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PRELIMINARY NOTE

This monograph has been prepared under resolution 2.312 b. adopted by the General Conference of Unesco at its twelfth session, which authorizes the Director-General "to undertake surveys and studies on the national science policy of Member States".

It is one of a series published by Unesco under the title "Science policy studies and documents". This series aims at making available to those responsible for scientific research and development throughout the world a synthesis of factual information concerning the science policies of various Member States of the Organization as well as normative studies of a general character.

The selection of the countries in which studies on the national scientific policy are undertaken is made in accordance with the following criteria: the originality of the methods used in the planning and execution of the national science policy, the extent of the practical experience acquired in such

fields and the level of economic and social development attained. The geographical coverage of the studies published in the series is also taken into account.

The country studies are carried out by the governmental authorities responsible for policy making in the field of science in the Member States concerned. The present monograph has been prepared under the responsibility of the Joint Committee of the Norwegian Research Councils; the opinions expressed therein are the sole responsibility of the authors and are not necessarily an expression of the views of Unesco.

This same series also includes reports of international meetings convened by Unesco on science policy, the organization and administration of scientific and technological research, and other related questions. As a rule, the country studies and reports of meetings are published in one language only, either English or French.

FOREWORD

In October 1962, Unesco approached the Joint Committee of the Norwegian Research Councils with a request for collaboration in preparing a study of science policy and research organization in Norway. This study forms part of a programme "to collect, analyse and disseminate information concerning the organization of scientific research in Member States and the policies of Member States in this respect", authorized by the adoption of resolution 2.1131 b. at the eleventh session of the General Conference of Unesco and confirmed by similar resolutions at later sessions. Norway is one of a number of countries selected for pilot studies.

At the request of the Joint Committee, Mr. Per Kleppe of the Royal Norwegian Ministry of Finance undertook to direct the preparation of this report. Miss Anne-Marie Arnesen and Mr. Norman Vetti, both members of the Secretariat of the Joint

Committee, assisted him in the work. Chapters 1 and 2 were prepared by Mr. Vetti, Chapters 3 and 4 by Miss Arnesen, and Chapters 5 and 6 by Mr. Kleppe. Several other persons, representing institutions working in fields covered by the report, contributed information and comments on parts of the material. In particular, the ministries concerned have had the opportunity to comment on Chapter 5.

Among those who in this way have given most valuable assistance during the preparation of the report, special mention may be made of the directors of the three research councils, Mr. Fjellbirkeland of the Norwegian Research Council for Science and the Humanities, Mr. Ringen of the Agricultural Research Council of Norway, and Mr. Major of the Royal Norwegian Council for Scientific and Industrial Research.

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CHAPTER I

HISTORICAL OUTLINE OF THE DEVELOPMENT OF THE NATIONAL SCIENTIFIC ORGANIZATION OF NORWAY FROM THE INSTITUTIONAL VIEWPOINT

Research institutions in Norway have a short history to look back on. During the long union with Denmark (1380-1814) Copenhagen was the cultural centre of the two nations, but scientific activities in Norway had a sporadic start at the Kongsberg Mining College established in 1757 (see 1.2) and in the milieu of the Royal Society of Arts and Science in Trondheim from 1767 (see 1.3). However, it was not until the opening of the University of Oslo in 1813 that the foundation was laid for the later development of Norwegian scientific institutions.

1.1 THE UNIVERSITIES

The traditions inherited from the University of Copenhagen and the German universities have given our seats of learning a double task: to promote research, which also covers recruitment of scientific personnel, and to educate people for special jobs, especially in the civil service. The latter task was of great importance to Norway after 1814, when the country obtained its liberal constitution and entered into a union with Sweden (1814-1905).

Research activity at the University of Oslo (1) developed mainly in connexion with teaching requirements. New branches of science were recognized as independent sciences and chairs were established parallel with development at the older universities in Scandinavia and Germany. There were originally four faculties, those of Theology, Law, Medicine and Philosophy. The latter was divided into the faculties of Liberal Arts and Natural Sciences (Mathematics and Science) by law of 1860. In 1959 the State College of Dentistry was incorporated in the University as the Faculty of Dentistry, and in 1963 a Faculty of Social Sciences was established.

In its first year the University was governed by a Senate consisting of all the teachers (six in all). After the union with Sweden in 1814 a Chancellor and a Pro-Chancellor were appointed according

to the Swedish pattern. The Chancellor functioned as the connecting link between the Senate and the Government.

From 1814 to 1845 Crown Prince Oscar was Chancellor but he was never present in the Senate. The Norwegian Pro-Chancellor, Count Wedel, left the chairmanship in the Senate to the oldest dean. In connexion with the amendment of the charter of the University in 1845 the position of chancellor was abolished. At the same time, however, the University was drawn closer to the State in all economic matters.

The University of Oslo was originally founded by voluntary subscriptions, but as in other North-European countries the Government gradually took over the larger proportion of total expenditure on teaching and research. The private share became correspondingly smaller and now consists mainly of interest on funds and donations.

The University made a modest start in 1813 with six teachers, four of whom were appointed as professors. Fifty years later, in 1863, the number of teaching and research staff was 47, of whom 35 were professors. During the next fifty years the number of chairs filled by professors was doubled and amounted to 71 in 1913. The last fifty years again show a considerable growth in the number of research and teaching staff. Recently it has become necessary to move the University out of the centre of Oslo to Blindern, where modern institutes and laboratories have been erected. In 1950 it was decided to establish practically all new university buildings in that area.

The nation has an Evangelical Lutheran State Church. This has not involved any interference

(1) Founded by Royal Resolution dated 2 Sept. 1811 and named Universitas Regia Fredericana. Commenced its activities in August 1813. Regulations dated 28 July 1824 with amendments, the latest dated 9 December 1955. In 1939 the name was changed. The official name is now the University of Oslo (Universitas Osloensis).

with the free fundamental research of the State universities and State colleges. A conflict between the State and an "orthodox" group arose in connexion with the appointment of a liberal theologian as professor at the University of Oslo in 1906. This led to the establishment of a separate college, the Independent Theological College (see 1.2).

Norway's second university the University of Bergen (2) developed from the Bergen Museum (3) which started its activities in 1825. The Museum was primarily a scientific institution with research laboratories for scholars and scientists and collections open to the public. When the Museum was recognized as a university by the National Assembly in 1946, it had already served as a research and teaching institution of university standard since 1914, when the heads of all the departments were appointed as professors by the Government. The foundation charter of the University of Bergen follows the same traditions as those described for the University of Oslo.

Royal commissions have prepared reports on the establishment of two new universities, one in Trondheim and the other in Tromsø. Proposals are expected to be presented in 1966 for approval by Parliament.

1.2 THE COLLEGES

The State colleges of Norway have been established independently of the universities. Whereas the universities are engaged in activities corresponding to those of the old European universities, special colleges have been established for teaching and research in applied fields.

A mining college, the Kongsberg Bergseminar, was established in 1757. This became in fact the first Norwegian institute for advanced teaching in technology. The College ceased its activities when the University of Oslo was established and a professorship in mining technology and a geological and mineralogical collection were transferred to the new university. That event did not lead to the general introduction of the teaching of technology at the University. The study of geology and mineralogy, however, received a promising start, but it was still regarded as a public task to establish teaching in technology at separate institutions.

Advanced teaching and research in technology now takes place at the Institute of Technology (4) in Trondheim. The institute was founded in 1900 and commenced its activities in 1910. The Institute of Technology was from the beginning granted full university status.

The Agricultural College of Norway (5) at Aas near Oslo, which developed from an agricultural school, was originally established in 1859 and received the status of college in 1897. It was granted full university status in 1919.

The Veterinary College of Norway (6) in Oslo was founded in 1935 and the Norwegian School of

Business Economics and Administration (7) in Bergen was founded in 1936. They were both granted university status immediately.

The Independent Theological College in Oslo was founded by an orthodox religious group in 1907. The college obtained university status in 1919. The Government must approve the academic qualifications of the professors. (8) The College does not, however, receive any government grant.

The State College for Teachers (9) in Trondheim was established in 1922 and had the task of giving additional training to teachers educated at teachers training schools. Teaching now corresponds to courses given at the universities.

1.3 LEARNED SOCIETIES

The oldest learned society of the country, the Royal Norwegian Society of Science and Letters in Trondheim, was founded by high government officials in 1767 (10). This Society has established research laboratories and a specialized library in connexion with a museum. The Society was reorganized in 1925, when the Museum became independent and developed stronger financial ties with the Government. The Norwegian Academy of Science and Letters in Oslo was established in 1857 by a group of professors at the University and is the internationally representative organ for Norwegian scholarship and science outside the universities.

Both the above-mentioned institutions have restricted membership. The members, Norwegians and foreigners, are divided into two classes, one devoted to natural science and the other to humanities.

The two learned societies administer funds which have been applied to the publishing of scientific treatises and papers (proceedings), fellowships and research projects. The Nansen Fund and associated funds, which give financial support to scientific research and which together have a total capital of \$223,000 (1963), may be mentioned in this connexion. These funds, together with the Funds for Promotion of Scientific Research, founded by the National Assembly in 1919, have been of great importance to Norwegian research and especially so during the years preceding

(2) Founded by Resolution of the National Assembly dated 9 April 1946.

(3) Regulations laid down by Royal Resolution dated 4 August 1909 and amendments.

(4) Established by Resolution in Parliament dated 31 May 1900.

(5) Founded by a law dated 18 July 1919.

(6) Founded by Resolution in Parliament in 1918 and in 1934.

(7) Founded by Resolution in Parliament in 1917 as the College of Business Administration and Economics.

(8) By a law dated 16 May 1913.

(9) Founded by Resolution in Parliament in 1922.

(10) Founded by Royal Resolution dated 17 July 1767.

the last world war. The increase in expenditure on research and the reduction of interest accruing from these funds, have, since the last war, necessitated the provision of new sources of revenue and these have been organized in connexion with the establishment of research councils.

The learned societies have received a small annual government grant towards their activities; the Norwegian Academy of Science and Letters has received this since 1865.

In 1926 a learned society was established in Bergen, and in 1955 an academy of engineering science was founded in Trondheim.

1.4 MUSEUMS

The majority of Norwegian museums were originally founded by individuals and built up through voluntary work and private contributions. Assistance from official sources came at a later stage.

The collections at the University of Oslo and at the National Gallery in Oslo are, however, exceptions to this rule since they were both founded by the State and then supported and developed as purely State institutions. The work of forming a collection at the University started immediately after the University itself was opened in 1813. The collections were considered a necessary basis for advanced studies and teaching and on expansion particular importance was attached to the natural history museums, the University Collections of Antiquities and the Museum of Ethnology.

The older museums founded by private individuals contained collections which, from the very beginning, covered wide fields of interest. Such "all-embracing" museums were established in Trondheim (1760), Bergen (1825), Tromsø (1872) and Stavanger (1877). As permanent positions were created for scholars and scientists, more system was introduced into these collections. Emphasis was gradually laid on developing the natural science divisions of these museums including work on the special conditions in various parts of the country affecting zoology, botany and geology. Work on historical aspects of Norwegian culture also became of great consequence as the scientific treatment of these disciplines developed. Such research was of dominating importance in the field of the humanistic sciences in the 19th century. The State has given the sole right to excavate and collect remains from prehistoric periods to the University Collection of Antiquities in Oslo and the above-mentioned museums in Bergen, Trondheim, Tromsø and Stavanger.

The scholarly and scientific positions at the museums have always been regarded as preparatory appointments to chairs at the universities and similar institutions.

1.5 SOME ASPECTS OF DEVELOPMENT'S IN APPLIED RESEARCH

The first government initiative in the field of applied research was embodied in the establishment of the Institute for Geological Surveys of Norway in 1858. Meteorological research and weather reports date back to 1866. There has been a considerable increase in the scope of activity from 1909.

In 1917 the Government Raw Materials Committee was appointed by the Ministry of Commerce. This was the first measure adopted in Norway to bring together representatives from the Government, the scientific sector and private industry with the aim of achieving better utilization of the country's raw materials. The Committee produced 26 reports on the application of Norwegian mineral raw materials and took the initiative in founding the Government Raw Materials Laboratory (1918). The Committee was also instrumental in establishing two specialized industrial research institutes, namely the Research Laboratory of the Norwegian Canning Industry (1931) and the Norwegian Pulp and Paper Research Institute (1923).

The Ministry of Commerce formed the Council for Technical and Industrial Research in 1935, this being composed of a total of seven representatives from the Government, manufacturing industry and the research institutions. This Council was active until the war intervened. It had functioned mainly as a consultative body to the Ministry of Commerce. Immediately after the war initiative was taken from private quarters within manufacturing industry to establish a research council for applied technological research. A committee composed of representatives of the Government, research and the private industrial sector presented a report on 9 April 1946, following which Parliament passed a resolution on 10 July 1946 establishing the Royal Norwegian Council for Scientific and Industrial Research.

Norwegian industries have become aware of the significance of research for production. One of the country's largest enterprises, Norsk Hydro A/S, was founded in 1908 for the purpose of producing nitrogenous fertilizers on the basis of a patented method which had been arrived at through the joint efforts of an experimental research scientist (K. Birkeland (1867-1917)) and an engineering expert (S. Eyde (1866-1940)). Manufacturing establishments, however, have generally been small units and few of them have developed their own laboratories. Against this background, and particularly since the war, these manufacturing enterprises have supported the forming of research associations within the individual branches of industry and 15 such specialized industrial research institutes have been established, partly through the assistance of the Royal Norwegian Council for Scientific and Industrial Research. Of these institutions the following should be mentioned: the Research Laboratory of the Norwegian Canning

Industry (1931), the Norwegian Pulp and Paper Research Institute (1923), the Institute of Wood Working and Wood Technology (1949), the Textile Research Institute (1949), the Research Laboratory of the Brewery Association (1946), the Herring Oil and Meal Industry Research Institute (1948) (see 2.9).

Manufacturing industry has also had the opportunity to conduct research through the various institutes for sponsored applied research. The Central Institute for Industrial Research and SINTEF (the Engineering Research Foundation at the Institute of Technology) were established in 1950. The Department for Applied Physics at Chr. Michelsen Institute has also been engaged in such activity since the end of the last war.

The specialized industrial research institutes chiefly tackle projects which are of interest to the whole of the branch of industry concerned. The sponsored research institutes also accept work from individual firms, the ordinary regulations governing patents being applicable.

Research in agronomy, animal husbandry, horticulture and dairying is, as previously stated, conducted at the different institutes of the Agricultural College. Since 1915 the Government has established several institutes which come under the Ministry of Agriculture and which supplement research work at this College. This applies to a series of regional research stations in agronomy and horticulture and to the Veterinary Institute (1914) and the Forest Research Institute (1916). Specialized institutes for plant protection, agricultural engineering and agricultural economics were also established in 1947. The Government has constituted research boards covering the different technical fields in order to encourage the various institutions to co-operate. The Research Board for Agronomy began operating in 1914, for forest research in 1917, for dairying in 1928 and for veterinary medicine in 1949. These research boards have mainly been composed of active research workers. They have had a joint secretariat in the Office for Agricultural Research in the Ministry of Agriculture since 1948.

The establishment by the Government of the Agricultural Research Council of Norway (11) in 1949 represented a continuation of these developments.

The State became engaged in fisheries research as early as 1862 when two scientists received financial support in the form of State scholarships to undertake scientific investigations on the fisheries. As a continuation of this work two research institutes were founded in Bergen, namely the Fisheries Research Institute (1892) and the Institute of Marine Research (1900). A research division was started at the Inspectorate of Fresh-Water Fisheries in 1914. The first two of these institutes were at a later stage placed under the Directorate of Fisheries and the Ministry of Fisheries. The third institute comes under the Ministry of Agriculture.

The Director of the Institute of Marine Research

in Bergen also has certain duties at the university, where he has the rank of professor (from 1963), this being part of a plan to establish closer links between the two institutions.

1.6 FUNDAMENTAL RESEARCH AFTER THE SECOND WORLD WAR

World War II, led, among other things, to a great retarding of Norwegian research activity. Stagnation and isolation prevailed and the University was closed for the last two years of the war. In the reconstruction period which followed, interest from the relevant funds was also very reduced (12).

The organization of the research councils, based on income from the state-run football pools agency, A/S Norsk Tipping, represented a minor revolution in the operating conditions of Norwegian research. The research councils were established after the bill concerning A/S Norsk Tipping became law (13) - the Royal Norwegian Council for Scientific and Industrial Research in 1946 and the Agricultural Research Council of Norway in 1949 (see 1.5). In 1947 the Ministry of Church and Education was requested by the Government to prepare the founding of a research council for science and the humanities. The Norwegian Research Council for Science and the Humanities was established in 1949 (14). Simultaneously, the Joint Committee of the Norwegian Research Councils was formed (14), its main task being to make recommendations as to the distribution of that part of the surplus of the football pools profits to be devoted to scientific purposes.

The establishing of the research councils led to formal contact between the research scientists at the Norwegian "seats of learning" and the Central Government Administration, so that these scientists, through the research councils, now have the opportunity to participate in the formulation of research policy to a far greater extent than earlier. On the other hand the Government Administration has now also the possibility of influencing research work at the seats of learning. Previously, the executive boards of the research funds had mainly been directly elected by research scientists at the universities and colleges and the learned societies. The regulations of the research councils represent a break with tradition, since it is now the Government that appoints members to the councils after recommendation from the research institutions (see 2.5).

(11) By Royal Resolution dated 28 October 1949.

(12) Total income from interest on 7 of the largest funds was reduced from 715,200 kr. in 1938 to 566,300 kr. in 1945 - a drop of 20.8%.

(13) The law referring to A/S Norsk Tipping was passed on 5 June 1946.

(14) By Royal Resolution dated 12 May 1949.

CHAPTER 2

THE LEGAL AND ADMINISTRATIVE STRUCTURES REGULATING THE PRESENT ORGANIZATION OF SCIENTIFIC RESEARCH IN NORWAY

2.1 THE GOVERNMENT ADMINISTRATION OF RESEARCH

The Storting is the Norwegian Parliament, with the supreme legislative power. The controls which govern the administration of research are determined by Parliament while the executive direction is vested in the King in Council, delegated to the ministries, and from them to the respective research institutions. This is shown in the general organigramme, Diagram 2. a.

Through appropriation from the annual budget Parliament controls the organization and the number of personnel of the State research institutions.

Research matters may in principle be handled by all the 12 standing committees in Parliament. Matters concerning the universities and the State colleges, except the Agricultural College and the Veterinary College, are considered in the Church and Education Committee, those concerning industrial research in the Industrial Committee and those concerning agricultural research in the Agricultural Committee.

Head of the central administration is the King in Council, the Government, which determines all matters of importance. Among these is the filling of state appointments, including professorships. Professors also belong to that category of officials where suspension from an appointment (other than on reaching retirement age) can only take place after a legal trial. This provision of the Constitution assists in securing the scientific independence of the Norwegian professor as it also secures the judicial independence of the judge.

The universities and colleges in Norway are, with three exceptions (the Agricultural College, the Veterinary College and the Independent Theological College), administered under the general direction of the Ministry of Church and Education. A separate department was established in the Ministry in 1938 for all matters relating to the universities and colleges, the research councils, and other research and cultural institutions. The task of this department is to a great extent administrative but it also prepares the policy

decisions of the Ministry in these fields. This work is largely based on proposals from the institutions. The Ministry has not interfered to any major degree with the long established internal self-government of the universities and colleges (see below, 2.2). Budget proposals covering state funds are sent from the universities and colleges to the Ministry. They are further prepared by the Ministry and after discussion in the Ministry of Finance and in the Government they are submitted to Parliament by the Government. The Ministry also prepares bills for presentation to Parliament often on the basis of proposals from special committees or from the research institutions themselves.

The Ministry of Agriculture, which is responsible for the administration of the Agricultural College and the Veterinary College, is organized along similar lines and has the same functions in relation to research in its respective fields as the Ministry of Church and Education. The Ministry of Industry and Handicrafts and the Ministry of Fisheries are in the same way responsible for research institutes established under their various departments (see 2.4).

In dealing with strictly professional problems the ministries prefer as a rule to fall back on advisory councils before decisions are taken. The research councils serve as advisory bodies on general research policy, investigate research questions and provide expert advice to the respective ministries (see 2.5).

2.2 THE UNIVERSITIES

As can be seen from Diagram 2. a, there are no executive institutions between the ministries on the one hand, and the universities and state colleges on the other. The conferences which take place between the rectors of the universities and the colleges have no formal status in relation to the ministries.

The University of Oslo is a state institution. The administration of the University is determined

by acts of Parliament (1). The Ministry of Church and Education is the responsible head of the executive machinery through which the laws are made effective. Through appropriations from the annual budget, Parliament and the Ministry fix the extent of growth of the institution. The government authorities do not interfere with research activities, the choice of projects or the recommendation procedure in connexion with the appointment of scientists. Only on extremely rare occasions has the Government failed to follow the recommendations of the University in such matters.

According to the law, it is the task of the University to offer instruction in academic subjects and to pursue scientific research. It should also - as far as this can be combined with the task mentioned - contribute to the diffusion of scientific knowledge among the public.

The Rector and the Senate (Collegium Academicum) constitute the highest governing body of the University. They administer the University in accordance with the provisions of the law and with the more detailed regulations adopted pursuant to the law. They represent the University in all matters relating to the Ministry. Reciprocally, the Ministry addresses its communications to the Rector and the Senate.

The Senate consists of the Rector, the Vice-Rector, the Deans of the six faculties, one representative of the non-professorial staff, and one representative of the students. The Rector and the Vice-Rector are elected for a period of three years at a meeting of the professors, associate professors, the chief librarian of the University Library, and representatives of the non-professorial staff and the students. The Faculty Boards plan and arrange the instruction, examinations and the conferment of degrees. A Faculty Board consists of the professors, the associate professors and representatives of the research fellows, the teachers, and the students in the faculty concerned. The Dean is elected for three years by the Faculty Board.

In 1962 an Administrative Director was appointed. This Director is secretary to the Senate and is responsible to the Rector and to the Senate for the administration of the University. He also directs the University Secretary, the Faculty Secretaries and the Bursar.

The University of Oslo has seven faculties, namely: Theology; Law; Medicine; Liberal Arts, Natural Sciences; Dentistry; Social Sciences.

The Institute of Pharmacy is administered as a separate institution and has a separate budget; the research and teaching staff belong to the Faculty of Natural Sciences.

The professors, the associate professors, the Chief Librarian of the University Library and the Director of the University are appointed by the King in Council on the basis of recommendations from the University. When a professor's chair becomes vacant, or a new one is created, this is advertised. For the purpose of considering

applications the Faculty Board concerned appoints an expert committee consisting of at least one member of the Faculty and representatives from other scientific institutions in Norway or the other Scandinavian countries. The formal recommendation of the Faculty has to be passed on to the Senate which finally submits it to the Government.

