women.

19. Great emphasis is given to the education of technicians. A complete picture of the situation in this field cannot be given, but it can be mentioned that in 1953 approximately 70,000 semi-professional engineers completed a 4-years' education from the so-called "technicums". Judging from the enrolment in the "technicums", this figure should increase considerably in the following years.

20. While the information on the quantitative trends in Soviet education is considered to be fairly accurate, it is more difficult to give any precise judgment of the quality of the graduates. However, the quality of the training has been improved considerably during the years, and, judging from the information available, there should not be any reason to believe that their training is inferior to that of most NATO countries.

21. In the figures given personnel from the USSR only has been included. Recent reports show that also in the Russian satellite countries like Poland and Czechoslovakia the technological education is under rapid development, and a great number of engineers are being educated every year.

C. Comparison between NATO countries and the USSR

22. In Table 2 approximate figures have been given for the total number of persons who took a Bachelor or equivalent degree in science or technology in NATO countries and the USSR in 1955. When studying the figures it must be kept in mind that they do not necessarily give a completely true picture, partly because the degrees compared will not all be of exactly the same value and partly because the number of students taking post-graduate studies in the various countries has not been taken into account. Nevertheless the figures are considered to give a reasonably good basis for comparison.

TABLE 2

	Population (Mill.)	Scientists	Engineers	Total
NATO Europe	255.9	12.000 (47)	15.200 (59)	27.200 (106)
NATO North America	176.1	23.600 (134)	24.100 (137)	47.700 (271)
TOTAL NATO	432	35.600 (82)	39.300 (91)	74.900 (173)
USSR	200	15.000 (75)	60.000 (300)	75.000 (375)

The figures in brackets are numbers of degrees per million inhabitants.

23. As will be seen the total number of scientists and engineers was in 1955 approximately the same in the USSR as in all NATO countries together. This means that the number educated

per capita is more than twice as high in the USSR as in NATO countries and more than three times as high as in NATO Europe.

This is even more serious when it is taken into account that the increase in degrees in the Soviet Union in the coming years is expected to be considerably higher than in the NATO countries.

24. It will further be noticed that whereas in NATO countries the number of engineers educated was only slightly higher than the number of scientists, the number of engineers in the USSR was four times as high as the number of scientists. In this connection it is of interest to notice that in Moscow there has been established a Central Translating Service, employing approximately 1,300 people, translating and distributing scientific publications from the Western countries. This highly organized service keeps the Soviet scientists quickly and well informed about new discoveries in the West, which can be exploited in their own country.

25. Information is not available to allow a comparison of the total numbers of scientists and engineers available in the NATO countries. In Table 3, however, some figures have been given for the USA and the USSR.

TABLE 3

	USA	USSR
<u>1956</u> Total number of		
Scientists	250.000	180.000
Engineers	650.000	535.000
<u>Between 1956 and 1960</u>		
Estimated to graduate		
Scientists	85.000	125.000
Engineers	143.000	420.000
<u>1960</u> Estimated total number of		
Scientists	320.000	260.000
Engineers	750.000	805.000

Source of estimates:

For USA: Dr. Hower Meyerhoff, Director,
Scientific Manpower Commission.

For USSR: Mr. Nicholas DeWitt, Russian Research
Centre, Harvard University.

As will be seen the USA still has a greater number both of scientists and engineers than the USSR, but with the expected strong increase in graduates in the USSR the total number of scientists

DECLASSIFIED - PUBLIC DISCLOSURE / DECLASSIFIE - MISE EN LECTURE PUBLIQUE

and engineers can be expected to compare fairly equally in 1960.

III. POSSIBLE MEASURES TO BE TAKEN BY NATO

26. The information given above should leave no doubt as to whether the strengthening of recruitment and training of scientists, engineers and technicians in member countries should be a NATO interest. Strength in this field constitutes one of the fundamental factors for economic growth, and thereby also political influence of member countries, and will play an increasing rôle for achieving military security. Therefore, to be discussed here, is what NATO as such can do in this field.

27. When considering possible NATO action it must be borne in mind that the recruitment and training of the personnel in question is mostly a national responsibility, and improvements must, on the whole, be made at national levels. Even within individual countries responsibility in this field is considerably decentralised. In countries having a federal system, the individual states or provinces play an important part, and in many countries universities or institutions of higher learning are independent institutions free of detailed government control.

28. It should also be taken into consideration that the situation in this field both with regard to needs and education of personnel is very different in member countries, and it would be impossible to suggest a common course which would be applicable for all members.

29. Keeping the above-mentioned factors in mind it seems that NATO or other international action in this field mainly should aim at stimulating activities in member countries.

30. NATO action should also be co-ordinated with the work already started by the OEEC. The OEEC has compiled information on shortages and surpluses of highly qualified scientists and engineers in member and associate countries in 1953 (published in 1955) and undertakes at present a similar study based on information for 1955. A symposium to study these questions was held in Vienna in October 1956. So far the need for action in this field, however, has not been considered at any OEEC Ministerial Meeting.

As the OEEC has collected information also from its associate member countries all NATO countries are included in the investigations which have been made.

31. The need for scientific and technological personnel would in the OEEC be evaluated mainly from its bearing on the economy of the Western countries. As the interests of NATO will in addition include the political and military aspects of the question, it is not considered that an evaluation of the situation in this field in both organizations would represent any unwanted duplication.

32. Taking all the above-mentioned factors into account it is recommended that NATO:

- (a) make an annual appraisal of the situation with regard to the recruitment and training of scientists and engineers in member countries. This could probably be based mainly on data collected by the OEEC;

DECLASSIFIED - PUBLIC DISCLOSURE / DECLASSIFIE - MISE EN LECTURE PUBLIQUE

N.A.T.O. UNCLASSIFIED

NATO CONFIDENTIAL
C-M(56)128

-8-

- (b) give recommendations to member countries for steps to be taken in this field which would serve the common course of the Alliance;
- (c) at certain intervals arrange meetings of one or two recognised authorities from each member country to
 - (i) exchange information and experiences in the field and thereby stimulate activities,
 - (ii) discuss and suggest possible NATO action to be taken.

33. Of special short-termed matters which might help member countries to make better use of the personnel available and which call for an immediate study can be mentioned:

- (a) the establishment of a Western joint service for translation and distribution of Soviet scientific publications;
- (b) the proper use of scientific and technological personnel during their military service.

It should, however, be recognised that it is the fundamental and more long-termed questions regarding recruitment and training which really call for a study. Without such studies and following action in the individual countries we shall not be able to meet the challenge from the East.

N.A.T.O. UNCLASSIFIED

NATO CONFIDENTIAL

Palais de Chaillot,
Paris, XVIe.

DECLASSIFIED - PUBLIC DISCLOSURE / DECLASSIFIE - MISE EN LECTURE PUBLIQUE