The University of Bergen (2)

The aims of the University of Bergen and its organizational pattern are mainly the same as those of the University of Oslo. In Bergen, however, the Administrative Director is a member of the Senate and is entitled to vote. The students and the non-professorial staff are not represented on the highest governing body. They are, however, represented on the Faculty Boards.

The University of Bergen has four faculties, namely: Liberal Arts; Natural Sciences (Mathematics and Science); Medicine; and the Institute of Dentistry.

A great number of institutes have been established under the faculties of the two universities. A professor or an associate professor is usually the head of each institute. The main task of the institutes is to facilitate and promote research work at the universities. The total number of institutes at the University of Oslo (1/1-65) is 90 and at the University of Bergen (1/1-65) 47.

The universities and the colleges have their own libraries. The University Library of Oslo functions as the national library; it contains approximately 2,000,000 books and periodicals (1962). At the University Library in Bergen the corresponding number is 400,000. The two university libraries and the Library of the Royal Norwegian Society of Science and Letters in Trondheim (ca. 350,000 books and periodicals) are entitled to order, without payment, one copy of all publications printed or published in Norway.

There are museums attached to the universities in both Oslo and Bergen (see 1.4 and 2.6). Oslo has a clinical hospital attached to the University, the State Hospital. The heads of each department at the hospital are professors of medicine. In Bergen and in Oslo there are also arrangements with other hospitals for teaching and research in medicine.

2.3 THE STATE COLLEGES

The main tasks of the Institute of Technology (3) in Trondheim are the training of engineers and architects and the encouragement of the development of technology and architecture.

- (1) Law (Fundats) dated 28 July 1824 and later amendments. A new university law is dated 9 December 1955.
- (2) Law dated 9 July 1948.
- (3) Governed by a law dated 12 June 1936, and later amendments.

The administration of the Institute of Technology is in the hands of the Rector, who is one of the professors of the Institute. The Rector is elected for a period of three years. The election takes place in a plenary session of the professorial Council, of which all the professors are members. The Professorial Council is the highest authority of the Institute. A Professorial Committee is established to assist the Rector. This Committee consists of the Deans of the seven departments with the Rector as chairman. The daily administration of the Institute of Technology has, since 1962, been organized in two departments: the Department for Technical and Economic Administration and the Department for Education. The heads of these departments are responsible to the Rector and the professorial bodies. The Institute has a special secretary for the meetings of the professorial bodies.

The seven departments of the Institute of Technology are the following: Architecture; Mines, Geology and Metallurgy; Civil Engineering; Electrical Engineering; Chemistry Mechanical Engineering, Naval Architecture and Aeronautics; General.

The General Department is responsible for theoretical training and research in subjects common to all departments (mathematics and physics) and has a division for economics and social psychology.

Each department consists of several divisions provided with assistant personnel and scientific equipment. A professor is usually the head of each division.

The Institute of Technology has its own library which functions as the national library of technical literature.

The Norwegian Ship Model Experiment Tank is attached to the Institute of Technology but has its own administration and separate grants from the Ministry of Church and Education. This is also the case with the Institute for Testing Materials.

An institute for sponsored research has been established by the Engineering Research Foundation at the Institute of Technology. This institution, SINTEF, is administratively independent of the Institute of Technology. The steering committee of SINTEF, however, is appointed by the Professorial Council of the Technological Institute. By means of this special arrangement it has been possible to utilize the personnel and the scientific equipment of the Institute of Technology for applied industrial research and to increase the Institute's research contact with industry and commerce.

The College for Teachers in Trondheim has undergone complete reorganization. It is at the moment a teachers' training institution for the intermediate stage of the school system. The scientific staff of the College has been given research facilities in the laboratories of the Museum of the Society of Arts and Science.

The possibility of amalgamating the College for Teachers and the Institute of Technology into a

third university is being considered. The new university would also incorporate the Museum with its laboratories and library established by the Royal Norwegian Society of Science and Letters in Trondheim.

The Norwegian School of Business Economics and Administration (4) is situated in Bergen. Its purpose is to give instruction on a scientific basis in business administration and economics and also to train teachers for commercial schools as well as to promote research work within its fields of study. The School is governed by a Rector and a Professorial Council.

The Agricultural College of Norway (5) at Aas, near Oslo, comes under the Ministry of Agriculture (see Diagram 2. a). Its object is to impart scientific instruction and to further scientific research.

The highest authority of the College is the Collegium, consisting of the Rector, who is Chairman, all professors and associate professors, one representative from the non-professorial staff and one representative from the students. The professorial board is composed of the Rector, the Vice-Rector and three members elected by the Collegium from among the professors or associate professors of the College. The Rector and the Vice-Rector are elected by the Collegium for a period of three years.

An Administrative Director deals with the daily administration but is not a member of the two bodies mentioned above. He is responsible to the Rector and to the Collegium.

The Agricultural College is organized into five departments, namely: Agronomy; Horticulture; Dairying; Forestry; Land reallocation.

Research work is carried out in 31 institutes and laboratories subordinated to the five departments.

The Veterinary College of Norway (6) in Oslo is under the general administration of the Ministry of Agriculture. The College is governed by a Rector who is the chairman of the Professorial Council. Members of the Professorial Council include all the professors and associate professors and the Director of the Veterinary Institute (7), one representative from the non-professorial staff and one representative from the students. The Rector is elected for a period of three years.

(4) Governed by Royal Resolution dated 7 May 1936 and amendments.

(5) Governed by a law dated 29 June 1962.

(6) Governed by a law dated 29 May 1953 and regulations dated 27 May 1957.

(7) The Veterinary Institute is a diagnostic laboratory particularly devoted to bacteriological, serological, anatomical and chemical research (see 2. 4). The Institute is independent of the College.

2.4 OTHER RESEARCH INSTITUTIONS SUBSIDIARY TO THE GOVERNMENT MINISTRIES

To meet the demand for applied research the Government has established research institutes under various ministries (see Diagram 2. a).

The ordinary expenses of the research institutes in this category are covered by the State Treasury. The institutes are directly affiliated to the ministries. Those institutes coming under the Ministry of Church and Education have boards appointed by the Government. As regards the Defence Research Establishment, the research programme is drawn up by the Defence Research Policy Board, which consists of the Joint Chief of Staff's Committee and four scientists nominated by the Council for Scientific and Industrial Research.

A complete list of the institutes under the respective ministries is given below :

Ministry of Industry and Handicrafts

Geological Survey of Norway

Polar Institute

Institute of Whale Research

Ministry of Fisheries

Directorate of Fisheries :

Institute of Marine Research

Norwegian Fisheries Research Institute

The Fishery Research Station

Ministry of Defence

Norwegian Defence Research Establishment

Ministry of Agriculture

Norwegian Forest Research Institute

Forest Research Institute of West Norway

Norwegian Plant Protection Institute

Institute of Agricultural Engineering

Norwegian Institute of Agricultural Economics

Veterinary Institute

Sixteen regional stations for research in agronomy and horticulture

Ministry of Church and Education

Meteorological Institutes, Research Department

Norwegian Institute of Cosmic Physics

Institute for Studies in Foreign Policy

Ministry of Local Government and Labour

Institute for Labour Hygiene

Institute for Physiology of Work

Institute for Psychology of Work

Ministry of Social Affairs

Institute for Social Research in Alcoholism

Ministry of Family and Consumer Affairs

State Research Institute for Home Economics

Ministry of Finance

Central Bureau of Statistics, Research Division

The government research institutes are especially concentrated in the fields of agriculture, fisheries, mineral resources and military defence.

In the communications sector, including roads, railways, telegraph and telephone, there are research units which function as part of the respective directorates under the Ministry of Transport. The establishment of an institute for applied social research under the Ministry of Church and Education has been proposed by the Government and approved by Parliament.

2.5 THE RESEARCH COUNCILS

In principle the three research councils and the Joint Committee of the Research Councils cover the whole range of Norwegian Research. Their activities are of an organizational, consultative and financial nature (see Diagram 2. a).

One of the councils (The Royal Norwegian Council for Scientific and Industrial Research) receives direct government grants. All of them share the surplus from the state-run football pools agency, A/S Norsk Tipping (8), which is bound by law to allocate a certain percentage of its income to research purposes. The distribution of the surplus from the football pools agency is given below (see 3. 5).

The Joint Committee of the Research Councils (9) makes recommendations to the Ministry of Education regarding the distribution among the three research councils of funds from the football pools agency, and has a co-ordinating function in relation to the research councils in matters of general policy.

The Joint Committee of eleven members consists of representatives from the three councils and representatives from the three ministries to which the councils are attached. All are appointed by the Government. Each council makes proposals to the Ministry of Church and Education as to its representation on the Committee. The chairman is appointed separately and is not a member of any of the councils.

The Joint Committee has at the moment four committees working on general problems within the research field.

The Research Council for Science and the Humanities (10) is concerned primarily with research within the range of study of the universities and the state colleges.

Grants are made for specific research projects and for recruitment of research workers through

(8) Founded and governed by a law dated 21 June 1946 and amendments.

(9) Regulations by Royal Resolution dated 12 May 1949. (The Joint Committee was dissolved by Royal Decree dated 27 August 1965, and a Government Advisory Committee on Science Policy "Hovedkomitéen for norsk forskning" was established.)

(10) Regulations by Royal Resolution dated 12 May 1949.

the award of fellowships and payment of salaries. The Council gives financial support to scientific and, to some extent, even to popular publications. It is responsible for assisting government ministries with reports and advice on specific research projects and in matters of general research policy. In this connexion the Council has established a special department to investigate questions connected with the supply and demand for persons with a university-level training, and the recruitment of research workers.

The Council consists of representatives from the ministries and the research institutions. The 32 members are appointed by the Government on the recommendation of the Ministry of Church and Education, which obtains suggestions from the interested institutions.

The Council is divided into five groups. These are: Group A. Languages and History, Group B. Social Sciences; Group C. Psychology, Education and Young Peoples' Welfare, Group D. Natural Sciences, Group E. Medicine.

The Executive Board consists of the chairmen of the five groups and the chairman and vice-chairman of the Council.

The Council derives its funds from the football pools (see 3.5).

The Agricultural Research Council of Norway (11) is concerned with improving and expanding the work of the existing agricultural research institutions, especially research institutions connected with the Agricultural College of Norway and the Veterinary College of Norway. It also has the task of advising the Ministry of Agriculture.

The Council is appointed by the Government on nominations by the research institutions, farmers' organizations and research boards and consists of 28 representatives from the Government, the research institutions and the various sectors of agriculture. The Council elects its own chairman. An executive committee of five members is responsible for directing its activities between the meetings of the Council.

The Council has a great number of permanent committees and research boards to assist it in its investigations and research planning.

The Council's funds are provided entirely through the Joint Committee from the surplus of A/S Norsk Tipping (see 3.5).

The Royal Norwegian Council for Scientific and Industrial Research (12) is active mainly in the field of applied research, but is also responsible for assisting research at the university institutes and particularly at the Norwegian Institute of Technology in Trondheim.

The 28 members of the Council are appointed by the Government and represent the interested government ministries, the Federation of Norwegian Industries, the Norwegian Shipowners' Association and research institutions. These different establishments and institutions send their proposals to the Ministry of Industry and Handicrafts and the Ministry presents a joint recommendation to the

Government. The Council elects the chairman and an executive committee consisting of six members.

The Council operates 16 institutes, of which 13 have been established by the Council. The institutes have their own boards, as a rule appointed by the Council, and are thus comparatively independent, though supervised and coordinated by the Council. The largest of them is the Institute of Atomic Energy, employing about 500 persons. Among others which should be mentioned is the Central Institute for Industrial Research, employing 240 persons. The total number of persons employed in the institutes of the Council is about 1200.

2.6 MUSEUMS

The university museums have been mentioned above. Independent of the universities are the natural history museums in Trondheim, Stavanger and Tromsø which are engaged in considerable research activities. The same is true of certain cultural historical museums, for instance the National Folk Museum in Oslo.

The museums have boards with representatives from the Ministry of Church and Education, the local government, and the member associations of the museum in question. The financial resources of these museums come from the same institutions as are represented on the boards. The larger part of their income derives from the State.

2.7 OTHER RESEARCH INSTITUTIONS

The Institute for Comparative Research in Human Culture was founded in 1919 when Parliament voted \$420,000 for the establishment of a Fund for the promotion of scientific research. The board of the Institute consists of representatives of Parliament, the Local Government of Oslo, the University of Oslo, and the Academy of Science and Letters.

The Christian Michelsen Institute has one department for the humanities and social sciences and one department for applied physics. Research activities are based on funds originally donated by Chr. Michelsen (13), these represented about \$980,000 in 1962. The board of the Institute is elected on the principle that the members appoint their successors.

The Institute for Social Research is an independent institution with representatives from the Ministry of Church and Education and the University

(11) Regulations by Royal Resolution dated 28 October 1949.

(12) Founded and governed by Resolution of Parliament dated 10 May 1946.

(13) Chr. Michelsen (1857-1925), Prime Minister and shipowner.

of Oslo on its board. It is financed by private donations and grants from the Research Council for Science and the Humanities.

2.8 CO-OPERATIVE INDUSTRIAL RESEARCH IN "BRANCH" INSTITUTES AND RESEARCH IN INDIVIDUAL COMPANIES

Norwegian industrial concerns are, on the whole, comparatively small. Only 75 companies employ more than 500 persons. There are, consequently, only a few concerns which are able to establish private research laboratories of any size. These individual research laboratories are to be found especially within the chemical, metallurgical, and electronic industries.

In several industries with similar research problems, joint research associations have been established. These associations consist of firms which finance a co-operative research institute, a specialized "branch" institute. These specialized institutes are affiliated to the trade associations which appoint the majority of members on the governing boards of the institutes. As a rule one board member is appointed by the Royal Norwegian Council for Scientific and Industrial Research. Some of the specialized institutes are operated jointly by a group of industrial companies, and four such institutes come directly under the Royal Norwegian Council for Scientific and Industrial Research. The specialized industrial research institutes are financed primarily by individual branches of industry. For specific research projects they can apply for support from the Royal Norwegian Council for Scientific and Industrial Research.

A complete list of the specialized industrial research institutes is given below:

Norwegian Pulp and Paper Research Institute
Norwegian Institute of Wood Working and Wood Technology
Research Laboratory of the Norwegian Brewery Association
Research Laboratory of the Norwegian Canning Industry
Norwegian Textile Research Institute
Research Laboratory of the Potato Starch Manufacturers

Norwegian Herring-Oil and -Meal Industry Research Institute
The Boot and Shoe Industry's Research Association
Structural Clay Products Research Institute
Research and Control Institute of the Association of Norwegian Codfish Exporters and Norwegian Frozen Fish Ltd.
Norwegian Radio Manufacturers' Association
Cement Industry Research Section
Rock Blasting Institute
Association for Testing and Research on Technical Materials
Typographic Industries Research Association
Research Committee of Conservation and Preservation of Agricultural Food Products
Research and Information Institute of the Norwegian Stone Industry.

2.9 SUMMARY

In Norway the state universities and state colleges have the task of training research workers and are responsible for the greater part of the country's fundamental research.

In addition there are government research institutes which are placed directly under the various ministries. The main task of these institutes falls into the category of applied research.

The research councils, especially the Royal Norwegian Council for Scientific and Industrial Research, have taken an active part in establishing and administering research institutes, most of which are involved in industrial research.

Norwegian industrial enterprises have relatively few individual laboratories but have co-operated in forming research associations and specialized "branch" institutes.

There are three institutes for sponsored, applied research in the industrial field: the Central Institute for Industrial Research in Oslo, the Engineering Research Foundation at the Institute of Technology (SINTEF) in Trondheim and the Chr. Michelsen Institute in Bergen. These institutes serve as central institutions for other research institutions as well as for industry.

The museums and several private research institutions also promote research in the humanities, natural sciences and social sciences.

CHAPTER 3

THE FINANCING OF SCIENTIFIC RESEARCH AND HIGHER EDUCATION IN NORWAY

3.1 INTRODUCTION

The years since World War II have witnessed extensive growth in the research and teaching capacity of the universities and state colleges. There has also been a great expansion in research capacity outside these institutions and industrial research has increased both in laboratories owned by individual firms, in jointly operated institutes and in sponsored research institutes. Most of the expenses involved in this expansion have been defrayed by the State but the research councils have also made considerable contributions. A minor part of university and state college incomes is derived from certain other endowments, either official, private or foreign. As regards research outside these institutions, finance has been provided by grants from industry, income from sponsored research paid for by the sponsoring firms themselves, and considerable contributions from abroad.

A survey of expenditure on higher education and research meets with many problems of selection and definition. One is the selection of research institutions outside universities and state colleges. Institutions not expected to engage in research may nevertheless do so and, on the other hand, some institutions supposed to undertake a certain amount of research and development work are doing hardly any. The problem of selection has, however, been solved here by the Joint Committee in co-operation with the research councils by including in the surveys institutions which have applied to the research councils for grants or have in other ways been connected with the councils. Furthermore, the institutions concerned have been included in their entirety.

Another problem has been to find the boundary line between expenditure on higher education and on research at universities and state colleges. In Norway there have in the past been no records giving a reliable basis for separating these activities statistically, but the need has now been recognized for data enabling this distinction to be drawn.*

Furthermore it has not been possible to distinguish between expenditure on applied and fundamental research*. It is known, however, that since World War II the growth in applied research has been considerably greater than in fundamental research.

3.2 RETROSPECTIVE FIGURES (1)

Table 3. I and diagram 3. a show the distribution of government net expenditure on research and higher education between the universities and state colleges on the one hand, and research activity outside teaching institutions on the other, from 1938 to 1965.

Expenditure from non-governmental sources of finance (e. g. interest from private funds, gifts and donations, voluntary contributions from commerce and industry, and earnings from research projects executed to order) is not included in table 3. I and diagram 3. a. For 1963, such expenditure amounted to \$7,890,000. For previous years, the corresponding figures have been estimated at approximately \$420,000 for 1938-39, \$3,490,000 for 1957-58, and \$5,365,000 for 1961. These figures do not include the expenditure of private laboratories belonging to individual concerns, which was estimated (by the Royal Norwegian Council for Scientific and Industrial Research) at nearly \$12.6 million in 1963.

* Figures showing the expenditure at higher educational establishments on research only (i. e. exclusive of expenditure on educational activities), as well as figures showing the breakdown of expenditure between fundamental and applied research and development, became available while this study was in the press; they are presented in tables 3.X, 3.XI, 3. XII, 3. XIII and 3. XIV, and are discussed in the Addendum to Chapter 3.

(1) Figures will in the following be rounded off to the nearest \$5,000. 100,000 N. kr. = \$13,961.

3.3 TOTAL EXPENDITURE ON RESEARCH AND HIGHER EDUCATION IN 1963 (2)

Total expenditure for research and higher education in Norway in 1963 amounted to approximately \$48,290,000. Of this, the humanities (including theology) accounted for \$5,200,000 (10.8%), the social sciences (law, economics, political science, sociology, education, psychology and ethnography) \$2,900,000 (6.0%), the natural sciences \$5,155,000 (10.7%), and the life sciences (biological sciences, medicine, dentistry, agricultural and veterinary sciences) \$12,800,000 (26.5%), including \$6,900,000 for medical research and higher education and \$4,400,000 for agricultural and veterinary sciences. Finally, technological sciences accounted for something like 46.0%, the actual figure for the expenditure in 1962 being \$22,225,000.

Government contributions provided \$35,065,000 (72.6% of the total), the research councils \$4,234,000 (8.8%) and other Norwegian sources \$5,795,000 (12.0%). Foreign sources contributed \$3,200,000 (6.6%).

The apportionment of funds from the various sources to the different scientific fields is shown in tables 3. II a and 3. II b and diagram 3. b.

Corresponding tables are also given for 1958-59, 1960 and 1961.

Expenditure in different categories and different subject fields is shown in tables 3. III a and 3. III b.

Capital expenditure as well as current expenditure is included. Expenditure on new buildings refers to actual allocations in the fiscal year and includes new equipment and apparatus for the buildings concerned. Wages and salaries include social insurance, pension funds and holiday pay. "Other expenditure" covers instruments, materials and equipment, books, journals, reference material and subscriptions to libraries, as well as pension subsidies, social insurance and administrative expenses. Sites, water and fuel, maintenance and repair of buildings and cleaning are also included here.

Of the total expenditure of \$48,290,000 in 1963, approximately \$27 million goes to universities and state colleges under the Ministry of Education: the distribution among the various establishments is shown in tables 3. IV a and 3. IV b.

Of the government grants to these institutions in 1963 nearly \$5,293,000 (23.6%) was allocated to new buildings.

The two state colleges under the Ministry of Agriculture were financed as shown in tables 3. Va and 3. V b.

\$150,000 (4.8%) of the government grants was allocated to new buildings.

3.4 GOVERNMENT EXPENDITURE

In Norway higher education is regarded as the responsibility of the State and, with only one exception,

the Independent College of Theology, universities and state colleges are run mainly by state funds. Attendance at these institutions is free of cost except for small fees for the use of laboratories and for examinations.

Fundamental research is also, with few exceptions, considered as a public responsibility, whereas state contracts to industry for research and development hardly exist. Fishery research is entirely sponsored by the Government and a special fund for fishery research has been established to intensify activities in this field. The Government also operates research institutions in such fields as, for instance, defence, agriculture and geology (see 5.5).

Government activity with regard to fundamental research is thus spread over a wide field. The expenditure on research and higher education by the various ministries in recent years is shown in table 3. VI.

Almost all research workers and teachers employed by institutions of higher education and other governmental bodies are paid according to civil service rates. With few exceptions highly qualified personnel receive salaries ranging from \$2,937 to \$7,020. Those engaged on particular assignments or short-term projects might, however, receive special contracts.

The usual net salary* scale is as follows:

Research assistants	starting at \$2,937 or \$3,545
Research fellows	" " \$3,385 " \$4,112
Lecturers, assistant	" " " " "
lecturers, curators	" " \$3,902 " \$5,455
Assistant professors	\$6,420
Professors	\$7,020

* Net salary: contributions towards old age pensions are deducted.

3.5 RESEARCH COUNCIL GRANTS (3)

In order to encourage and assist both fundamental and applied research, particularly in new fields, the research councils make a number of research grants each year, partly in the form of contributions towards the expenses of specific projects, and partly to meet such capital items as the cost of new buildings or elaborate equipment.

Rules for the use of the net income of the Norwegian football pools agency, which makes these grants possible, were established by Parliament in 1946. It stated that 50 per cent of the stakes received should be paid out as prizes, and after

(2) Source: The respective research councils. The selection of institutions differs somewhat from that in table 3. I. Totals are available up to 1965 (budget), but distributions among the different subjects can at present only be given up to 1963.

(3) Background material to this subdivision is mainly taken from "The Research Councils of Norway", Oslo 1960.

the administrative expenses were calculated the surplus should be divided between scientific and sports purposes in the following way:

	<u>Sport</u>	<u>Science</u>
Of the surplus:		
up to \$139,617	100%	-
between \$139,617 and 279,234	80%	20%
between \$279,234 and 418,851	60%	40%
between \$418,851 and 558,468	40%	60%
over \$558,468	20%	80%

The great majority of applications for grants from all three councils come from institutes and institutions.

For their research staff, NAVF (the Research Council for Science and the Humanities) and NLVF (the Agricultural Research Council) adhere to the salary scales applying to civil servants, including university and state college personnel. The councils ensure that, as far as possible, the working conditions for research fellows as well as their welfare and social services are identical with those of staff at state research institutes. For personnel working at state institutions NTNF (the Norwegian Council for Scientific and Industrial Research) follows a slightly different principle. It then adheres to the practice of these institutions, but at its own institutions and in paying people working at other non-state institutions it tries to approach the conditions which are normal in industrial research.

The Joint Committee has only provided direct financial support to research to a small extent.

a. Retrospective figures

The football pool's first year of activity was 1948: Table 3.VII shows the surpluses since then.

The surplus for scientific activities for the ten-year period 1955-1964 was distributed as shown in tables 3.VIIIa and 3.VIIIb.

In addition to grants allocated through the Joint Committee, the Royal Norwegian Council for Scientific and Industrial Research also obtains direct government grants and considerable contributions from industrial sources, partly as subsidies, partly as income from sponsored research.

b. Grants allocated in 1963

The amount put at the disposal of the Joint Committee by the football pool agency for the fiscal year 1963 represents approximately 9 per cent of the total public expenditure on research activities. 43 per cent of the councils' grants was allocated to projects connected with universities and State colleges.

The surplus of \$3,958,000 in 1963 was distributed between the three councils as shown in diagram 3.c.

The sums were disposed of by the councils as shown in table 3.IX.

In addition to the allowances from the football pools agency, the Council for Scientific and Industrial Research received \$4,967,000 as government grants (including \$1,890,000 for its own administration and for research grants channelled through the Council) and \$750,000 from other sources.

3.6 OTHER GRANTS

a. Norwegian funds:

A number of funds make contributions to research activities. When collecting data about grants from these funds it is, however, often difficult to discover whether they derive from official or private sources.

Of the more important funds should be mentioned the university and state college funds with a total capital (1963) of approximately \$10.8 million, more than two-thirds belonging to the University of Oslo. The Christian Michelsen Fund (see 2.7) amounts to \$1.2 million.

The two learned societies, the Norwegian Academy of Science and Letters and the Royal Norwegian Society of Science and Letters, administer funds amounting to \$353,000.

These funds are used to finance the publication of scientific treatises and papers and also, to some extent, contributions to research projects (see 1.3). The Nansen Fund and funds affiliated to it, administered by the Norwegian Academy of Science and Letters, have a total capital of approximately \$2,500,000.

The largest contribution from a private fund has in recent years come from the shipowner Anders Jahre, who donated nearly \$140,000 in 1963 and has contributed approximately \$755,000 since 1954. The money has been distributed through the university authorities in Oslo.

Of the funds specially sponsoring medical research, mention should be made of the Norwegian Cancer Society, which allocated \$133,000 to research in 1963, and the Norwegian National Public Health Association, which contributed \$92,000 to research in 1963.

b. Foreign sources

Norway also co-operates in research at an international level, receiving considerable contributions from abroad, especially for atomic energy research and rocket projects. The latter are, above all, Scandinavian projects and constitute part of the extensive co-operation between these northern countries in the field of higher education and research. The total contribution from foreign sources in 1963 amounted to approximately \$3,250,000, whereof nearly \$1,427,000 was contributed to the Norwegian Institute of Atomic Energy and \$70,000 to the universities and state colleges.

3.7 SUMMARY

Total expenditure on higher education and research in Norway amounted to \$48,290,000 in 1963. The corresponding amounts for 1960 and 1961 were \$35,600,000 and \$42,815,000 respectively. For the fiscal year 1958-59 the amount was \$22,725,000,

excluding technical research outside universities and State colleges. Total figures for technical research are unfortunately not available for 1958-1959. It must however be noted that the figures for 1958-1959, 1960 and 1961 are not quite comparable with those for 1963, as they also include the institutions' expenditure outside pure research and

teaching, whereas the 1963 figures cover only pure research and teaching.

Higher education and research in Norway are financed mainly by government grants, which provided 72.6 per cent in 1963 (74 per cent in 1960). Other Norwegian sources, including football pools, contributed 20.8 per cent, and foreign sources 6.6 per cent in 1963.

ADDENDUM TO CHAPTER 3

While this study was in the press, additional information relating to the year 1963 became available, regarding expenditure on research only (i.e. exclusive of expenditure on educational activities), and also regarding the breakdown between expenditure on fundamental and applied research and development activities. The relevant figures are given in tables 3.X to 3.XIV and are discussed below.

Table 3.X shows total expenditure on research in Norway for the year 1963, broken down by source of funds and by type of research establishment. The amounts shown in this table, as also in table 3.XI, under "Public Sources" include government grants, football pool funds, public funds and grants from county and municipal authorities. The amounts shown under "Other Sources" include interest from private funds, gifts and donations, and payments for research projects executed to order.

Over half the total expenditure on research came from public sources, and of this amount nearly a half was allocated to higher educational establishments, about 30 per cent to public institutes, 17 per cent to research council institutes, and 8 per cent to private institutes.

Industry provided about one-third of the total expenditure on research; the distribution was 83.3 per cent to industrial laboratories, 7.5 per cent to research council institutes, 7.9 per cent to private institutes, and only a very small percentage to universities, State colleges and public institutes.

Financial contributions from foreign sources amounted to about 7 per cent of the total.

On analysing the distribution of expenditure according to the types of research establishment, it is found that about 28 per cent of the total was used in industrial laboratories, 27 per cent in universities and State colleges, 20 per cent in public institutes and 16 per cent in research council institutes.

Table 3.XI shows a more detailed breakdown of the research expenditure as between the individual universities and State colleges. The University of Oslo received the largest individual share, namely 43.7 per cent of the total for establishments

of this kind; the Institute of Technology received 19.5 per cent, the University of Bergen 15.8 per cent, and the Agricultural College 12.8 per cent.

Table 3.XII shows the apportionment of funds as between fundamental and applied research and development work in the different types of research establishments. The figures presented are based on evaluations made by the establishments themselves. However, it is often difficult to locate the border lines between these different fields, and this must be borne in mind when considering the figures.

Table 3.XIII shows the percentage breakdown of the total amounts devoted respectively to fundamental and applied research and development work, according to the different types of research establishment. It will be seen that universities and State colleges account for about two-thirds of all fundamental research and for over 40 per cent of fundamental and applied research taken together. Industrial laboratories account for over half the development work and under 10 per cent of fundamental and applied research taken together.

Table 3.XIV shows capital and current expenditures and their percentage breakdown by subjects of research. Current expenditure accounts for 80.4 per cent of all research expenditure; a large part of this represents salaries.

In table 3.XIV, the subjects covered by "Natural Sciences" include mathematics, physics, biology, geology and other natural science research at universities and State colleges and also at the Norwegian Institute of Cosmic Physics, the Radiological Dating Laboratory, the Institute for Marine Research, the Institute for Whale Research, meteorological institutes and the Polar Institute, as well as the work of the chemistry department at the State Institute of Public Health. This coverage does not coincide exactly with that of "Natural Sciences" in tables 3.II and 3.III, hence the figures are not strictly comparable. Again, the figures for "Technical Sciences" in table 3.XIV cover research in industrial laboratories, which was not the case for tables 3.II and 3.III. On the present basis, expenditure on technical sciences accounts for nearly two-thirds of all expenditure on research in 1963.

Table 3. I Government expenditure (including grants from football pools) on higher education and research.¹ (\$ millions)

	1938-39	1946-47	1951-52	1956-57	1957-58	1958-59	1959-60	1960 (2nd half)	1961	1962	1963	1964	(budget) 1965
<i>Government expenditure</i>													
University and state colleges	0.975	2.720	4.745	9.005	9.415	10.500	12.950	7.460	17.520	21.305	25.780	28.255	39.310
Other research	0.630	1.885	3.560	8.655	9.965	12.410	12.690	7.320	16.265	17.050	18.165	20.700	23.030
All higher education and research	1.605	4.605	8.305	17.660	19.370	22.910	25.640	14.780	33.785	38.355	43.945	48.955	62.360
<i>Football pools</i>													
Universities and state colleges	-	-	0.700	1.465	1.250	1.550	1.470	0.865	1.650	1.475	1.850	1.810	1.800
Other research	-	-	0.490	1.605	1.950	1.910	2.080	0.955	2.260	2.545	2.100	2.270	2.400
All higher education and research	-	-	1.190	3.070	3.200	3.460	3.550	1.820	3.910	4.020	3.950	4.080	4.200
<i>Total</i>													
Universities and state colleges	0.975	2.720	5.445	10.470	10.665	12.050	14.420	8.325	19.170	22.780	27.630	30.065	41.110
Other research	0.630	1.885	4.050	10.260	11.915	14.320	14.770	8.275	18.525	19.595	20.265	22.970	25.430
Total, all higher education and research	1.605	4.605	9.495	20.730	22.580	26.370	29.190	16.600	37.695	42.375	47.895	53.035	66.560
As percentage of Gross National Product	0.20	0.27	0.32	0.48	0.52	0.57	0.59	0.66	0.68	0.70	0.76	0.76	² 0.88

1. Including capital expenditure. Figures for 1938-39 and 1946-47 from "The Research Councils of Norway", p. 12, later figures from the Joint Committee of the Norwegian Research Councils (FFU).

2. Preliminary figure.

Table 3.II.a/1958-59 Expenditure for 1958-59 on research and higher education in different subject fields, showing amounts (\$ millions) and percentages from different sources of funds¹

		Humanities	Social sciences ²	Natural sciences ³	Medicine	Agricultural sciences	Technical sciences	Total all subjects
Gov't grants	\$ m.	1.620	2.300	4.170	2.525	3.250	6.150	20.015
	%	48.5	87.5	85.5	75.0	76.0	44.0	62.0
Football pools	\$ m.	0.520	0.155	0.600	0.345	0.710	1.180	3.510
	%	15.5	6.0	12.5	10.0	16.5	8.5	11.0
Other Norwegian sources	\$ m.	1.210	0.140	0.085	0.455	0.270	6.550	8.880
	%	36.0	5.5	1.5	13.5	6.0		
Foreign sources	\$ m.	-	0.030	0.035	0.045	0.060		
	%	-	1.0	0.5	1.5	1.5		
Total all sources	\$ m.	3.350	2.625	4.890	3.370	4.290	13.880	32.405
	%	100	100	100	100	100	100	100

Table 3.II.b/1958-59 Expenditure for 1958-59 on research and higher education, showing amounts (\$ millions) and percentages from different sources expended on different subject fields¹

		Humanities	Social sciences ²	Natural sciences ³	Medicine	Agricultural sciences	Technical sciences	Total all subjects
Gov't grants	\$ m.	1.620	2.300	4.170	2.525	3.250	6.150	20.015
	%	8.0	11.5	21.0	12.5	16.0	31.0	100
Football pools	\$ m.	0.520	0.155	0.600	0.345	0.710	1.180	3.510
	%	15.0	4.5	17.0	10.0	20.0	33.5	100
Other Norwegian sources	\$ m.	1.210	0.140	0.085	0.455	0.270	6.550	8.880
	%	13.5	2.0	1.5	5.5	3.0		
Foreign sources	\$ m.	-	0.030	0.035	0.045	0.060		
	%							
Total all sources	\$ m.	3.350	2.625	4.890	3.370	4.290	13.880	32.405
	%	10.5	8.0	15.0	10.5	13.0	43.0	100

1. Data from the Joint Committee of the Norwegian Research Councils.
2. Including the Central Bureau of Statistics.
3. Including meteorological institutions.

Table 3.II.a/1960 Expenditure for 1960 on research and higher education in different subject fields, showing amounts (\$ millions) and percentages from different sources of funds¹

		Humanities	Social sciences ²	Natural sciences ³	Medicine	Agricultural sciences	Technical ⁴ sciences	Total all subjects
Gov't. grants	\$ m.	2,310	2,060	4,880	3,320	4,140	9,600	26,310
	%	63.5	83.0	89.0	74.0	79.0	68.0	74.0
Football pools	\$ m.	0,420	0,240	0,545	0,410	0,975	0,975	3,385
	%	11.5	9.5	10.0	9.0	15.0	7.0	9.5
Other Norwegian sources	\$ m.	0,910	0,150	0,040	0,700	0,260	3,600	5,865
	%	25.0	6.0	0.5	15.5	5.0	25.0	16.5
Foreign sources	\$ m.	-	0,035	0,040	0,070	0,060		
	%	-	1.5	0.5	1.5	1.0		
Total all sources	\$ m.	3,640	2,485	5,505	4,500	5,255	14,175	35,560
	%	100	100	100	100	100	100	100

Table 3.II.b/1960 Expenditure for 1960 on research and higher education, showing amounts (\$ millions) and percentages from different sources expended on different subject fields¹

		Humanities	Social sciences ²	Natural sciences ³	Medicine	Agricultural sciences	Technical ⁴ sciences	Total all subjects
Gov't. grants	\$ m.	2,310	2,060	4,880	3,320	4,140	9,600	26,310
	%	9.0	8.0	18.5	12.5	15.5	36.5	100
Football pools	\$ m.	0,420	0,240	0,545	0,410	0,795	0,975	3,385
	%	12.5	7.0	16.0	12.0	23.5	29.0	100
Other Norwegian sources	\$ m.	0,910	0,150	0,040	0,700	0,260	3,600	5,865
	%	15.5	3.0	1.5	13.0	5.5	61.5	100
Foreign sources	\$ m.	-	0,035	0,040	0,070	0,060		
	%							
Total all sources	\$ m.	3,640	2,485	5,505	4,500	5,255	14,175	35,560
	%	10.0	7.0	15.5	12.5	15.0	40.0	100

1. Data from the Joint Committee of the Norwegian Research Councils.

2. Including the Central Bureau of Statistics.

3. Including meteorological institutions.

4. Estimates. Figures for the Institute of Technology for 1960, for other technical institutes 1959-60.

Table 3.II.a/1961 Expenditure for 1961 on research and higher education in different subject fields, showing amounts (\$ millions) and percentages from different sources of funds. ¹

		Humanities	Social sciences ²	Natural sciences ³	Life sciences	Technical sciences ⁴	Total all subject
Gov't. grants	\$ m.	2.865	2.310	3.385	8.295	14.145	31.000
	%	80.0	84.0	84.5	80.9	63.7	72.5
Football pools	\$ m.	0.475	0.245	0.525	1.130	1.325	3.700
	%	13.1	8.9	13.1	11.1	5.9	8.7
Other Norwegian sources	\$ m.	0.250	0.180	0.050	0.730	4.145	5.365
	%	6.9	6.6	1.5	7.1	18.7	12.4
Foreign sources	\$ m.	-	0.015	0.035	0.090	2.610	2.750
	%	-	0.5	0.9	0.9	11.7	6.4
Total all sources	\$ m.	3.590	2.750	4.005	10.245	22.225	42.815
	%	100	100	100	100	100	100

Table 3.II.b/1961 Expenditure for 1961 on research and higher education, showing amounts (\$ millions) and percentages from different sources expended on different subject fields. ¹

		Humanities	Social sciences ²	Natural sciences ³	Life sciences	Technical sciences ⁴	Total all subjects
Gov't. grants	\$ m.	2.865	2.310	3.385	8.295	14.145	31.000
	%	9.2	7.5	10.9	26.9	45.5	100
Football pools	\$ m.	0.475	0.245	0.525	1.130	1.325	3.700
	%	12.9	6.6	14.2	30.6	35.7	100
Other Norwegian sources	\$ m.	0.250	0.180	0.050	0.730	4.145	5.365
	%	4.7	3.4	1.1	13.6	77.2	100
Foreign sources	\$ m.	-	0.015	0.035	0.090	2.610	2.750
	%	-	0.5	1.3	3.3	94.9	100
Total all sources	\$ m.	3.590	2.750	4.005	10.245	22.225	42.815
	%	8.3	6.5	9.3	23.9	52.0	100

1. Data from the Joint Committee of the Norwegian Research Councils.
2. Including the Central Bureau of Statistics.
3. Including meteorological institutions.
4. Figures for 1962.

Table 3.II.a/1963 Expenditure for 1963 on research and higher education in different subject fields, showing amounts (\$ millions) and percentages from different sources of funds¹

		Humanities	Social sciences	Natural sciences ²	Life sciences	Technical sciences ³	Total
Gov't grants	\$ m.	4.480	2.285	4.530	9.625	14.145	35.065
	%	86.3	78.3	87.9	75.2	63.7	72.6
Football pools	\$ m.	0.540	0.330	0.475	1.560	1.325	4.230
	%	10.4	11.3	9.2	12.2	5.9	8.8
Other Norwegian sources	\$ m.	0.170	0.240	0.055	1.185	4.145	5.795
	%	3.3	8.2	1.1	9.3	18.7	12.0
Foreign sources	\$ m.	-	0.065	0.095	0.430	2.610	3.200
	%	-	2.2	1.8	3.3	11.7	6.6
Total	\$ m.	5.190	2.920	5.155	12.800	22.225	48.290
	%	100	100	100	100	100	100

Table 3.II.b/1963 Expenditure for 1963 on research and higher education, showing amounts (\$ millions) and percentages from different sources expended on different subject fields.¹

		Humanities	Social sciences	Natural sciences ²	Life sciences	Technical sciences ³	Total
Gov't grants	\$ m.	4.480	2.285	4.530	9.625	14.145	35.065
	%	12.8	6.5	13.0	27.4	40.3	100
Football pools	\$ m.	0.540	0.330	0.475	1.560	1.325	4.230
	%	12.8	7.8	11.2	36.9	31.3	100
Other Norwegian sources	\$ m.	0.170	0.240	0.055	1.185	4.145	5.795
	%	3.0	4.0	1.0	20.5	71.5	100
Foreign sources	\$ m.	-	0.065	0.095	0.430	2.610	3.200
	%	-	2.0	3.0	13.4	81.6	100
Total	\$ m.	5.190	2.920	5.155	12.800	22.225	48.290
	%	10.8	6.0	10.7	26.5	46.0	100

1. Data from the three research councils.
2. Including meteorological institutions.
3. Figures for 1962.

Table 3.III.a/ 1958-59 Expenditure for 1958-59 on research and higher education, according to different categories of expenditure, showing amounts (\$ millions) and percentages expended on different subject fields (technical sciences excepted).¹

		Salaries and wages	New buildings	Other expenditure	Total all categories
Humanities	\$ m.	1.380	1.180	0.790	3.350
	%	16.0	40.5	12.0	18.0
Social sciences	\$ m.	1.260	0.165	1.200	2.625
	%	14.0	5.5	18.0	14.0
Natural sciences	\$ m.	2.460	0.610	1.820	4.890
	%	28.0	21.0	27.0	27.0
Medicine	\$ m.	1.600	0.750	1.070	3.370
	%	18.0	25.5	15.0	18.0
Agricultural sciences	\$ m.	2.150	0.240	1.900	4.290
	%	24.0	7.5	28.0	23.0
Total all subjects	\$ m.	8.850	2.945	6.730	18.525
	%	100	100	100	100

Table 3.III.b/ 1958-59 Expenditure for 1958-59 on research and higher education, showing amounts (\$ millions) and percentages in the different categories of expenditure, for the different subject fields (technical sciences excepted).¹

		Salaries and wages	New buildings	Other expenditure	Total all categories
Humanities	\$ m.	1.380	1.180	0.790	3.350
	%	41.5	36.0	23.5	100
Social sciences	\$ m.	1.260	0.165	1.200	2.625
	%	48.0	6.5	45.5	100
Natural sciences	\$ m.	2.460	0.610	1.820	4.890
	%	50.5	12.5	37.0	100
Medicine	\$ m.	1.600	0.750	1.020	3.370
	%	47.5	22.5	30.0	100
Agricultural sciences	\$ m.	2.150	0.240	1.900	4.290
	%	50.0	5.5	44.5	100
Total all subjects	\$ m.	8.850	2.945	6.730	18.525
	%	48.0	16.0	36.0	100

1. Data from the Joint Committee of the Norwegian Research Councils. Total expenditure on technical sciences in 1958-59 was \$ millions 13.880; however the breakdown into separate categories cannot be given for this year.

Table 3.III.a/ 1960 Expenditure for 1960 on research and higher education, according to different categories of expenditure, showing amounts (\$ millions) and percentages expended on different subject fields.

		Salaries and wages	New buildings	Other expenditure	Total all categories
Humanities	\$ m.	1,750	1,070	0,820	3,640
	%	10.5	22.5	6.0	10.0
Social sciences	\$ m.	1,450	0,075	0,960	2,485
	%	8.5	1.5	7.0	7.0
Natural sciences	\$ m.	3,100	0,325	2,080	5,505
	%	18.0	7.0	15.0	15.5
Medicine	\$ m.	2,300	0,600	1,600	4,500
	%	13.5	12.5	11.5	12.5
Agricultural sciences	\$ m.	2,100	0,600	2,555	5,255
	%	12.5	12.5	18.5	15.0
Technical sciences ¹	\$ m.	6,300	2,100	5,775	14,175
	%	37.0	44.0	42.0	40.0
Total all subjects	\$ m.	17,000	4,770	13,790	35,560
	%	100	100	100	100

1. Estimates.

Table 3.III.b/ 1960 Expenditure for 1960 on research and higher education, showing amounts (\$ millions) and percentages in the different categories of expenditure, for the different subject fields

		Salaries and wages	New buildings	Other expenditure	Total all categories
Humanities	\$ m.	1,750	1,070	0,820	3,640
	%	48.0	29.5	22.5	100
Social sciences	\$ m.	1,450	0,075	0,960	2,485
	%	58.5	3.0	38.5	100
Natural sciences	\$ m.	3,100	0,325	2,080	5,505
	%	56.5	6.0	37.5	100
Medicine	\$ m.	2,300	0,600	1,600	4,500
	%	51.0	13.5	35.5	100
Agricultural sciences	\$ m.	2,100	0,600	2,555	5,255
	%	40.0	11.5	48.5	100
Technical sciences ¹	\$ m.	6,300	2,100	5,775	14,175
	%	45.0	15.0	40.0	100
Total all subjects	\$ m.	17,000	4,770	13,790	35,560
	%	48.0	13.0	39.0	100

1. Estimates

Table 3.III.a/ 1961 Expenditure for 1961 on research and higher education, according to different categories of expenditure, showing amounts (\$ millions) and percentages expended on different subject fields.¹

		Salaries and wages	New buildings	Other expenditure	Total all categories
Humanities	\$ m.	1,945	1,170	0,475	3,590
	%	9.1	20.0	3.0	8.4
Social sciences ²	\$ m.	1 745	0 040	0,965	2,750
	%	8.2	0.7	6.2	6.4
Natural sciences ³	\$ m.	2,625	0,210	1 160	3,995
	%	12.2	3.6	7.4	9.3
Life sciences	\$ m.	5,200	1,155	3,900	10,255
	%	24.3	19.7	25.0	23.9
Technical sciences	\$ m.	⁴ 9,850	3,275	⁴ 9,100	22 225
	%	46.2	56.0	58.4	52.0
Total all subjects	\$ m.	21,365	5,850	15,600	42,815
	%	100	100	100	100

Table 3.III.b/ 1961 Expenditure for 1961 on research and higher education, showing amounts (\$ millions) and percentages in the different categories of expenditure, for the different subject fields.¹

		Salaries and wages	New buildings	Other expenditure	Total all categories
Humanities	\$ m.	1,945	1,170	0,475	3,590
	%	54.2	32.6	13.2	100
Social sciences ²	\$ m.	1,745	0,040	0,965	2,750
	%	63.5	1.5	35.0	100
Natural sciences ³	\$ m.	2,625	0,210	1,160	3,995
	%	65.7	5.2	29.1	100
Life sciences	\$ m.	5,200	1,155	3,900	10,255
	%	50.7	11.2	38.1	100
Technical sciences	\$ m.	⁴ 9,850	3,275	⁴ 9,100	22,225
	%	44.3	14.7	41.0	100
Total all subjects	\$ m.	21,365	5,850	15,600	42,825
	%	49.8	13.7	36.5	100

1. Data from the Joint Committee of the Norwegian Research Councils.

2. Including the Central Bureau of Statistics.

3. Including meteorological institutions.

4. Estimates based on figures for 1960.

Table 3.III a/1963 Expenditure for 1963 on research and higher education, according to different categories of expenditure, showing amounts (\$ millions) and percentages expended on different subject fields.¹

		Salaries and wages	New buildings	Other expenditure	Total all categories
Humanities	\$ m.	3,715	1,210	0,265	5,190
	%	14.0	13.7	2.1	10.7
Social sciences	\$ m.	1,965	0,855	0,070	2,920
	%	7.4	10.0	0.5	6.0
Natural sciences ²	\$ m.	3,045	0,990	1,120	5,155
	%	11.5	11.2	8.7	10.7
Life sciences	\$ m.	8,015	2,450	2,335	12,800
	%	30.1	27.9	18.1	26.6
Technical sciences ³	\$ m.	9,850	3,275	9,100	22,225
	%	37.0	37.2	70.6	46.0
Total all subjects	\$ m.	26,590	8,810	12,890	48,290
	%	100.0	100.0	100.0	100.0

Table 3.III b/1963 Expenditure for 1963 on research and higher education, showing amounts (\$ millions) and percentages in the different categories of expenditure, for the different subject fields.¹

		Salaries and wages	New buildings	Other expenditure	Total all categories
Humanities	\$ m.	3,715	1,210	0,265	5,190
	%	71.6	23.3	5.1	100
Social sciences	\$ m.	1,965	0,855	0,070	2,920
	%	67.3	30.3	2.4	100
Natural sciences ²	\$ m.	3,045	0,990	1,120	5,155
	%	59.0	19.2	21.8	100
Life sciences	\$ m.	8,015	2,450	2,335	12,800
	%	62.6	19.2	18.2	100
Technical sciences ³	\$ m.	9,850	3,275	9,100	22,225
	%	44.3	14.7	41.0	100
Total all subjects	\$ m.	26,590	8,810	12,890	48,290
	%	55.1	18.2	26.7	100

1. Data from Joint Committee of Research Councils.

2. Including meteorological institutions.

3. Estimated from 1960 figures.

Table 3.IV.a/ 1958-59 Expenditure for 1958-59 on universities and state colleges under the Ministry of Education, showing amounts (\$ millions) and percentages expended on the different establishments.

		Government grants	Football pools	Other sources	Total all sources
University of Oslo	\$m.	3.230	0.520	0.225	3.975
	%	38.5	45.5	59.5	40.2
University of Bergen	\$m.	1.100	0.155	0.055	1.310
	%	13.0	14.5	14.5	13.2
Institute of Technology	\$m.	3.255	0.455	¹ 0.050	3.750
	%	39.0	39.0	13.0	37.9
College of Business Administration and Economics ²	\$m.	0.180	0.010	0.050	0.240
	%	2.0	1.0	13.0	2.4
College for Teachers	\$m.	0.620	0.001	-	0.621
	%	7.5	-	-	6.3
Total all establishments	\$m.	8.385	1.131	0.380	9.896
	%	100	100	100	100

Table 3.IV.b/ 1958-59 Expenditure for 1958-59 on universities and state colleges under the Ministry of Education, showing amounts (\$ millions) and percentages from the different sources of finance.

		Government grants	Football pools	Other sources	Total all sources
University of Oslo	\$m.	3.230	0.520	0.225	3.975
	%	81.5	13.0	5.5	100
University of Bergen	\$m.	1.100	0.155	0.055	1.310
	%	84.0	12.0	4.0	100
Institute of Technology	\$m.	3.255	0.445	¹ 0.050	3.750
	%	86.5	12.0	1.5	100
College of Business Administration and Economics ²	\$m.	0.180	0.010	0.050	0.240
	%	75.0	4.0	21.0	100
College for Teachers	\$m.	0.620	0.001	-	0.621
	%	100	-	-	100
Total all establishments	\$m.	8.385	1.131	0.380	9.896
	%	85.0	11.5	3.5	100

1. Estimates only available.

2. Present name: School of Business Economics and Administration.

Table 3.IV.b/1960 Expenditure for 1960 on universities and state colleges under the Ministry of Education, showing amounts (\$ millions) and percentages expended on the different establishments. ¹

		Government grants	Football pools	Other sources	Total all sources
University of Oslo	\$m.	5.550	0.460	0.360	6.370
	%	47.2	59.0	70.0	49.5
University of Bergen	\$m.	1.745	0.125	0.030	1.900
	%	15.0	16.0	6.0	14.5
Institute of Technology	\$m.	3.670	0.180	0.070	3.920
	%	31.5	23.0	13.5	30.0
College of Business Administration and Economics ²	\$m.	0.265	0.015	0.055	0.335
	%	2.5	2.0	10.5	2.5
College for Teachers	\$m.	0.445	-	-	0.445
	%	3.8	-	-	3.5
Total all establishments	\$m.	11.675	0.780	0.515	12.970
	%	100	100	100	100

Table 3.IV.b/1960 Expenditure for 1960 on universities and state colleges under the the Ministry of Education, showing amounts (\$ millions) and percentages from the different sources of finance. ¹

		Government grants	Football pools	Other sources	Total all sources
University of Oslo	\$m.	5.550	0.460	0.360	6.370
	%	87.0	7.0	6.0	100
University of Bergen	\$m.	1.745	0.125	0.030	1.900
	%	92.0	6.0	2.0	100
Institute of Technology	\$m.	3.670	0.180	0.070	3.920
	%	93.5	4.5	2.0	100
College of Business Administration and Economics ²	\$m.	0.265	0.015	0.055	0.335
	%	79.0	4.5	16.5	100
College for Teachers	\$m.	0.445	-	-	0.445
	%	100	-	-	100
Total all establishments	\$m.	11.675	0.780	0.515	12.970
	%	90.0	6.0	4.0	100

1. Data from the Joint Committee of the Norwegian Research Councils.
2. Present name: School of Business Economics and Administration.

Table 3.IV.a/1961 Expenditure for 1961 on universities and state colleges under the Ministry of Education, showing amounts (\$ millions) and percentages expended on the different establishments.

		Government grants	Football pools	Other sources	Total all sources
University of Oslo	\$m.	7.880	0.735	0.340	8.955
	%	52.5	67.0	67.4	53.9
University of Bergen	\$m.	2.390	0.120	0.055	2.565
	%	15.9	11.0	10.9	15.5
Institute of Technology ¹	\$m.	4.030	0.230	0.050	4.310
	%	26.9	21.1	9.9	25.9
College of Business Administration and Economics ²	\$m.	0.275	0.010	0.060	0.345
	%	1.8	0.9	11.8	2.1
College for Teachers	\$m.	0.440	0.001	-	0.441
	%	2.9	-	-	2.6
Total all establishments	\$m.	15.015	1.096	0.505	16.616
	%	100	100	100	100

Table 3.IV.b/1961 Expenditure for 1961 on universities and state colleges under the Ministry of Education, showing amounts (\$ millions) and percentages from the different sources of finance.

		Government grants	Football pools	Other sources	Total all sources
University of Oslo	\$m.	7.880	0.735	0.340	8.955
	%	88.0	8.2	3.8	100
University of Bergen	\$m.	2.390	0.120	0.055	2.565
	%	93.2	4.7	2.1	100
Institute of Technology ¹	\$m.	4.030	0.230	0.050	4.310
	%	93.5	5.3	1.2	100
College of Business Administration and Economics ²	\$m.	0.275	0.010	0.060	0.345
	%	79.7	2.9	17.4	100
College for Teachers	\$m.	0.440	0.001	-	0.441
	%	100	0.0	-	100
Total all establishments	\$	15.015	1.096	0.505	16.616
	%	90.4	6.6	3.0	100

1. Including the Ship-Model Experiment Tank and the Institute for Testing Materials.
2. Present name: School of Business Economics and Administration.

Table 3.IV.a/ 1963 Expenditure for 1963 on universities and state colleges under the Ministry of Education, showing sources of finance and amounts (\$ millions) and percentages expended on the different establishments. ¹

		Government grants	Football pools	Other sources	Total all sources
University of Oslo	\$m.	10.765	0.590	2.290	13.645
	%	48.0	59.5	59.6	50.0
University of Bergen	\$m.	3.900	0.135	1.045	5.080
	%	17.4	13.6	27.2	18.6
Institute of Technology ²	\$m.	6.270	³ 0.260	³ 0.385	6.915
	%	27.9	26.2	10.0	25.4
College of Business Administration and Economics	\$m.	1.050	0.005	0.095	1.150
	%	4.7	0.5	2.5	4.2
College for Teachers	\$m.	0.455	0.002	0.025	0.482
	%	2.0	0.2	0.7	1.8
Total all establishments	\$m.	22.440	0.992	3.840	27.272
	%	100.0	100.0	100.0	100.0

Table 3.IV.b/ 1963 Expenditure for 1963 on universities and state colleges under the Ministry of Education, showing amounts (\$ millions) and percentages from the different sources of finance. ¹

		Government grants	Football pools	Other sources	Total all sources
University of Oslo	\$m.	10.765	0.590	2.290	13.645
	%	78.9	4.3	16.8	100
University of Bergen	\$m.	3.900	0.135	1.045	5.080
	%	76.8	2.7	20.5	100
Institute of Technology ²	\$m.	6.270	³ 0.260	³ 0.385	6.915
	%	90.7	3.8	5.5	100
College of Business Administration and Economics	\$m.	1.050	0.005	0.095	1.150
	%	91.3	0.4	8.3	100
College for Teachers	\$m.	0.455	0.002	0.025	0.482
	%	94.4	0.4	5.2	100
Total all establishments	\$m.	22.440	0.992	3.840	27.272
	%	90.4	6.6	3.0	100

1. Data from Norwegian Research Council for Science and the Humanities.
2. Including the Ship-Model Experiment Tank and the Institute for Testing Materials.
3. Estimates.

Table 3.V.a Expenditure for 1963 on state colleges under the Ministry of Agriculture, showing sources of finance and amounts (\$ millions) and percentages expended on different colleges.

		Government grants	Football pools	Other sources	Total
Agricultural College of Norway ¹	\$m.	2 185	0 296	0 120	2 601
	%	69.3	62.5	70.6	68.4
Norwegian Veterinary College	\$m.	0 970	0 185	0 050	1 205
	%	30.7	37.5	29.4	31.6
Total	\$m.	3 155	0 481	0 170	3 806
	%	100	100	100	100

Table 3.V.b Expenditure for 1963 on state colleges under the Ministry of Agriculture, showing amounts (\$ millions) and percentages from different sources of finance.

		Government grants	Football pools	Other sources	Total
Agricultural College of Norway ¹	\$m.	2 185	0 296	0 120	2 601
	%	84.0	11.4	4.6	100
Norwegian Veterinary College	\$m.	0 970	0 185	0 050	1 205
	%	80.1	15.8	4.1	100
Total	\$m.	3 155	0 481	0 170	3 806
	%	83.0	12.5	4.5	100

1. Not including the farm, forestry, horticulture and dairy farming activities undertaken in connexion with the College.

Table 3.VI Net expenditure¹ on research and higher education, showing the amounts² and percentages expended by the various Ministries.

	1961		1962		1963		1964		1965 (budget)	
	\$ millions	%	\$ millions	%	\$ millions	%	\$ millions	%	\$ millions	%
Ministry of Education	18.500	54.9	21.850	57.2	25.600	60.5	27.650	58.8	38.150	63.5
Ministry of Foreign Affairs	0.300	0.9	0.350	0.9	0.350	0.8	0.050	0.1	0.050	0.1
Ministry of Local Government and Labour	-	-	-	-	0.200	0.5	0.250	0.5	0.300	0.5
Ministry of Social Affairs	0.800	2.4	0.950	2.4	1.000	2.4	0.800	1.7	1.050	1.7
Ministry of Commerce and Shipping	-	-	-	-	-	-	-	-	-	-
Ministry of Industry	5.200	15.4	4.650	12.0	5.750	13.6	7.200	15.3	8.250	13.7
Ministry of Fisheries	1.350	4.0	1.450	3.8	1.300	3.1	1.450	3.1	1.550	2.6
Ministry of Agriculture	3.400	10.1	4.300	11.2	3.850	9.1	5.150	10.9	5.800	9.7
Ministry of Transport	0.100	0.3	0.150	0.4	0.250	0.6	0.050	0.1	-	-
Ministry of Family and Consumer Affairs	0.050	0.1	0.050	0.1	-	-	-	-	-	-
Ministry of Finance	1.500	4.4	1.300	3.4	1.350	3.2	1.450	3.1	1.700	2.8
Ministry of Defence	2.550	7.5	3.300	8.6	2.600	6.2	3.000	6.4	3.200	5.4
Ministry of Justice	-	-	-	-	-	-	-	-	-	-
Ministry of Wages and Prices	-	-	-	-	-	-	-	-	-	-
Total all ministries	33.750	100	38.350	100	42.250	100	47.050	100	60.050	100

1. Incomes and old age pensions are deducted
2. To the nearest \$ 50,000.

Table 3.VII Surplus from Football Pool Agency, 1948-1964.
Allocations to Sport and Science

	Sport		Science		Total
	\$ millions	%	\$ millions	%	\$ millions
1948	0.419	60	0.279	40	0.698
1949	0.558	40	0.838	60	1.396
1950	0.642	35	1.173	65	1.815
1951	0.698	35	1.396	65	2.094
1952	0.828	30	1.955	70	2.793
1953	0.977	28	2.513	72	3.490
1954	1.089	27	2.960	73	4.049
1955	1.117	27	3.072	73	4.189
1956	1.145	26	3.183	74	4.328
1957	1.201	26	3.407	74	4.608
1958	1.229	25	3.518	75	4.747
1959	1.300	25	3.804	75	5.104
1960	1.343	25	3.972	75	5.315
1961	1.315	25	3.832	75	5.147
1962	1.357	25	4.042	75	5.399
1963	1.287	25	3.776	75	5.063
1964	1.566	24	4.867	76	6.433
Total	18.081	27	48.587	73	66.668

Table 3.VIII.a Distribution of receipts from Football Pools among the research councils for the period 1955-64 showing amounts (\$ millions) and percentages allocated to different purposes ¹

		NAVF ⁴	NLVF ⁵	NTNF ⁶	FFU	Total
<i>Ordinary grants:</i>						
Research projects	\$ m.	9.972	6.367	9.418	-	25.757
	%	59.6	72.6	72.0	-	65.8
Printing	\$ m.	1.935	0.076	0.022	-	2.033
	%	11.6	0.9	0.2	-	5.2
Travel awards	\$ m.	0.358	0.160	0.391	-	0.909
	%	2.1	1.8	3.0	-	2.3
Sabbatical years for professional staff	\$ m.	0.109	0.061	0.084	-	0.254
	%	0.7	0.7	0.6	-	0.6
Post-doctorate awards to non-Norwegians	\$ m.	-	-	0.287	-	0.287
	%	-	-	2.2	-	0.7
Administration	\$ m.	1.076	0.429	² -	-	1.505
	%	6.4	4.8	-	-	3.8
Available through the year	\$ m.	0.452	0.162	0.206	-	0.820
	%	2.7	1.8	1.6	-	2.2
Joint Committee (FFU) ordinary grants	\$ m.	-	-	-	0.428	0.428
	%	-	-	-	67.0	1.0
Ordinary grants total	\$ m.	13.902	7.255	10.408	0.428	31.993
	%	83.1	82.6	79.6	67.0	81.6
Extraordinary grants ³	\$ m.	2.832	1.524	2.672	0.211	7.239
	%	16.9	17.4	20.4	33.0	18.4
Total	\$ m.	16.734	8.779	13.080	0.639	39.232
	%	100.0	100.0	100.0	100.0	100.0

1. Data up to 1958 from "The Research Councils of Norway", Oslo, 1960: for later years, from the Joint Committee of the Research Councils (FFU).

2. Covered from other sources.

3. Mainly for new research buildings, equipment and industries.

4. NAVF = Norgesalmenvitenskapelige Forskningsråd (Norwegian Research Council for Science and the Humanities).

5. NLVF = Norges Landbruksvitenskapelige Forskningsråd (Agricultural Research Council of Norway).

6. NTNF = Norges Teknisk Naturvitenskapelige Forskningsråd (Norwegian Council for Scientific and Industrial Research).

Table 3.VIII.b Distribution of receipts from Football Pools for the period 1955-64, showing amounts (\$ millions) and percentages distributed to the different research councils¹

		NAVF	NLVF	NTNF	FFU	Total
<i>Ordinary grants :</i>						
Research projects	\$ m.	9.972	6.357	9.418	-	25.757
	%	38.7	24.7	36.6	-	100
Printing	\$ m.	1.935	0.076	0.022	-	2.033
	%	95.2	3.7	1.1	-	100
Travel awards	\$ m.	0.358	0.160	0.391	-	0.909
	%	39.4	17.6	43.0	-	100
Sabbatical years for professional staff	\$ m.	0.109	0.061	0.084	-	0.254
	%	42.9	24.0	33.1	-	100
Post-doctorate awards to non-Norwegians	\$ m.	-	-	0.287	-	0.287
	%	-	-	100.0	-	100
Administration	\$ m.	1.076	0.429	² -	-	1.505
	%	71.5	28.5	-	-	100
Available through the year	\$ m.	0.452	0.162	0.206	-	0.820
	%	55.1	19.8	25.1	-	100
Joint Committee (FFU)	\$ m.	-	-	-	0.428	0.428
	%	-	-	-	100.0	100
Ordinary grants total	\$ m.	13.902	7.255	10.408	0.428	31.993
	%	43.4	22.7	32.6	1.3	100
Extraordinary grants ³	\$ m.	2.832	1.524	2.672	0.211	7.239
	%	39.1	21.1	36.9	2.9	100
Total	\$ m.	16.734	8.779	13.080	0.639	39.232
	%	42.7	22.4	33.3	1.6	100

1. Data up to 1958 from "The Research Councils of Norway", Oslo, 1960; for later years, from the Joint Committee of the Research Councils (FFU).

2. Covered from other sources.

3. Mainly for new research buildings, equipment and industries.

Table 3.IX. Disposal of football grants (ordinary and extraordinary) in 1963 by the research councils and the Joint Committee (FFU), showing amounts (\$ millions) and percentages devoted to different purposes.

	NAVF		NLVF		NTNF		FFU		TOTAL	
	\$ millions	%	\$ millions	%	\$ millions	%	\$ millions	%	\$ millions	%
Research projects	1.139	67.6	0.712	82.5	1.200	87.5	-	-	3.051	77.1
Travel grants	0.026	1.5	0.014	1.6	0.042	3.0	-	-	0.082	2.1
Post-doctorate grants to non-Norwegians	-	-	-	-	0.035	2.6	-	-	0.035	0.9
Sabbatical year for professional staff	0.010	0.6	0.005	0.6	-	-	-	-	0.015	0.4
Printing	0.229	13.6	0.007	0.9	-	-	-	-	0.236	6.0
Administration and investigations	0.154	9.2	0.050	5.8	¹ -	¹ -	0.039	100	0.243	6.0
Available through the year	0.056	3.3	0.015	1.6	² 0.031	² 2.3	-	-	0.102	2.6
Extraordinary grants (now buildings and instruments)	0.070	4.2	0.060	7.0	0.063	4.6	-	-	0.193	4.9
Total all purposes	1.684	100	0.863	100	1.371	100	0.039	100	3.957	100

1. Covered from other sources.

2. Includes expenditure on printing.

Table 3.X. Total expenditure on research in 1963 (\$ millions)

Source of funds	TYPE OF RESEARCH ESTABLISHMENT					
	Higher Education	Public Institutes	Research Council Institutes	Privates Institutes	Industrial Laboratories	Total all types
Public	12.38	8.24	4.74	2.20	0.09	27.63
Industry	0.14	0.07	1.22	1.27	13.44	16.14
Foreign	0.16	1.34	1.70	0.26	-	3.46
Other	0.53	0.06	0.04	0.86	<0.01	1.49
Total all sources	13.21	9.71	7.70	4.59	13.53	48.72

Table 3.XI. Expenditure on research at universities and State Colleges in 1963
(\$ thousands)

Source of funds	1	2	3	4	5	6	7	Total all establishments
Public :								
Gov't grants	4,636	1,758	2,187	510	1,325	277	49	10,742
Football pools	590	137	207	3	296	186	2	1,421
Funds	-	-	51	-	28	1	-	80
County and municipal	85	45	-	-	1	-	-	131
Industry	48	4	63	2	25	-	-	142
Foreign	93	67	-	-	2	1	-	163
Other	319	75	67	21	13	5	29	529
Total all sources	5,771	2,086	2,575	536	1,690	470	80	13,208

1. University of Oslo
2. University of Bergen
3. Institute of Technology
4. College for Business Administration and Economics
5. Agricultural College of Norway
6. Norwegian Veterinary College
7. College for Teachers and Independent Theological College

Table 3.XII. Percentages of funds devoted to fundamental and applied research and development work in different types of research establishments.

Type of establishment	Fundamental research %	Applied research %	Development work %	Total %	Total \$ millions
Universities and State Colleges	71.3	22.9	5.8	100	13.21
Public Institutes	24.1	51.6	24.3	100	9.71
Research Council Institutes	9.5	39.5	51.0	100	7.70
Private Institutes	36.6	43.9	19.5	100	4.59
Industrial laboratories	1.4	20.1	78.5	100	13.53
All establishments	29.5 (\$ m. 14.37)	32.4 (\$ m. 15.80)	31.1 (\$ m. 18.55)	100	48.72

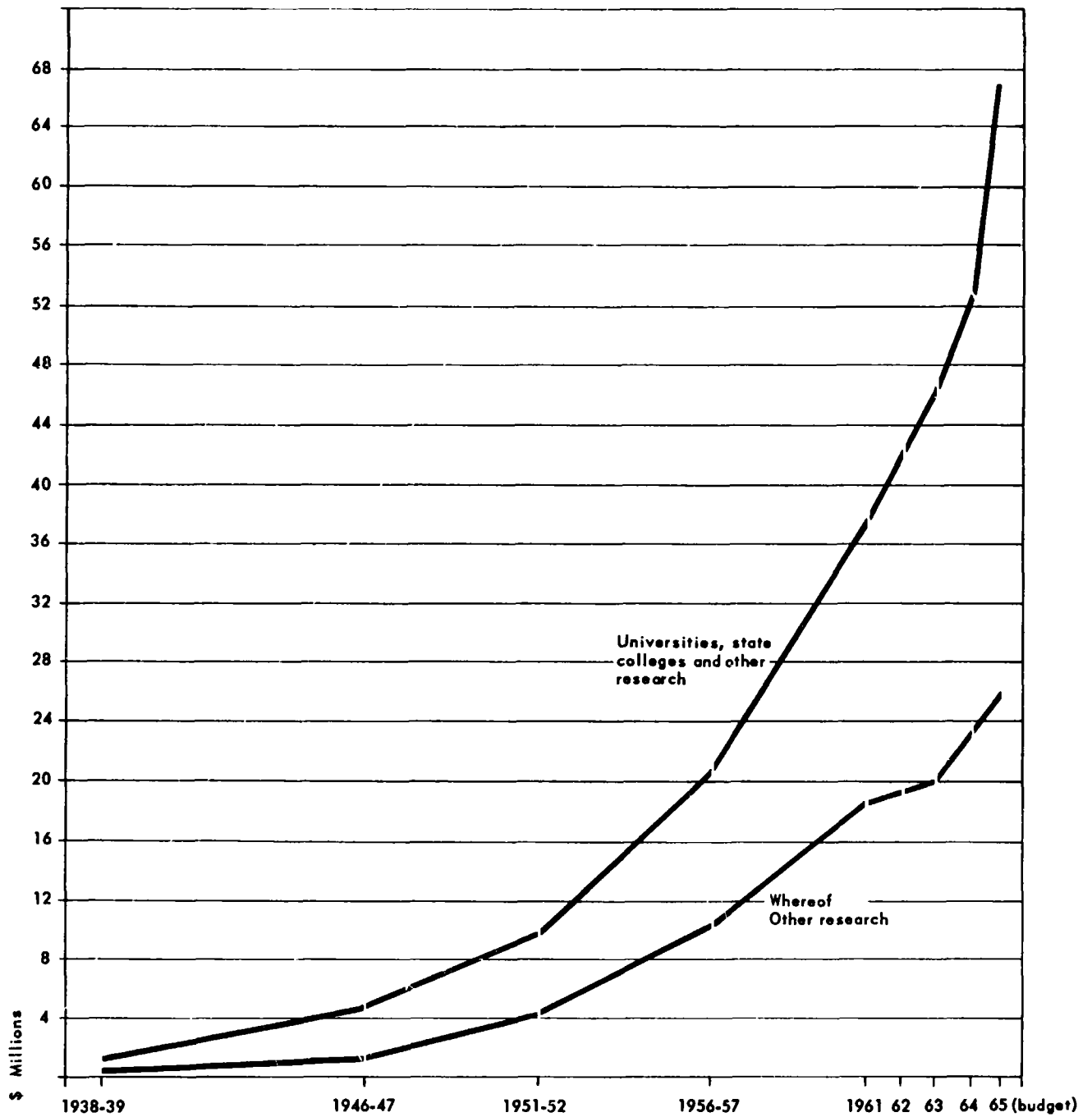
Table 3.XIII. Expenditure on fundamental and applied research and development work, percentage distribution among different types of establishment.

Type of establishment	Fundamental research %	Applied research %	Development work %	All R & D %
Universities and State Colleges	65.6	19.1	4.1	27.1
Public Institutes	16.3	31.7	12.7	19.9
Research Council Institutes	5.1	19.2	21.2	15.8
Private Institutes	11.7	12.8	4.8	9.4
Industrial laboratories	1.3	17.2	57.2	27.8
Total all establishments	100.0	100.0	100.0	100.0

Table 3.XIV. Capital and current expenditure on research, and percentage distribution according to subjects.

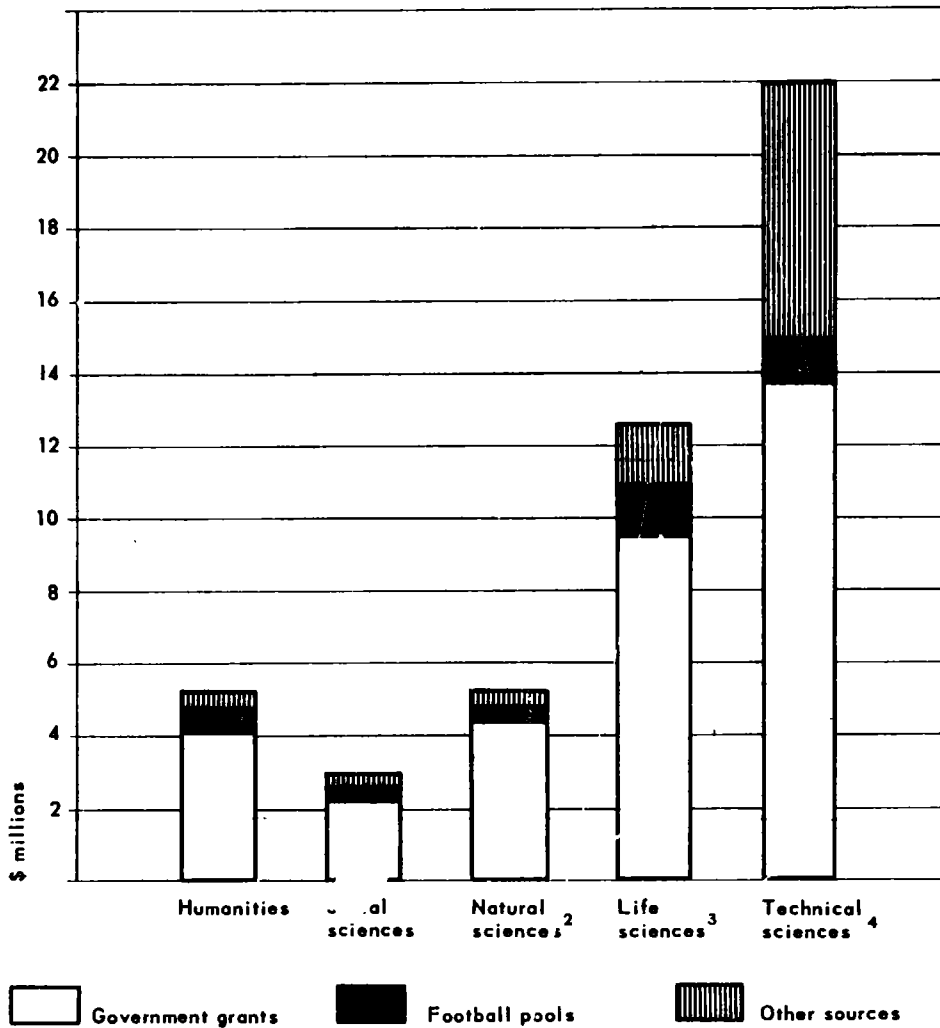
Subject of research	Capital expenditure		Current expenditure		Total research expenditure	
	\$ thousands	%	\$ thousands	%	\$ thousands	%
Humanities	619	6.5	2 069	5.3	2 688	5.5
Social sciences	436	4.6	1 791	4.6	2 227	4.6
Natural sciences	1 218	12.8	3 782	9.6	5 000	10.2
Medical sciences	1 480	15.5	2 842	7.3	4 322	8.9
Veterinary sciences	147	1.5	576	1.5	723	1.5
Agricultural sciences	736	7.7	2 801	7.1	3 537	7.3
Technical sciences	4 910	51.4	25 321	64.6	30 231	62.0
Total all subjects	9 546	100.0	39 182	100.0	48 728	100.0

Diagram 3.a Government expenditure (including grants from football pools) on higher education and research 1938-1939 until 1965.¹



1. By the Joint Committee of the Norwegian Research Councils.

Diagram 3.b Total expenditure on research and higher education in 1963, showing sources of finance and fields of activity.¹



1. Source: The Research Councils.
2. Including astronomy, chemistry, geology, mathematics, mechanics, physics, etc.
3. Including biological sciences, medicine, dentistry, agricultural and veterinary sciences.
4. Figures for 1962. Government expenditure in 1962 amounted to \$14,145,000. The corresponding figure for 1963 was approximately \$17 million.

Diagram 3.c Distribution of the football pool grants to the Joint Committee and the research councils in 1963. \$ millions.

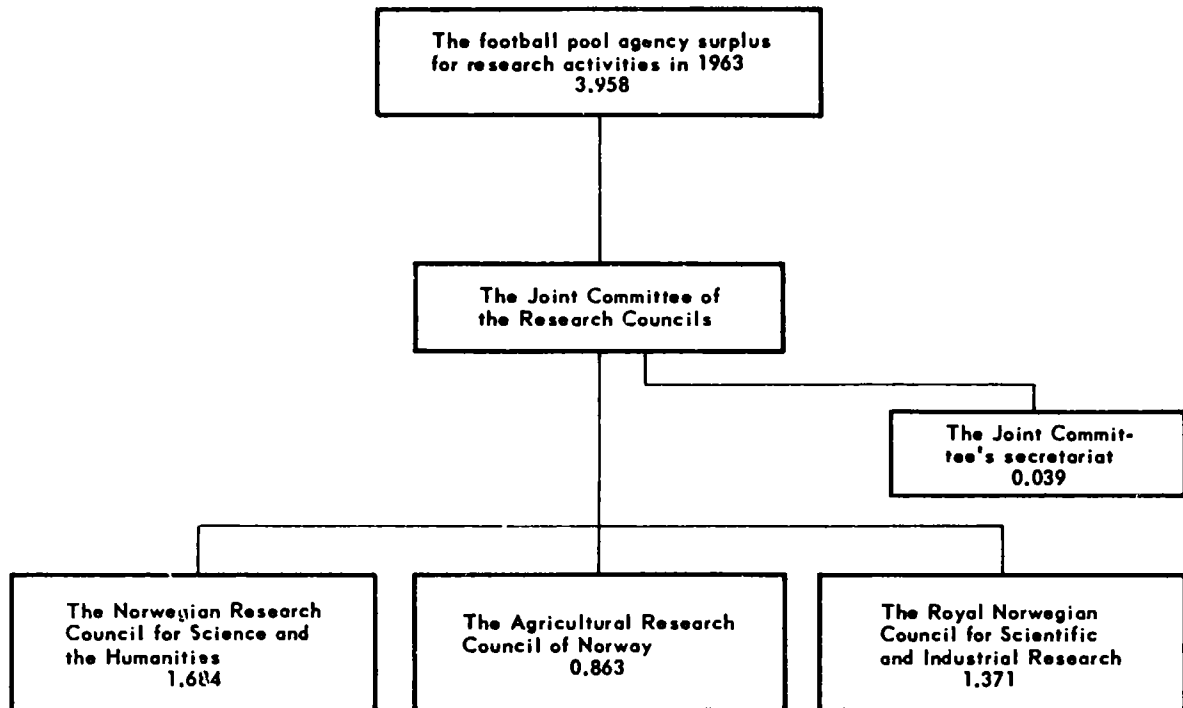
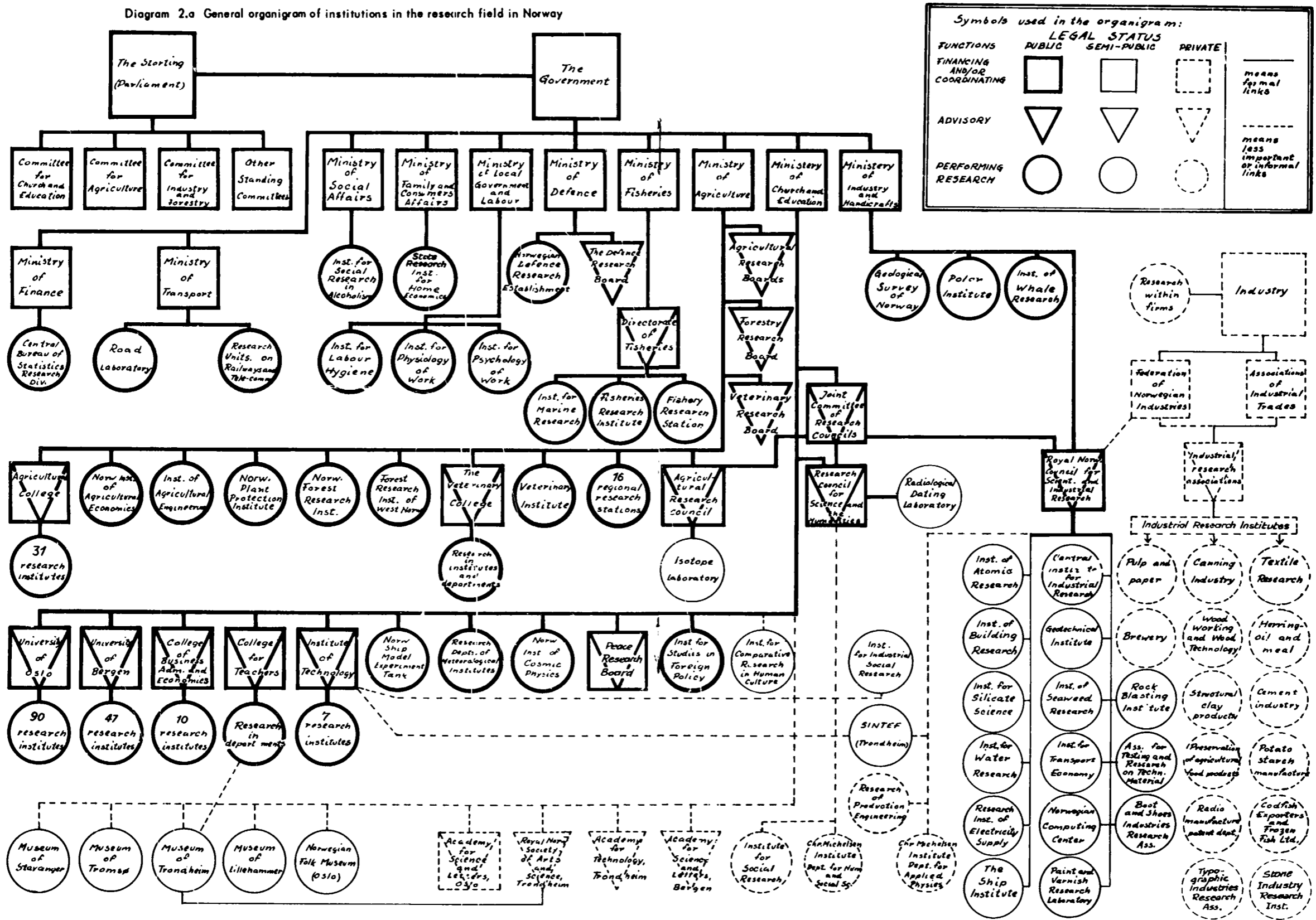


Diagram 2.a

**General organigram
of institutions in the research field
in Norway**

Diagram 2.a General organigram of institutions in the research field in Norway



CHAPTER 4

THE TRAINING AND UTILIZATION OF ACADEMIC, SCIENTIFIC AND TECHNOLOGICAL PERSONNEL

Academic, scientific and technological personnel are recruited from the universities in Oslo and Bergen, the Institute of Technology, the Agricultural College of Norway, the Veterinary College of Norway, the Norwegian School of Business Economics and Administration, and the Independent Theological College. At the College for Teachers, students can at present only pass a lower academic degree (cand. mag.). This may, however, be changed in the not too distant future, as it is planned to reorganize the College for Teachers together with the Institute for Technology to form a third university.

Comprehensive studies investigating both the influx of students into the different branches of university and State college education and the number of graduates examined at these institutions have only been made in recent years. This has been done by the Central Bureau of Statistics, the research councils, and the Joint Committee of the Norwegian Research Councils in co-operation with the institutions concerned.

The Joint Committee has also made surveys of the personnel connected with research and higher education. Detailed figures are, however, only available for the last five years. "Life Sciences" has only been extracted from Natural Sciences for the 1964 figures.

When attempting to give an indication of the number of personnel engaged in research and higher education it is difficult to know where to draw the line. The concept "research" is not so unequivocal that the institutions and organizations which are to be included are clearly defined. The limiting definition of what is to be included under "research" has been worked out by the Joint Committee in consultation with the research councils.

4.1 STUDENTS MATRICULATING FROM SECONDARY SCHOOLS (GYMNASIA)

A Norwegian student wishing to enter one of the institutions of higher education has, as a rule, to

pass the final examination of a gymnasium (examen artium), the final examination of an economics gymnasium, or the final examination of a 3-year technical school. On the basis of one of these examinations, which are taken after seven years of elementary school and five or six years of secondary school, the student usually enters a university or a State college at the age of nineteen or twenty.

The number of students passing the examen artium or an equivalent examination has risen rapidly in recent years. During the inter-war period the number of matriculated students increased from 3 per cent to approximately 5 per cent of the 19 ½ years age-group. In 1964 approximately 17 per cent of the same age-group passed the examen artium.

4.2 STUDENTS AT UNIVERSITIES AND STATE COLLEGES

a. Entrance qualifications

Matriculation does not of course always lead to study at a university or a State college. Admission to certain institutions and faculties is dependent on the subjects the student has studied at gymnasium level. To be admitted to the Institute of Technology, for instance, the student has to have passed the examination of the gymnasium science course or of the 3-year technical school. To be admitted to the Faculties of Medicine one of the two science courses is required, and to enter the Faculty of Theology at the University of Oslo the student must have passed the examination of the gymnasium Latin course with Greek as an additional subject. Students who have not taken the initial course required can, however, pass additional examinations after matriculation and thus enter the field of study they wish, provided they have obtained sufficiently high marks.

At present there is no limitation on the number of students admitted to the Faculties of

Theology, Law, Liberal Arts and Natural Sciences (except for the Institute of Pharmacy) and matriculated students may register for these courses without further formalities. On the other hand, the Faculty of Medicine and the Faculty of Dentistry have maintained a "numerus clausus", mainly due to overcrowded conditions at the universities, and consequently only those with the highest matriculation marks have been able to study medicine. From Autumn 1965 this will, however, be changed, and for those wishing to study medicine, other criteria, such as earlier practice and other examinations, will also be taken into consideration.

Some limitation has to be applied also at the Institute of Technology and the Norwegian School of Business Economics and Administration.

All those wishing to take university degrees, except students of dentistry, have to pass a basic course in philosophy lasting one term, and this is usually done immediately after enrolment. In some faculties the students also have to take pro-paedeutic courses in subjects connected with their major field of study.

In most cases, students entering the Institute of Technology must already have had a year of workshop training before starting their theoretical studies.

Requirements for admission to any of the departments at the Agricultural College as a regular student involve an examination from an agricultural school, 2 or 3 years of experience in the branch concerned, and either the matriculation examination or a special preparatory course.

b. Courses

Preparation for examinations differs very much from subject to subject. It usually involves lectures, courses and laboratory work in varying degrees. Until recently it has not been compulsory, apart from a few instances, for students in the faculties of the humanities and natural sciences to attend lectures. It has thus been up to the students themselves whether they acquire their knowledge from attending courses or independently, since they are generally entitled to present themselves for examination when they feel prepared. This same practice is still followed for the major degrees, but compulsory courses have now been introduced for the minor degrees. In medicine, pharmacy and dentistry, courses and laboratory work are always compulsory but lectures are not.

At the Institute of Technology lectures are held in the different departments and experiments are conducted in the laboratories attached to these.

The College for Teachers is at the moment a teachers' training institution for the intermediate stage of the school system. Research facilities are provided in the laboratories of the Museum of the Society of Science and Letters in Trondheim. Lectures and seminars are held as at the universities.

At the School of Business Economics and Administration teaching is given by lectures and seminars both for those aiming at an entirely commercial degree and for those who intend to become teachers in commercial schools. Visits are also organized, and most students take some practice abroad during their studies.

Veterinary students obtain instruction in such basic subjects as chemistry, zoology and botany at the University of Oslo. Special subjects are, however, taught at the Veterinary College itself. Lectures are not compulsory, but courses are, as well as the four clinics. The last clinic is ambulatory and gives practice outside the college.

c. New students

The number of students registered at institutions of higher education may be expressed in different ways. In this survey the actual number of new students shown in the tables represents those who have passed preparatory courses and are registered as having started their special studies (tables 4.I and 4.II).

A relatively large number of Norwegian students are studying abroad. This is partly traditional but has, especially since the war, been due principally to the limitation of registration of new students in some fields of study. To provide a complete picture of the number of students continuing their studies after matriculation, an estimate has been made of the number going abroad (table 4.III).

The number of new students abroad rose rapidly during the 1950's, when it became possible to obtain loans guaranteed by the State even for studies abroad. The number of Norwegian students abroad seems to have reached its maximum in 1957-1958 and has since dropped due to the increasing difficulty for the foreign institutions in providing space.

It is estimated that students admitted to universities and State colleges in the early 1950's amounted to 30-35 per cent of the total number having passed the matriculation examination. This percentage has, however, been increasing and has in later years been around 50 per cent.

d. Total number of students

The total number of students at universities and State colleges in Norway has varied considerably during the last few decades, as shown in table 4.IV.

The table 4.IV shows again that the number of students in "closed studies" is less influenced by variations in the total number of students than that in "open studies", and especially in humanities and law. While the percentage of law students to the total number of students in Norway was 17 in 1938, it was 22 in 1946, and approximately 6 in 1964. On the other hand the percentage of students in natural sciences was 11 in 1938 and 19 in 1964.

As regards technological subjects, the increase was from approximately 13 per cent in 1938 to nearly 19 per cent in 1964.

Table 4.IV shows the variation of the total number of Norwegian students from 1938 to 1964. The figures show an increase in the number of students studying in Norway from approximately 6,000 in 1938 to 15,000 in 1964, i.e. about 150 per cent. In relation to the age group 20-24 years it represents an increase from approximately 2 per cent to approximately 6.5 per cent. Students abroad are not included in the 1938 figures, but they may be assumed to have been relatively few.

e. Graduates from Norwegian and foreign institutions of higher education

The number of students who passed their examinations in different subjects in accordance with the above-mentioned rules is shown in table 4.V, which includes Norwegians graduating abroad.

f. Examinations and degrees

In the open faculties of the universities degrees can be obtained in various combinations of a great range of subjects.

In other fields the student can specialize at the end of his studies, but the final examination is the same for everybody. The degrees obtainable at the University of Oslo are shown in table 4.VI.

At the University of Bergen teaching is conducted along very similar lines to those at the University of Oslo and table 4.VI also applies to the University of Bergen. So far, however, examinations have only been held in the liberal arts, natural sciences and medicine.

The cand. mag. examination in certain subjects of the natural sciences and liberal arts can also be taken at the College for Teachers on the same basis as at the universities.

The Independent Theological College also has the same examination rights and is entitled to confer degrees equivalent to those of the University of Oslo, although this private institution to some extent stresses other parts of the curriculum than those stressed by the university.

The degrees obtainable at the other institutions of higher education not mentioned above are listed in table 4.VII.

Table 4.VI shows that students of the liberal arts and natural sciences may take a lower degree, cand. mag. (candidatus magisterii), which is regarded as an academic qualification. This degree can form the basis for teaching in secondary schools after being supplemented by a term's attendance at one of the two teachers' courses. In order to qualify for a cand. mag. degree the student must take either one subject at lower level (grunnfag) and two at intermediate level (mellomfag) or three at intermediate level. For the lower level, two terms attendance are required, and for the intermediate level usually three terms.

If the result of the examination is satisfactory, the students may write a specific thesis and extend one of his intermediate subjects into a main subject and obtain a full degree - cand. philol. (candidatus philologiae) or cand. real. (candidatus realium).

For students who do not aim primarily at teaching positions there are special degrees, magister artium or magister scientiarum, which are usually not regarded as higher degrees than the cand. philol. or the cand. real. They involve, however, greater concentration on the main subject, and more attention is paid to the thesis. A "magister" is also eligible for teaching positions in the secondary schools on the same level as a cand. philol. or a cand. real., provided that two of his three subjects are taught in the school and that he has passed one of the above-mentioned teachers' courses.

The licentiate degree, which has been introduced recently, corresponds most closely to a Ph.D. in the United States and may be taken by graduates from all faculties if they have obtained a laudabilis (first class honours) in their final examination. The basic requirement for this degree is a scientific thesis which has to be approved by the Faculty Council. The degree is conferred and the diploma issued by the Faculty when the candidate's work and his two trial lectures have been approved.

Doctor's degrees are not obtained through an examination based on specified studies but are, as a rule, conferred on the basis of a thesis representing independent research work, two trial lectures and a public disputation. A doctor's thesis is assessed by a committee of experts specially appointed by the university in each individual case. This degree ranks higher than an American Ph.D. or a British Ph.D.

Table 4.VIII shows the number of doctors degrees conferred in selected periods.

In certain professions, some supplementary education is required in addition to the university degree. This is for instance the case for theologians, who have a one-year post-graduate course in pastoral theology, and for medical doctors who have one year of compulsory post-graduate hospital work. Students who have graduated in medicine and dentistry at institutions of higher education abroad have also to attend some terms of additional education in Norway and to pass a special examination in order to obtain a Norwegian licentia practicandi.

4.3 ECONOMICALLY ACTIVE POPULATION WITH HIGHER EDUCATION

In 1960, the number of university or State college trained men and women who were economically active was as shown in table 4.IX.

Corresponding figures for vocationally trained personnel are shown in table 4.X. The total

numbers of university or similar graduates under 70 years of age in 1950 and 1960 are shown in table 4.XI.

The university or State-college-training working population has increased approximately 35 per cent from 1950 to 1960. This means that their share of the total population has risen from 1.1 per cent to 1.4, still a comparatively small proportion of the total economically active population.

Table 4.XII and Diagram 4.a show the distribution of the university and State-college-trained population working full time in higher education and research and its variation between 1938 and 1960.

Figures for the total number of personnel engaged in higher education and research in 1963 have been determined by the three research councils (Diagram 4.a). According to the Research Council for Science and the Humanities, the total full-time research and teaching staff for the humanities, natural sciences and medicine in 1963 was 1,860, while the auxiliary staff amounted to 970. The number of personnel engaged in technical sciences was about 4,500, including 2,000 research workers. The number of personnel involved in agricultural research in 1963 was equivalent to 815 full time, made up of 349 research workers and 466 technicians. Compared with 1958-1959, this represents an increase of 184, or 29 per cent.

The technical sciences increased their share of the total during this period. This was also the case with the social sciences, although to a lesser extent. There was some increase for medical scientists while there was a relative decline in the natural sciences, humanities and agricultural sciences.

4.4 ACADEMIC, SCIENTIFIC AND TECHNOLOGICAL PERSONNEL AT UNIVERSITIES AND STATE COLLEGES

The qualified academic, scientific and technological personnel at universities and State colleges can be divided into six groups, namely: professors; assistant professors; amanuenses, curators; lecturers; research fellows; research assistants.

The time devoted to teaching and to research activities differs in each group. Even if the amount of teaching is fixed in each category it is extremely difficult to give any general estimate for the amount of time that goes to teaching and to research. In addition to lecturing there is a varying amount of preparatory work and quite often, for professors also, considerable time is required for administrative duties.

Professors are required to lecture five hours per week, either ex-cathedra or to seminars. As head of a department, however, a professor has reduced teaching duties.

Until recently the position of an assistant professor was generally considered as allowing the holder to engage in extended research activity, and entailed lecturing etc. only three hours a week.

This is gradually changing, however, and the duties of assistant professors now in practice resemble more closely those of professors. Their teaching is similar to that of professors, they conduct examinations on equal terms, and several assistant professors are heads of departments. Furthermore, an assistant professor has a seat on the Faculty Board, he takes part in the daily work of his department, and he can be chosen as a dean of the Faculty. The Senate has taken note of these changes and from the autumn of 1963 an assistant professor will also have five hours lecturing a week, he may be required to teach students at all levels, and he will be formally bound to take part in the administrative work of his department. The work demanded of an assistant professor is at the same high level as of a professor, but the latter is expected to have a more comprehensive scientific production.

Part-time professors or assistant professors, usually engaged at the faculties of medicine, hold teaching appointments while their main employment is at a university teaching hospital or other hospital.

Ranging below assistant professor come amanuenses and curators. They are connected with a department or a museum and should be considered as highly qualified personnel, having varying teaching duties. A "first amanuensis" or a "first curator" with a doctor's degree receives the same salary as an assistant professor, whereas one without a doctor's degree is paid as a lecturer or somewhat less.

Lecturers are first and foremost teachers, giving between 8 and 12 lessons a week. The number of lectures varies somewhat from subject to subject, but the time used for actual teaching and for preparation should not exceed 24 hours. In spite of this, the amount of time available for research activity is not very large.

Research fellows, both those with a university or State college grant as well as those who are attached to these institutions but are paid by the research councils or by other funds, are considered as highly qualified personnel. Their teaching duties should not exceed two hours a week.

Research assistants are usually fresh graduates when they become attached to a university or a State college. They are required to complete 20 hours of different kinds of assistance work a week and may occupy the rest of the time as they choose. A research assistant is usually appointed for three years at a time.

In 1964, universities and State colleges employed nearly 2,200 academic, scientific and technological personnel in full-time positions. In addition, there were nearly 600 part-time positions, some 90 of which were professorates or assistant professorates. The remaining part-time positions were covered by teachers on a lower level, giving a maximum of 4 lectures a week. All faculties have this form of part-time employment, but it is most widely practised in the faculties of

medicine and natural sciences. Of the full-time positions, 87 per cent were at universities and State colleges under the general administration of the Ministry of Education. The Agricultural College and the Veterinary College are under the general administration of the Ministry of Agriculture.

Of the full-time positions 1,885, i.e. 85 per cent, were government-paid, about 8 per cent were financed by the research councils and about 7 per cent were financed by other Norwegian or foreign foundations. The government-paid percentage in 1961 was nearly 80. Table 4.XIII shows the distribution of the government-paid personnel by rank and institution, tables 4.XIVa and 4.XIVb show their distribution by rank and subject.

Of the part-time personnel in 1964 there were 27 professors and 60 assistant professors, as shown in table 4.XV.

The number of students in relation to the number of full-time personnel at Norwegian universities and State colleges under the Ministry of Education is shown in table 4.XVI.

Only full-time scientific personnel paid by the government are included in table 4.XVI, as the teaching duties for those paid by other sources are usually quite light. The number of teaching hours per student would have given a considerably better picture of the teaching standard, but available statistics do not allow such calculations.

Lately the shortage of scientific personnel at universities and State colleges has increased with the great inflow of new students. The problem has been discussed in Parliament and plans⁽¹⁾ are in hand for extending those institutions and ameliorating the teaching conditions. It is estimated that by 1969 the capacity for students at universities and State colleges will be approximately 25,000 and it is hoped that the resulting graduates will adequately supply Norwegian requirements.

(1) Report of the Committee for the Expansion of Universities and University Institutions 1961-1970, Oslo, March 1961.

**Table 4.I Registered new students in the universities
of Oslo and Bergen, 1951 to 1964¹**

	Humanities and Social sciences ²		Natural sciences ²		Medicine ³		Total ⁴	
	Number	%	Number	%	Number	%	Number	%
1951-1955	2,900	65.9	1,000	22.8	500	11.3	4,400	100
1956-1960	4,450	61.4	2,210	30.5	590	8.1	7,250	100
1961	1,270	63.2	560	27.9	180	8.9	2,010	100
1962	1,450	61.0	690	29.0	230	10.0	2,370	100
1963	2,010	64.5	840	27.0	260	8.5	3,110	100
1964	2,150	66.5	820	25.0	270	8.5	3,240	100

1. Data from the Norwegian Research Council for Science and the Humanities.
2. Figures do not include those aiming at M.A. or M. Sc. degree, or actuaries.
3. The College of Dentistry was incorporated in the University of Oslo in 1961.
4. It should be noted that, although totals are included to give significance to the percentages, registration in the different subjects is not made simultaneously.

Table 4.II New students at the State Colleges, 1951 to 1964¹

		1951-1955	1956-1960	1961	1962	1963	1964
School of Business Economics and Administration	Number	280	290	60	90	130	175
	%	11.6	8.6	6.5	10.0	12.0	14.0
College for Teachers²	Number	-	390	290	270	280	330
	%	-	11.5	30.5	27.0	26.0	26.5
Institute of Technology	Number	1,440	1,900	470	485	515	590
	%	59.6	56.5	50.0	49.5	48.5	47.0
College of Agriculture	Number	330	430	100	110	115	125
	%	13.7	12.8	10.5	11.0	11.0	10.0
Veterinary College	Number	110	100	25	25	25	30
	%	4.6	3.0	2.5	2.5	2.5	2.5
College of Dentistry³	Number	255	255	-	-	-	-
	%	10.5	7.6	-	-	-	-
Total	Number	2,415	3,365	945	980	1,065	1,250
	%	100	100	100	100	100	100

1. Data from the Norwegian Research Council for Science and the Humanities.

2. Students taking minor degrees ("cand. mag.").

3. The College of Dentistry was incorporated in the University of Oslo in 1961.

Table 4.III Norwegian students entering institutions of higher education abroad, 1951 to 1964.¹

	Medicine and dentistry		Engineering and architecture		Other subjects		Total	
	Number	%	Number	%	Number	%	Number	%
1951-1955	200	36.4	300	54.5	50	9.1	550	100
1956-1960	1,200	42.1	1,250	43.9	400	14.0	2,850	100
1961	230	40.3	250	44.0	90	15.7	570	100
1962	280	43.0	270	41.6	100	15.4	650	100
1963	390	49.5	300	38.0	100	12.5	790	100
1964	310	43.0	320	44.5	90	12.5	720	100

1. Data for the State Loan Fund for Students. Students taking short courses are not included. The figures for the two 5-year periods are estimates.

Table 4. IV Variation of number of Norwegian students, 1938 to 1964, showing percentages for different subjects. The numbers studying abroad are included in the main numbers and are also shown separately, in brackets.¹

	1938		1950		1955		1960		1961		1962		1963		1964	
	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%
Humanities and social sciences	2,950	52	3,600	54	2,770	35	4,470	36	5,250	38	5,600	40	7,230	42	7,225	45
" " " (abroad) ²					(300)		(320)		(350)		(350)		(390)		(490)	
Natural sciences	650	11	940	13	920	12	2,120	17	2,500	18	2,900	19	3,450	19.5	3,870	19.5
Medicine and Dentistry	1,190	20	930	13	1,520	19	2,380	19	2,470	18	2,580	16.5	2,810	16	2,985	14.5
" " (abroad)					(710)		(1,280)		(1,340)		(1,470)		(1,600)		(1,680)	
Agricultural and Veterinary sciences	220	4	370	6	320	4	400	3	440	3.5	460	3	440	3	460	2.5
Engineering and Architecture	760	13	980	14	2,390	30	3,050	25	3,090	22.5	3,180	21.5	3,400	19.5	3,730	18.5
" " (abroad)					(1,290)		(1,200)		(1,140)		(1,130)		(1,200)		(1,330)	
Total	5,770	100	7,020	100	7,920	100	12,420	100	13,750	100	14,720	100	17,330	100	18,570	100
" (abroad)					(2,300)		(2,800)		(2,800)	(20.5)	(2,900)	(20)	(3,190)	(18.5)	(3,500)	(17.5)
Total as percentage of population age-group 20-24	1.9		2.6		2.7		4.5		5.2		5.5		6.2		6.4	

1. Data for 1938 according to the Central Bureau of Statistics. Other figures from the Norwegian Research Council for Science and the Humanities.
2. Estimates. Figures for Norwegian students abroad for 1938 and 1950 unobtainable. Short course students abroad not included.

Table 4.V Graduates from Norwegian and foreign institutions of higher education in selected 5-year periods and in the single years 1961 to 1964, showing percentages for the different subjects.¹

	1936-1940		1946-1950		1951-1955		1956-1960		1961		1962		1963		1964	
	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%
Humanities and social sciences ²	1,500	42.5	2,900	44.8	2,780	41.5	1,390	26.0	⁴ 431	23.0	⁴ 539	27.5	⁴ 557	27.0	⁴ 677	31.0
Natural sciences	280	7.9	400	6.2	550	8.0	480	9.0	⁵ 328	17.5	⁵ 371	19.5	⁵ 457	22.5	⁵ 424	19.5
Medicine and Dentistry ³	710	20.1	1,230	18.9	1,000	15.0	1,060	19.0	258	14.0	244	12.5	307	15.0	349	16.0
Agriculture and Veterinary sciences	120	3.4	400	6.2	450	7.0	470	8.0	101	5.5	109	5.5	108	5.5	115	5.5
Engineering and Architecture ³	920	26.1	1,550	23.9	1,920	28.5	2,100	38.0	⁶ 739	40.0	⁶ 664	35.0	617	30.0	610	28.0
Total	3,530	100	6,480	100	6,700	100	⁷5,500	100	1,857	100	1,927	100	2,046	100	2,175	100

1. Data up to 1961 from Norwegian Research Council for Science and the Humanities, data from 1962 onward direct from the institutions.
2. Managerial economists examined abroad not included.
3. Including Norwegian graduates from foreign universities.
4. Including 158 cand. mag. in 1961, 184 in 1962, 225 in 1963 and 290 in 1964; also including 20 exam. oecon. in 1962, 36 in 1963, and 29 in 1964.
5. Including 208 cand. mag. in 1961, 251 in 1962, 272 in 1963 and 229 in 1964.
6. Including 350 from foreign institutions in 1961 and 300 in 1962.
7. The drop in this figure compared with that for 1951-1955 may be to some extent a consequence of a reduced birth-rate during the war years.

Table 4.VI Degrees obtainable at the University of Oslo

Faculty	Abbreviation	Full Latin form	Average length of study ¹
Theology	Cand. theol.	Candidatus theologiae	6 years
	Dr. theol.	Doctor theologiae	No time limit
Law	Cand. jur.	Candidatus juris	5 years
	Cand. oecon.	Candidatus oeconomiae	5 years
	Examin. oecon.	Examinatus oeconomiae	3 years
	Mag. art.	Magister artium	5-7 years
	Licentiat	Licentiatius juris	No time limit
	Dr. juris.	Doctor juris	No time limit
	Dr. philos.	Doctor philosophiae	No time limit
Humanities	Cand. mag.	Candidatus magisterii	4-5 years
	Cand. philol.	Candidatus philologiae	6-7 years
	Cand. psychol.	Candidatus psychologiae	5 years
	Cand. paed.	Candidatus pedagogiae	4 years ²
	Mag. art.	Magister artium	5-7 years
	Licentiat	Licentiatius philosophiae	No time limit
	Dr. philos.	Doctor philosophiae	No time limit
Natural sciences	Cand. actuar.	Candidatus actuarius	6 years
	Cand. mag.	Candidatus magisterii	3½ years
	Cand. pharm.	Candidatus pharmaciae	4½ years
	Cand. real.	Candidatus realium	5½ years
	Mag. scient.	Magister scientiarum	5-7 years
	Licentiat	Licentiatius philosophiae	No time limit
	Dr. philos.	Doctor philosophiae	No time limit
Medicine	Cand. med.	Candidatus medicinae	6½ years
	Dr. med.	Doctor medicinae	No time limit
Dentistry	Cand. odont.	Candidatus odontologiae	4 years
	Dr. odont.	Doctor odontologiae	No time limit

1. There is no time limit on the period of study allowed for the different degrees. Doctors degrees and licentiate degrees are taken over a very varied number of years,

2. Following on 2 or 4 years teachers' training college,

Table 4.VII Degrees obtainable at the state colleges

Institution	Degree	Average length of study
Institute of Technology	Bachelor of Engineering (siv. ing.)	4-4½ years
	Bachelor of Architecture	4-4½ years
	Licentiatius	No time limit
	Doctor Technicae	No time limit
Agricultural College of Norway	Bachelor of Agriculture	3 years
	Licentiatius	No time limit
	Doctor of Agriculture	No time limit
Veterinary College of Norway	Bachelor of Veterinary Science	5½ - 6 years
	Doctor of Veterinary Science	No time limit
School of Business Economics and Administration	Bachelor of Commerce	3 years
	Bachelor of Commerce specializing to become teacher at a business college	4 years
	Licentiatius	No time limit
	Doctor Oeconomiae	No time limit

Table 4.VII Doctors degrees conferred in the 5-year period 1960-64¹ and in the single year 1964¹

Institution, degree	Number of doctor degrees conferred	
	In 1964	During 1960-1964
University of Oslo		
Doctor theologiae	0	1
Doctor juris	3	6
Doctor medicinae	17	40
Doctor philosophiae		
humanities	2	27
social sciences	2	14
natural sciences	13	47
Doctor odontologiae	3	6
University of Bergen		
Doctor medicinae	1	4
Doctor philosophiae		
humanities	1	5
natural sciences	1	8
State College of Dentistry (see University of Oslo)		
Institute of Technology	7	16
School of Business Economics and Administration	0	1
Agricultural College of Norway	0	5
Veterinary College of Norway	0	2
Total	50	182

1. Data obtained from the respective institutions.

Table 4.IX Economically active population with higher education
(universities and state colleges) in 1960; shown by
age-groups, to the nearest 50.

Age-groups →	All	15-19	20-24	25-29	30-39	40-49	50-59	60-69	70 or over
Men	34,800	-	400	3,450	10,500	8,800	7,150	4,100	400
(as % of total vocationally trained economically active male population)	11.4	-	1.6	9.0	11.5	11.5	13.6	14.6	20.0
Women	3,000	-	100	400	850	750	550	300	50
(as % of total vocationally trained economically active female population)	3.8	-	0.7	4.1	5.5	5.5	4.6	5.3	8.3
Total	37,800	-	500	3,850	11,350	9,550	7,700	4,400	450
(as % of total vocationally trained economically active population)	10.0	-	1.3	8.0	10.6	10.6	11.9	13.0	17.3

Table 4.X Economically active population with vocational education¹
in 1960; shown by age-groups, to the nearest 100.

Age-groups →	All	15-19	20-24	25-29	30-39	40-49	50-59	60-69	70 or over
Men	321,000	7,900	24,300	38,400	91,100	76,700	52,500	28,100	2,000
(as % of total economically active male population)	34	11	28	40	38	31	26	22	10
Women	78,500	6,600	14,900	9,700	15,400	13,600	12,000	5,700	600
(as % of total economically active female population)	24	12	31	39	35	26	21	17	14
Total	399,500	14,500	39,200	48,100	106,500	90,300	64,500	33,800	2,600
(as % of total economically active population)	28	20	29	40	38	30	25	21	11

1. With more than one year courses.

Table 4.XI University and similar graduates under 70 years of age in 1950 and 1960 ¹

	1950		1960		Percentage increase from 1950 to 1960
	Numbers	% of total	Numbers	% of total	
Humanists and social scientists	9,600	38.6	12,600	37.0	30
Natural scientists	1,950	7.8	2,950	9.0	50
Doctors and dentists	4,900	19.7	6,400	19.0	30
Agricultural and veterinary	2,400	9.7	3,050	9.0	25
Engineers and architects	6,000	24.2	8,700	26.0	45
Total	24,850	100	33,700	100	35

1. Computed on the basis of figures published by the Joint Committee of the Norwegian Research Councils ("Om behovet for og tilgangen på akademisk arbeidskraft") and the number of candidates for the later years.

Table 4.XII Variations in the number of full-time personnel engaged in Norwegian higher education and research

	1938-1939		1952-1953		1956-1957		1960	
	Numbers	% of total	Numbers	% of total	Numbers	% of total	Numbers	% of total
The humanities natural sciences and medicine	600 (250)	48	1,500 (600)	45	1,800 (750)	39	2,300 (1,000)	38
Agricultural and veterinary sciences	250 (150)	20	650 (400)	19	800 (450)	17	800 (450)	13
Technical sciences	400 (200)	32	1,200 (650)	36	2,000 (1,200)	44	3,000 (1,800)	49
Total for higher education and research	1,250 (600)	100	3,350 (1,650)	100	4,600 (2,400)	100	6,100 (3,250)	100

1. The figures in brackets indicate the number of auxiliary personnel (technicians, administration, etc.) included in the overall figures. Thus the numerical ratio of auxiliary personnel to personnel engaged in higher education and research proper was 0.9 in 1938-1939 and 1.1 in 1960.

Table 4.XIII. Full-time academic, scientific and technological personnel at the different institutions in 1964, showing the percentage distribution in different ranks.

	University of Oslo		University of Bergen		NTH ¹		NHH ²		NL ³		NLH ⁴		NVH ⁵		TOTAL	
	Numbers	%	Numbers	%	Numbers	%	Numbers	%	Numbers	%	Numbers	%	Numbers	%	Numbers	%
Professors ⁶	160	18.7	63	22.1	76	18.2	17	28.3	8	17.0	33	20.6	12	17.9	369	19.5
Assistant professors ⁶	66	7.7	37	13.0	47	11.2	7	11.7	8	17.0	12	7.5	8	11.9	185	9.8
Lecturers, amanuenses, curators	359	42.0	107	37.5	133	31.8	22	36.7	28	59.6	54	33.8	24	35.8	727	38.4
Research assistants ⁷	202	23.6	68	23.9	117	28.0	8	13.3	3	6.4	55	34.4	21	31.4	474	25.1
Research fellows ⁷	68	8.0	10	3.5	45	10.8	6	10.0	-	-	6	3.7	2	3.0	137	7.2
Total	855	100.0	285	100.0	418	100.0	60	100.0	47	100.0	160	100.0	67	100.0	1,892	100.0

1. Norwegian Institute of Technology.

2. Norwegian School of Business Economics and Administration.

3. Norwegian College for Teachers.

4. Agricultural College of Norway, Figures for Government-paid posts only.

5. Veterinary College of Norway.

6. Including 6 professors and 1 assistant professor not paid by Government grants.

7. Financed by Government grants only.

Tables 4.XIV, a and b Full-time academic, scientific and technological personnel at universities and state colleges in 1964, showing distribution by rank and by subjects.

Table 4.XIVa. Showing percentages in different ranks

	Humanities ¹		Social sciences		Natural sciences		Life sciences		Technical sciences		Total all subjects	
	Numbers	%	Numbers	%	Numbers	%	Numbers	%	Numbers	%	Numbers	%
Professors ²	69	24.2	45	23.2	44	13.7	135	20.1	76	18.2	369	19.5
Assistant professors ²	28	9.8	24	12.4	28	8.7	58	8.6	47	11.2	185	9.8
Lecturers, amanuenses, curators	149	52.1	80	41.2	140	43.6	225	33.4	133	31.8	727	38.4
Research assistants ³	21	7.3	20	10.3	95	29.6	221	32.8	117	28.0	474	25.0
Research fellows ³	19	6.6	25	12.9	14	4.4	34	5.1	45	10.8	137	7.3
Total, all ranks	286	100	194	100	321	100	673	100	418	100	1 892	100

Table 4.XIVb. Showing percentages in different subjects.

Professors ²	69	18.7	45	12.2	44	11.9	135	36.6	76	20.6	369	100
Assistant professors ²	28	15.1	24	13.0	28	15.1	58	31.4	47	25.4	185	100
Lecturers, amanuenses, curators	149	20.5	80	11.0	140	19.2	225	30.8	133	18.5	727	100
Research assistants ³	21	4.4	20	4.2	95	20.0	221	46.6	117	24.8	474	100
Research fellows ³	19	13.9	25	18.2	14	10.2	34	24.8	45	32.9	137	100
Total, all ranks	286	15.1	194	10.3	321	17.0	673	35.6	418	22.0	1,892	100

1. Including theology.

2. Including 6 professors and 1 assistant professor not paid by Government grants.

3. Estimates.

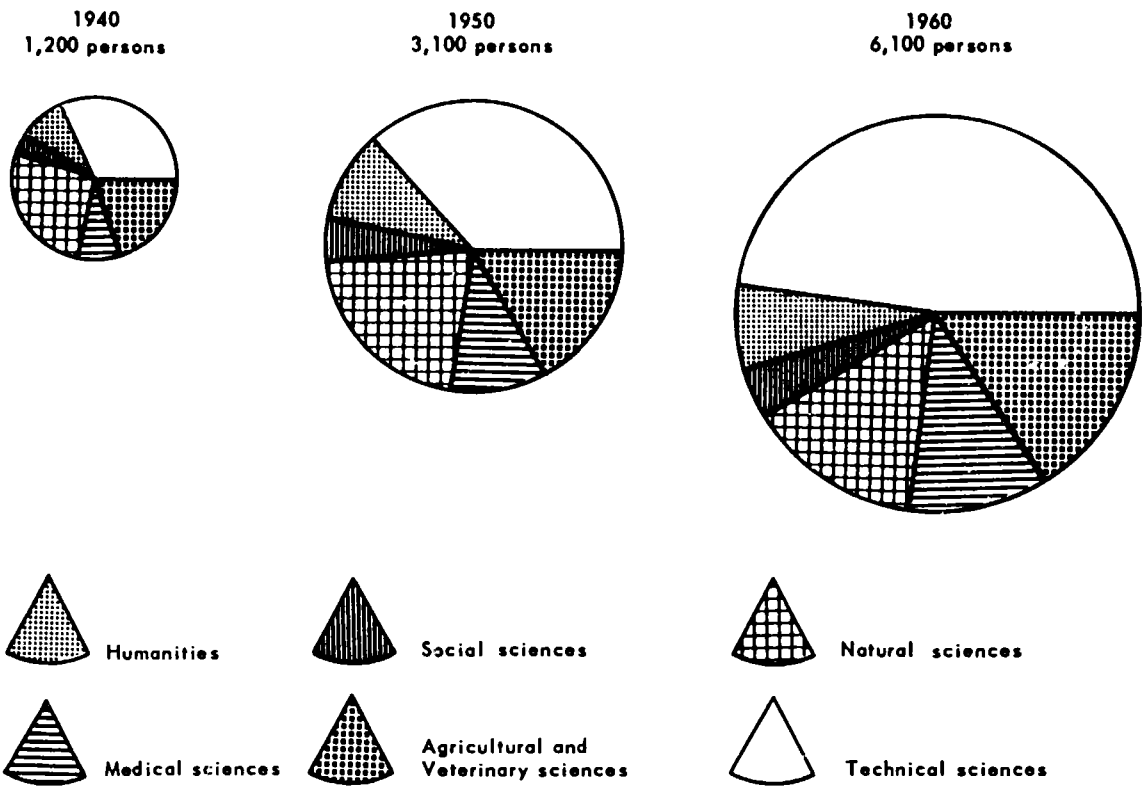
Table 4.XV Part-time professors and assistant professors in 1964.

	Humanities	Social sciences	Natural sciences	Life sciences	Technical sciences	Total
University of Oslo :						
Professors	1	1	2	18	-	22
Asst. professors	-	-	1	38	-	39
University of Bergen :						
Professors	-	-	1	-	-	1
Asst. professors	-	-	-	15	-	15
Institute of Technology :						
Professors	-	-	-	-	2	2
Asst. professors	-	-	-	-	6	6
State College for teachers :						
Professors	-	-	-	2	-	2
Total :						
Professors	1	1	3	20	2	27
Asst. professors	-	-	1	53	6	60
The independent Theological College employs 10 persons with university-level qualifications.						

Table 4.XVI Number of students per academic, scientific and technological position at universities and state colleges under the Ministry of Education.

	1938	1946	1952	1956	1960	1962	1964
Students per position	11	12	7	7	8	8	9

Diagram 4.a Full-time personnel engaged in higher education and research work in 1940, 1950, and 1960.



CHAPTER 5

THE MAIN OBJECTIVES OF NATIONAL SCIENTIFIC POLICY AND THEIR RELATION TO NATIONAL PLANS FOR ECONOMIC AND SOCIAL DEVELOPMENT

5.1 THE INTERDEPENDENCE BETWEEN RESEARCH ACTIVITY AND ECONOMIC AND SOCIAL DEVELOPMENT

The interdependence between, on the one hand, research activity and, on the other, economic and social development is marked and clear in most fields of applied research. In other fields, however, such as the greater part of fundamental research, it is rather vague. In some cases effects of research can be observed after a short time, in other cases only after a long time.

Norway is closely linked with the outside world both economically and in its cultural and social life. Of utmost importance to the country has been the stimulus from research and technology in other countries, either in the form of commodities, machines, developed techniques, etc., or in the form of research results which have to be digested and adapted for use in Norway.

In some fields the importance of research and development to economic and social growth has long been understood in Norway, but on the whole it is only since World War II that this has been more generally recognized for the majority of sectors and in many types of research. It is still not fully acknowledged, however, that practically all types of research affect economic and social development either in the short or the long run. How these effects work and how strong they are is still comparatively unexplored ground and in fact involves very complicated research problems.

Interdependence also means that research and scientific policy are influenced by the economic and social situation. As will be shown in the following, the character and dimensions of research in Norway have been strongly influenced by the special institutional background and economic structure of the country.

5.2 NATIONAL SCIENTIFIC POLICY AS PART OF THE NATION'S GENERAL POLICY

Although there has been considerable economic planning and many individual development plans have been prepared since the second World War, it would give a false picture to say that government policy has been based on a specified overall plan for the development of all sectors of the community. This has not even been the case with regard to the activities of official institutions. The general policy of the government has been outlined in the form of leading "principles", in programmes (more or less long-term and more or less specified) for special areas, and in the yearly fiscal and national budgets. Of special interest in this connexion are the so-called long-term programmes published since World War II.⁽¹⁾

Some examples of the position occupied by science policy within the framework of general policy may be taken from these 4-year programmes. In the first really comprehensive programme, that of 1953, research in general is placed under the heading "cultural activities", in this way stressing the aspect of research as a kind of consumption and thus an aim in itself. The investment character of research is, however, clearly indicated in connexion with the treatment of the different industries (manufacturing industries, agriculture, fishery, etc.).

In the long-term programme for the period 1966-1969, research is dealt with under a special heading. The general cultural aspect of research

(1) Appendix 11 to the fiscal budget 1945-1946 (for the reconstruction period after the war). St. meld. (Report to the Parliament) 54 (1948) (for the period 1949-1952, in connexion with the Marshall plan), St. meld. 62 (1953) (for the period 1954-1957), St. meld. 67 (1957) (for the period 1958-1961), St. meld. 60 (1960-1961) (for the period 1962-1965), St. meld. 63 (1964-1965) (for the period 1966-1969).

is mentioned, but the stress is laid on the economic importance of research. In addition, and in this case in line with the earlier programmes, the importance of research to economic growth is underlined in the sections dealing with the problems of the different industries. To sum up, the long-term programmes have stressed the necessity of applied research and development for the growth of specified sectors and industries, but research in general and fundamental research especially have only very recently been regarded in the same way, as a definite factor of general policy. There has been a growing tendency to acknowledge that research must play an important part in the development of the country, but there seems to have been some difficulty in practice in utilizing action in the research field as an instrument in the general economic policy. The long-term programme for 1966-1969 includes plans for a greater research effort than in the preceding period and for the setting up of a special Government Committee for research questions. This committee "shall, in co-operation with public and private research institutions, deal with the organizational problems of research and aim at developing a co-ordinated and active research policy".

Long-term programmes covering special fields often point to research and development as being among the main factors for applying policy. A special programme of this kind is the report on the development of universities and colleges in the sixties.⁽²⁾ Although this report is mainly concerned with the expansion of the educational capacity of the universities and colleges, it also lays down principles with regard to the recruitment of scientists and the development of research within the institutions, especially stressing the necessity of ensuring that research activities do not lag behind in the expansion of universities and colleges.

5.3 THE MAIN OBJECTIVES OF NATIONAL SCIENTIFIC POLICY AND THE PRIORITY PROBLEM IN SCIENCE POLICY

What may be called Norwegian national scientific policy consists of a number of "policies", each covering different fields, drawn up by different ministries, research councils and other agencies. These policies are partly co-ordinated through the budgetary system and the system of research councils. As regards fundamental research, the Ministry of Education exercises a decisive influence but the universities and their institutes have far-reaching self-government in the choice of research projects, while the influence of the Norwegian Research Council for Science and the Humanities is great, as regards both the character and volume of fundamental research. In the case of applied research, the number of decision-taking bodies is much greater. Several ministries, research councils, foundations, institutes, co-operative research institutes and private firms form their own

research policies. Through the system of research councils and through the central government budget procedure, co-ordination of the different research activities financed by public money takes place. But a great part of research, for instance most privately financed research, is not co-ordinated in this way.

The overall research policy of the government has had the character of a general attitude rather than of a specific programme. An illustration of this is to be found in the handling of the question of the utilization of the surplus of the State-run football pool system when it was introduced in Norway in 1946. It was decided that the surplus should be divided between sport and science, with an increasing percentage going to science as the surplus increased. This showed the favourable attitude of the authorities towards science as such, but on the other hand it is clear that the authorities did not at the time foresee the size of the sums that science would acquire from this new source. The relatively great stimulus which research received in Norway in the fifties on the basis of funds from the football pools can therefore only partly be said to have originally been planned by the authorities. However, when the big football pool surpluses occurred, the new situation was accepted unhesitatingly by the authorities, with the one modification that they asked the research councils to meet, for a transitional period, the cost of projects (especially building projects) which would otherwise have to be covered in the fiscal budget. Today the policy seems to be increasingly to cover in the fiscal budget outlays which, under the system of 1946, were to be paid for from football pool receipts.

The various objectives of science policy in Norway are not common to all research bodies. Some institutions stress certain objectives, others place the emphasis elsewhere. Objectives may be short- or long-term. Distinction is made between the direct and indirect effects of the policy aims in fundamental research. From the long-term point of view, and also taking account of indirect implications, the differences between fundamental and applied research seem to be of minor importance.

The objectives of Norwegian science policy may be outlined in several ways. They can be divided into the following main sections:

- (a) Promotion of fundamental research in main fields. This is especially a university point of view. Coverage is requested, more or less independently of national economic and social priorities, for what are regarded as the main fields of science.
- (b) The provision of adequate opportunity to eminent scientists to work in their special fields. Regardless of whether the field of activity involved is a major one or not, really eminent scientists should be given the best possible opportunity to

(2) The report was presented in March 1961.

work in sectors which they have themselves chosen. This is a view accepted in all circles and by public opinion, although it can often prove difficult in the small research milieu of Norway to provide such scientists with satisfactory working conditions.

(c) Development of research necessary as the basis for higher education and the recruitment of scientists. This is an objective especially advocated by the universities and colleges, the research councils and the Ministry of Education. It is connected with (a), but is another aspect of policy.

(d) The encouragement of branches of science which have special Norwegian conditions as their fields of study. There are many sectors which are of special interest to Norwegians and which are not usually studied by non-Norwegians. The Norwegian judicial system, and Norwegian history, literature, geology, zoology and flora are all examples of this. The results of this type of research are required by, among others, schools, administrative units and various industries. These results are also a most natural source of "raw material" for Norwegian scientists.

(e) Development of research on important regional differences. This can be looked upon as a special aspect of (d). There are many important geographical variations in Norway which can be of great practical interest. These may be climatic, geological, social, linguistic, etc. There is accordingly a need for regional meteorological, geological, agricultural, fisheries, dialectal and sociological research.

(f) Encouragement of applied research in fields of special importance for the economic and social development of Norway. This is the main objective of the bulk of applied research and represents in particular the point of view of the ministries responsible for different sectors of the economy, the technological and agricultural research councils, the colleges and private industries. As regards the use of resources, this is by far the most important of the objectives of Norwegian science policy.

The objectives mentioned above, embodied in the practical form of requests made by the different research institutions, cannot, even in the long run, be completely achieved. A choice must always be made as to the best way of disposing of the limited resources. As already mentioned, there are many decision-making bodies involved in Norwegian science policy. These are responsible for the order of priorities represented in the general lines of policy. In the following, some of the aspects of problems of priority will be mentioned.

(a) Limitation of resources may refer to scarcity of financial resources, manpower, appropriate buildings, technical equipment, etc. In each of these sectors there has been a fairly substantial shortage in Norway. Those institutions which make policy decisions have had to decide on priorities with regard to the use of both financial and

other resources in the different fields.

In the long run, however, the scarcity of qualified manpower seems to be the real bottleneck. Taking into account the rapidly increasing number of specialized fields within modern science, it is evident that research in Norway can only cover a fraction of these even if everything is done both to recruit new scientists and to give the research institutes a flexible organization enabling them to cover a rather wide range of activities when necessary. The manpower priority problem thus has several aspects. Firstly, the shortage of scientists can be reduced by different educational and recruitment policies. Secondly, the shortage can be reduced by better organization of and technical assistance to the existing body of scientists. Finally, the authorities can aim at a more nearly optimal allocation of the limited manpower resources between the different sectors of research.

(b) The fact that Norway is a small country makes the problem of limited resources a much graver and more important question than would be the case in a big country. The number of scientists in each main field is so restricted and the scientific milieu so small, that the specialities embarked upon cannot be numerous. This is the case as regards fundamental research and even more so for applied research. On the other hand, it is in the Norwegian interest to be able to follow and make use of the growing stream of scientific results from other countries. Norway must have a large import of research results as she also has of actual commodities. An important part of Norwegian science policy must therefore be to establish a system by which it will be possible effectively to receive, to transform and to apply these results.

(c) Fixing of priorities in deciding between the use of resources for research and for other activities is the responsibility of the political authorities and, in the case of privately financed research, the firms concerned.

For private business this is, or rather should be, included in calculations aiming at highest possible long-term profitability. Awareness of the usefulness of research is, however, limited (the majority of Norwegian industrial units are small). It has therefore become an important part of official science policy to provide incentives to privately financed research (see 5.4(c)).

As regards research under public control, the allotment of funds from the football pools has been fixed by law and these are, in practice, at the disposal of the research councils. Appropriations in the fiscal budget take account of these funds and, vice versa, the ministries have regard to the disposable funds of the research councils when fixing budgets for research activity. Research is not treated as an independent sector in general budgetary discussions, but figures as an item in each individual ministry's budget. In addition there is the fact that research is, to a great extent, linked to education and in some degree to the

information services directed towards industry. Accordingly, there is no explicit overall fixing of priorities between research as a whole and other activities, neither within the framework of the fiscal budgets nor in the long-term programmes. The policy decided upon does, of course, imply certain priorities. However, it is only within limited areas of research that there is any absolutely determined allotting of priorities.

(d) The priority problem within the scientific field as a whole involves an evaluation of the relative importance attached to the different objectives of science policy mentioned above, from both the short- and long-term point of view. These priorities are, however, decided upon by many individual institutions. An overall appraisal of the whole scientific field takes place only in the form of the general lines followed by the government and the research councils.

Within the field of fundamental research the Ministry of Education, the universities and the Norwegian Research Council for Science and the Humanities have a decisive influence on priorities, the Ministry being more concerned with the general lines followed, the institutions and the Research Council more with the specific allocation of resources. There is, however, some tendency in this field to take the existing allocation as more or less given and to use, to some degree, a system of proportional growth where increases are concerned. For fundamental research it has proved very difficult to arrive at a generally acceptable basis for priority fixing, but - especially through the activities of the Norwegian Research Council for Science and the Humanities - practical solutions have been found.

This problem of priority fixing is somewhat easier in the fields of applied research because of its closer connexion with actual economic and social needs. Here, however, the decision making is more scattered, responsibility resting with several ministries and the whole private sphere taking an active part. This latter situation is to a great extent counteracted through active co-ordination by the Royal Norwegian Council for Scientific and Industrial Research and the Agricultural Research Council of Norway, not only as regards the money directly administered by them but also in their capacity as advisory bodies for most of the research work in their respective fields financed by public money through co-operation within industry. The Ministry of Industry uses the Royal Norwegian Council for Scientific and Industrial Research as its advisory body for most research activity falling under the Ministry, and in practice this Research Council has a dominating influence on the allocation of money which is appropriated in the budget of that Ministry (with the exception of atomic energy research). The influence of the Agricultural Research Council on the Ministry of Agriculture is not so extensive, especially taking into consideration the fact that the colleges for agriculture and forestry and for veterinary science are administered

by this ministry. However, together with the influence exercised by these colleges and some research institutes not attached to them, the Research Council has a dominating influence on priority fixing within agricultural research.

5.4 THE MEANS OF APPLYING SCIENCE POLICY

To achieve the aims described in 5.3 the government and the research councils exercise many different means. These means may be used to implement a policy which aims at an increased volume of research, or at a greater effectiveness of scientific work, or at a change in the distribution of research resources. The instruments of policy are manifold. In this connexion it will be possible to mention only some of them - those which are of greatest importance.

(a) Financing research

Money for research is distributed through public budgets, research councils, funds, etc. (cf. chapter 3). This implies an effective means of influencing both the total volume of research and its distribution. Details of research are generally left to the institutions and the research councils, whereas the general lines of policy and investment are decided by the ministries involved.

(b) Establishment of new institutes

In applied research an effective means of furthering a special branch of science may be the establishment of a new institute. This has been the case especially in the technological field, but also in others; an example of the latter is the establishment of a new institute of applied social research which has recently been approved by the national assembly.

(c) Giving incentives to research within industry

The means for providing incentives in this connexion are to be found in the activities of the research councils (taking initiative, giving information and aid, furthering co-operation), in direct public support of specialized industrial research institutes and in the establishment of institutes for sponsored research. Other means include legislation giving industrial sectors the right to some sort of "self-taxation" for collective research activities (as is the case in the canned goods industry) or giving them special taxation arrangements for money spent on research. Limited access to such arrangements is allowed in the ordinary tax law.⁽³⁾ A

(3) Skattelov for landet av 18. aug. 1911. Nr.8 § 44. (Ordinary taxation law for rural areas.) Skattelov for byene av 18. aug. 1911. Nr.9 § 38. (Ordinary taxation law for urban areas.)

new law was passed in 1962, granting firms the right to deduct from their taxable income sums earmarked for specific research purposes.

(d) International co-operation in scientific matters is a very important instrument of science policy in Norway, as a small country dependent on results in other countries. Co-operation between the Scandinavian countries is particularly close in many sectors, but Norway also tries to play an active part with other countries and within international organizations. Co-operation mainly takes the shape of joint institutes, of division of labour, but may also be on a non-institutional basis. An example of co-operation with another country was that between Norway and the Netherlands during the first period of atomic research at Kjeller (near Oslo). The boiling-water reactor project at Halden is based on co-operation between several OECD countries, and Norway takes part in the Dragon project in the United Kingdom and Eurochemic in Belgium. A special means of implementing this aspect of Norwegian policy is the scholarship system (mainly under the research councils) for studies abroad.

(e) An adequate organization for administering research activity is an important means of encouraging co-ordination and co-operation and thereby achieving the best possible use of existing resources of manpower, technical equipment, buildings, libraries, etc. The setting up of the research councils has been the main effort in this direction, but also within the individual institutions efforts are being made to create better organization. This is the case with regard to the Institute of Technology in Trondheim and the University of Oslo.

(f) A long-term recruitment policy for scientists has been one of the main objectives, of, especially, the research councils, who have used scholarships and have created posts for new staff at the various institutions etc. as a means to this end.

(g) The results of research are disseminated by several ministries (especially the Ministries of Agriculture, Industry, Fisheries, and Family and Consumer Affairs), by the research councils, and through the institutes for sponsored research. Various methods are used - special advisory bureaux, circulation of relevant literature, courses, booklets, scientific journals and other periodicals, films, etc. Very recently, a special fund has been established for grants to industry for development work.

5.5 MAIN ACTION OF THE GOVERNMENT IN THE FIELD OF RESEARCH

Government activity in the field of research has principally taken place through official or semi-official institutes. Research and development contracts to industry, which play an important rôle in the research policy of governments of many

other countries, hardly exist in Norway, although there is now a growing interest in the possibility of introducing that form of research policy into Norway.

With very few exceptions, fundamental research is a public responsibility in Norway, with the universities and - to some degree - the colleges as the institutional framework. The most important government action in the field of research since World War II is, no doubt, represented by the steps taken to expand the universities and colleges.⁽⁴⁾ Although this expansion is based mainly on the needs of higher education, its effect on research capacity as regards fundamental research will be very great. More advanced university studies are based on participation in research activity. Most teachers at universities and colleges are also required, in addition, to do research work.

Government activity with regard to fundamental research is spread over a wide field. It is difficult to indicate any one sector as being considered of more importance than another.

Since World War II the growth in Norwegian research activity has been markedly greater in applied than in fundamental research (the rapid expansion of the universities in the sixties may, at any rate for some time, alter this picture). This development partly reflects the growing interest in research in private industry, but even more the tendency within the different ministries to look upon "research" as an important factor in the furthering of economic and social growth within their specific fields of activity. Most often these research activities form a natural and logical part of the policy of the ministry, but there are also examples of a more vague belief in "research" as a dynamic factor, without a clear appreciation of how research will influence development in particular cases.

The following have been the main activities of the various ministries in the field of applied research.

(a) The Ministry of Industry (covering the fields of manufacturing industry, handicrafts, mining and the power industry).

Probably the most important step taken by this ministry in the field of research was the creation of the Royal Norwegian Council for Scientific and Industrial Research in 1946. The establishment of this Council was based on a report from a committee appointed by the ministry in the autumn of 1945, the original initiative coming from a group of industrialists. The Council is based on co-operation between the State, private industry and scientists. From the ministry's point of view it is its main instrument for the promotion of research. Most of the activities of the Council (described in chapter 2) can also be taken as an expression of the policy of the ministry.

(4) The main lines of the actual expansion programme are to be found in the report of 1961, which has already been mentioned.

While the Institute of Atomic Energy (established in 1948 after a period of preparation) is formally a non-governmental body, it is in practice the public institution for the practical use of atomic energy. Today nearly the whole budget of the Institute is financed from the central government budget with the exception of funds coming from other countries, especially from OECD countries, to the OECD-sponsored project of a boiling-water reactor at Halden. Being the first outside "the big five" to construct a reactor, the Institute's main problems today are metallurgical and technical questions concerning the working of reactors and how to use reactors in ships.

Of a different character are the three industrial institutes for sponsored research, the Central Institute for Industrial Research in Oslo, the Engineering Research Foundation at the Institute of Technology in Trondheim and the Chr. Michelsen Institute in Bergen (the two last mentioned institutes are not members of the research council but work in close collaboration with it and receive financial support from it). These institutes have proved to be very efficient instruments for meeting the needs of Norwegian industry and of official bodies.

Other examples of institutes which fill clearly defined practical needs are the Norwegian Building Research Institute and its sister institute, the Norwegian Geotechnical Institute. These are financed mainly by a tax on all building and construction work, introduced in a law of 1951. They divide their activities between research and consultant work.

Other institutes operating in this field are mentioned in chapter 2. Of special interest are the committees under the Research Council which tackle problems of great importance and promote this specific type of research, if necessary by establishing new institutes (as was the case, for instance, with the Institute for Water Research).

Directly under the ministry as a governmental institute is the Norwegian Geological Survey with various departments.

It is of major interest to the Ministry of Industry to stimulate industrial research, either inside individual enterprises or in joint research institutes. Within manufacturing industry this task is to a great extent taken care of by different research associations. The ministry has also been interested in the dissemination of research results within industry. A special development fund for industry was established in 1965, for financing practical applications of promising research findings.

(b) The Ministry of Agriculture (which also covers the forestry sector) was the first ministry to methodically make use of research as a means of policy and is perhaps even today the ministry which makes most active use of it. The organizational set-up as described in chapter 2 is far more integrated than that in the sector of manufacturing industry. The reason for this is that practically all research takes place in public institutions, the only

exceptions of any importance being the forestry side of the activities of the Research Association of Forestry and Wood-manufacturing Industries and the old-established Society for the Welfare of Norway (founded in 1809) which, however, work in close contact with the official institutes. Practically all this research is financed from the central government budget or with money from the football pools.

The importance of differing geographical conditions and the desirability of close contact with the different types of agriculture has caused a characteristic division of research in this general sector between central institutions and local research and development units. The latter are practically all financed directly from the central government budget and represent different branches of research (horticulture, agronomy, dairy farming, sheep farming, etc.). In forestry research is centralized in two institutes.

The central agricultural institutions are the colleges of agriculture and veterinary science but in addition to these, and from the research point of view of equivalent or perhaps even greater importance, there are the central institutes dealing with, for example, forestry, agricultural technology, agricultural economics, plant diseases and animal diseases.

The Agricultural Research Council has not established any institutes of its own but functions as a very dynamic co-ordinator and initiator of new types of agricultural research.

(c) The Ministry of Fisheries. Fishery research in Norway is entirely directed and financed by the State, the Fisheries Directorate in Bergen being the dominant agency. Under this directorate come the Institute of Marine Research (with three research ships and a scientific aquarium), the Norwegian Fisheries Research Institute (mainly concerned with fish processing and the use of fish) and a unit for research in freezing technique. A special fund for fisheries research has been established to intensify activity in this field (being one of the few bodies giving research contracts to industry). After the setbacks to both the cod and herring fisheries in recent years, the ministry has even greater hope of results from this research than before.

(d) The Ministry of Transport. Until recently applied research in the field of inland transport has played only a modest rôle in Norway, especially as compared with the importance of the industries concerned. There are laboratories engaged in "development" work attached to the State Railways and State Telephone System. The State Road Laboratory recently acquired a new building and is now rapidly increasing its activities as an important instrument in the steadily expanding process of road building and improvement. The establishment of the Institute of Transport Economics (under the Royal Norwegian Council for scientific and Industrial Research) has been of very great value to policy in this sector.

(e) The Ministry of Defence. Just after World War II the Norwegian Defence Research Establishment was established at Kjeller, near Oslo. This Institute has developed into a very effective instrument for research in the sectors concerned. Research at the Institute serves not only military purposes but also civil ones, especially in the fields of telecommunications and operation analyses.

(f) The Ministry of Foreign Affairs. Following on the establishment of the Foreign Policy Institute (administratively under the Ministry of Education), there has been some research in this field. A standing committee for research into problems of peace and international conflicts, the Peace Research Board, was established in 1963.

(g) The Ministry of Social Affairs. Medical research is taking place in the public hospitals. In 1959 an institute was founded to study the social problems of alcoholism. The ministry has also organized research on problems connected with juvenile delinquency. It has expressed to the Committee on Applied Social Research (report 1960) its great interest in the development of further applied research in this field.

(h) The Ministry of Family and Consumer Affairs. This ministry administers an institute for research in home economics (an important part of its activities being the testing of household machinery and

apparatus). The government-appointed Consumer Council has taken the initiative in the field of research and development of consumer goods. A special Consumer Research Committee has been established to co-ordinate research in this field (under the Joint Committee of the Research Councils).

(i) The Ministry of Local Government and Labour administers the Institute of Industrial Hygiene, the Institute of Industrial Physiology and the Institute of Industrial Psychology, which are placed together in a new building near the University of Oslo. The University Institute of Hygiene will also be accommodated in the new building. The fields covered by these institutes are now developing rapidly and this type of research is regarded as an important factor in the process of improving working conditions.

(j) The Ministry of Finance makes most use of the research department of the Central Bureau of Statistics (research into business cycles, taxation and structural problems in the economic field).

(k) Other ministries have also shown interest in research in their special fields. This applies in the case of the Ministry of Justice (criminology, research into the functioning of legislation) and of the Ministry of Education (educational research, research into research).

CHAPTER 6

NORWEGIAN RESEARCH POLICY: ECONOMIC AND DEMOGRAPHIC FACTORS

6.1 LOCATION, CLIMATE AND NATURAL RESOURCES

Norway covers an area, excluding the island group of Svalbard, of 324,000 square kilometres.⁽¹⁾ It is situated between 50°N and 71°N, being long and narrow in form. At its narrowest point, near Narvik, it measures no more than 6 km and at the broadest no less than 430 km across. The distance between the extreme northern and southern points is 1,752 km.⁽²⁾ Turning Norway on its most southerly point and running south, the country would stretch to a point between Rome and Naples. Norway is bordered on the north, west and south by the Arctic Ocean, the Atlantic Ocean and the North Sea, respectively.

By far the largest part of the land is unproductive; about 22 per cent is covered by productive forests and just over 3 per cent is arable land.⁽³⁾ Mountain chains form most of the land area, dividing the country into isolated valleys and high mountain plateaus and forming deep fjords and inlets. The actual coast line runs to a length of about 20,000 km.

These few facts serve to illustrate the very considerable land transport problems in Norway and its close contact with the sea. The country draws great advantages from its long coast line, since this formed the original basis for extensive shipping activity and provides rich fishing grounds.

The climate varies somewhat between the different regions but on the whole it is maritime in nature with relatively cool summers and, considering the latitudes involved, not too severe winters.⁽⁴⁾ A continental type climate is found only in the innermost areas of south Norway and the non-coastal areas of Finnmark, the most northern part of the country. The harbours are in the main ice-free throughout the winter.

Geologically, the country is composed of very old formations.⁽⁵⁾ In relation to its size, it is not rich in ore or mineral deposits, but iron, sulphur, copper, zinc, lead, titanium, molybdenum, niobium, wolfram and cobalt are mined. There are also

deposits of quartz, calcium, feldspar, graphite and mica. Coal is mined in Svalbard.

Water power is one of Norway's most important natural resources. It is estimated⁽⁶⁾ that there is a total potential of approximately 15 million kW (at 82 per cent efficiency).

Water power is especially abundant in the west of the country, in other mountainous areas of southern Norway and in the southernmost districts of northern Norway. Numerous and widely scattered lakes form natural reservoirs. Very high waterfalls are found particularly in the west of the country where there is also a high rate of precipitation.

6.2 DEMOGRAPHIC CONDITIONS

a. Total population

The total population of Norway at the end of 1963 was just under 3.7 million, or 11 persons per sq. km. This compares with a total population in 1900 of just over 2.2 million. Following a relatively rapid increase in growth during the early decades of this century, the rate slackened and was relatively limited in the inter-war years. Since the end of the Second World War the rate of growth has again increased. According to the prognoses indicated in Diagram 6.a, there will continue to be a relatively rapid increase in growth and total

(1) Source: Statistical Yearbook for 1964 (N.O.S. XII 142) Table 5

(2) Source: Statistical Yearbook for 1964 (N.O.S. XII 142) Table 1

(3) Source: Statistical Yearbook for 1964 (N.O.S. XII 142) Table 86

(4) Data are given in Statistical Yearbook for 1962, Table 3

(5) Source: Ahlmann: Norge, natur og naeringsliv (1957), Chapter 1

(6) Source: Statistical Yearbook for 1964, Table 166

population is expected to pass the 4 million mark at the beginning of the 1970's.

b. Age groups

Diagram 6.b shows the age group distribution of the population on the basis of a division into three groups, children, adults and old people, the age limits being set at 15 and 65. (The distribution for 1975 is based on forecasts by the Central Bureau of Statistics.)

The relative share of the 0-14 group showed a considerable decline between 1920 and 1960. The 15-64 group increased its share from 60 to 66 per cent of the total population in the period 1920 to 1950, but dropped again during the 1950's quite considerably. The oldest age group, i.e. 65 and over, increased its share very sharply in the period covered by the diagram. Prognoses for this group indicate that its share will continue to increase very markedly. Comparing figures for 1960 with forecasts for 1975 there is a slight fall in the children's group, a considerable decline for the population of working age, and a further increase in the old-age group.

The groups 7-13 and 14-19 are of particular interest and importance for the education authorities as they correspond to the compulsory elementary schooling period and the various alternatives for more advanced education below university level. Following a sharp drop in its relative share of total population in the inter-war years, the age group 7-13 showed a rapid rise in the 1950's and hit the highest point so far reached in 1957. (7) The rapid increase in live births which took place in the 1940's was reflected in this development. The age group 14-19 is expected to reach its maximum in 1964. (7) Thereafter, it is forecast that both these groups will show only limited variations in absolute figures. Relative to total population they are expected to decline somewhat.

c. Education

The number of pupils in the compulsory elementary schools reflects the development of the birth rate, with a time lag of about 11 years. In the advanced schools, however, the number of pupils has increased more rapidly since the war than would follow naturally from the increase in the population, this being due to a combination of the factors of increased numbers of children and higher school attendance. This refers both to the advanced general schools as well as to most vocational schools. The number of pupils sitting for the university entrance examination - artium exam - expressed as a percentage of all 19½-year-olds was just over 11 per cent at the end of the 1940's. By 1963 it had jumped to 17 per cent. It is estimated that it will have reached 21 per cent by 1970.

These large school-leaving groups and the fact that the number of young people taking the

artium exam who are aiming at university or other higher education has now risen to between 50 and 60 per cent, have resulted in a very large flow of students to the universities and corresponding institutions (cf. chapter 4).

d. Urbanization

Diagram 6.c shows the distribution of the population as between towns and other built-up areas on the one hand and sparsely populated areas on the other in the years 1900, 1930 and 1960. Some 57 per cent of the population lived in built-up areas in 1960 and only about 43 per cent in other areas. Throughout this century there has been a steady movement of people away from the rural areas to the towns and more densely populated areas, and this trend became particularly marked after the Second World War. In 1900 the number of people living in towns and other built-up areas was no more than about 36 per cent of the total. This development reflects a major change of a structural economic nature and also changes in social conditions.

Norway has no really big cities. The capital, Oslo, including its suburbs, has only some 600,000 inhabitants. (8)

e. The labour force and its distribution

Developments as regards the labour force in Norway have in the main followed the usual pattern of the industrialized countries. Table 6.I shows that the share in the total of agriculture and forestry dropped from 35 per cent in 1900 to 15 per cent in 1960. It would seem that the drain of people from these activities will continue, and in the long run their share is expected to be considerably lower than at present.

Fishing and other similar activities, such as whaling and sealing, have long been relatively important occupations in Norway which even immediately after the last war absorbed about the same share of the labour force as at the turn of the century. But during the 1950's these activities have lost manpower and their share of the total is falling sharply.

Manufacturing and mining accounted for 20 per cent of the total labour force in 1900 whereas by 1960 these activities claimed 26 per cent. But their share no longer seems to be growing markedly. Building and construction activities play an important rôle in Norway and their share of the labour force has risen substantially in the course of this century.

(7) Source: Budget proposals for 1963 from the Ministry of Church and Education

(8) Source: Statistical Yearbook for 1964, Table 388.

In a country such as Norway, with long lines of communication and transport in relation to the size of the population, and with a substantial international merchant fleet, manpower engaged in such activities will play a larger rôle than in most other countries. The relative share of the transport and communications sector has also been increasing through this century. Even more sharply on the rise, however, has been the share taken by commerce and other services. Adding together the figures for transport, retail and wholesale trade, and the service sector plus the column "Other" in table 6.I, it will be seen that their share has risen from 32 per cent in 1900 to 45 per cent in 1960. Although this total includes groups whose importance is falling, e.g. domestic service, there is a clear trend in Norway, as in most other countries, towards a larger share being taken by the service industries.

6.3 SOME SOCIAL FACTORS OF INTEREST

a. Social structure

As will be seen from point 6.4 below, the variation in incomes in Norway is relatively limited. Furthermore, taxation is progressive and there is a highly developed system of transfers via the public budgets, which means that equalization of incomes has made great strides.

There has been very considerable equalization since the turn of the century both of incomes and of educational opportunities and general social and cultural standards.

Generally speaking, the objective of equal opportunity is firmly rooted in the people. This is in part tied up with general political developments in Norway.

b. Political structure

One of the main characteristics of Norwegian political structure is the importance and the extensive independence of the local government authorities. Point 6.8 below shows the municipalities' share of total public finances. The municipalities are also regarded by the people as very important political bodies.

The National Assembly or Storting traditionally plays a perhaps more important rôle in the political apparatus in Norway than in the majority of other countries.

c. Organizations

In almost all sectors of the Norwegian community there are organizations which look after the interests of the groups they represent in relation to the public authorities. The most obvious organizations to be mentioned are the trade unions, the associations of employers, and other industrial

organizations. The Federation of Norwegian Trade Unions is the largest organization on the workers' front and has close connexions with the Labour Party.

Among the business organizations, those of the farmers and the fishermen have considerable political influence. The co-operative organizations of consumers and of farmers and fishermen play an important part in Norwegian economic life. Associations of employers in manufacturing, in trade, handicrafts, shipping, etc. also have a major rôle in the Norwegian economic and social picture. These organizations also represent their members in relations with the public authorities, as for example, when the central administration wishes to be informed of the views of business.

d. The position of women

Traditionally, the position of women in Norway is relatively strong. They won political rights at a relatively early stage. Equality in work outside the home has, however, made less progress. Women have a considerably lower job percentage than men, only 25 per cent of the age group 15-69 years as compared to almost 89 per cent for men, in the year 1960.⁽⁹⁾

As regards the distribution of women workers in the different fields of activity, the position is that the share of agriculture etc. has declined sharply in this century as is also the case for paid domestic work. Industry has a somewhat higher percentage, while the share taken by commercial and other service activities has increased very greatly.⁽¹⁰⁾ To illustrate the educational level for women it may be mentioned that whereas the women's share of artium candidates in 1910 was 32 per cent, and there was little increase in the inter-war years, it had risen by 1963 to just over 42 per cent of all artium candidates.⁽¹¹⁾

6.4 PRICES AND WAGES

a. Development of prices

Diagram 6.d shows price developments since World War II. Following a considerable increase in prices during the war, efforts were made in the immediate post-war years up to 1949 to hold a stable price level. This price stabilization policy is, however, closely bound up with the so-called cost-of-living index for workers' families which comprised a somewhat different sample of goods from total private consumption. Thus, prices for

(9) Source: Statistical Yearbook for 1964, tables 10 and 17

(10) Source: Economic Survey 1900-1950 (S.Ø.S. no.3)

(11) Sources: Statistical surveys for 1948 and 1958. Statistical Yearbook for 1964, table 361

total consumption will not show the same stability as this cost-of-living index. From 1950 to 1952 there was a sharp rise in prices arising mainly from the devaluation of the krone and then the Korean hostilities. Since that time price movements have been less violent but the general picture has consisted typically of sharp upward movements followed by periods of greater stability.

b. Development of incomes

The development of wages for workers in manufacturing activity and building and construction since 1949 is shown in Diagram 6.e. Up to 1964 these groups had an increase in nominal wages of 177 per cent, while the improvement in real wages (i.e. nominal wages divided by a consumer price index) was 45 per cent.

The increase in industrial wages occupies a key position in the total income picture since it normally sets the pace for the wage claims of other groups. Incomes have developed in rather an uneven fashion since the war, both because there has been a general tendency to give the lowest groups a greater increase than those better off, and because the incomes of the self-employed have fluctuated with changing cyclical movements. Also within the ranks of the industrial workers there are considerable differences in the movements of wages. Wage earners in the higher brackets have not had anything like the same growth in their incomes as the lower-paid workers and also the sharp tax progression in the higher incomes is a major determinant of what they get in the form of disposable income.

The distribution of factor income on a percentage basis as between the various income types is given in table 6.II. Factor income is gross income minus indirect taxes plus subsidies. The table shows that while wages in 1930 accounted for less than 47 per cent of the total private factor income, in 1964 their share had increased to 65 per cent. This is in part a reflection of the more important rôle played by wage earners in the labour force than in earlier years but also shows that they have had a relatively more rapid increase in income. Earnings of the self-employed in agriculture and fishing were scarcely 9 per cent of the total factor income in 1930. By 1950 their share had increased to rather more than 10 per cent because of the policy of equalization of incomes pursued in the post-war years. The fact that the figure is as low as 7 per cent in 1964 is partly due to the very poor results of the major fisheries in recent years. Capital incomes in the categories of personal income from interest and incomes from houses have fallen sharply in importance in relation to pre-war, but it is particularly the deterioration in the incomes of other enterprises which is noticeable. In 1930 this represented more than 34 per cent of total factor income and in 1950 still 32 per cent. In 1964, however, it had fallen to 26 per cent, a development which can in part be explained by the

difficult situation some Norwegian export industries were facing, e.g. shipping.

Developments in the distribution of income can, for instance, be measured by the respective shares of total income before taxation taken by the major earning groups. Measured in this way the uppermost 5 per cent of income earners had in 1907 about 27 per cent of total incomes in the country districts, in 1948 this percentage had fallen to 14. Corresponding figures for the towns were under 30 per cent in 1912 and 19 per cent in 1948.⁽¹²⁾ No later comparable estimates are available, but taxation statistics for 1958 show that the top 1 per cent of income earners accounted for barely 8 per cent of total incomes in 1950, and in 1958 the top 1 ½ per cent received barely 7 per cent of total incomes.⁽¹³⁾

c. Wages and prices policy

During and immediately after World War II the authorities introduced price subsidies and direct price control in an attempt to stabilize prices of consumer goods. This stabilization policy was given up in 1949-1950 and prices then rose very rapidly while at the same time direct price control was gradually and considerably reduced. Price subsidies, on the other hand, have been maintained and still play a rôle in keeping a stable price level on consumer goods at least over relatively short periods.

A special prices policy applies to agricultural and fish products. There are mainly social motives behind this policy (levelling of incomes etc.), guaranteeing, among other things, the farmers and fishermen certain minimum prices for their products. This is achieved partly through the controls afforded by the laws pertaining to these sectors and partly through appropriations from the central government budget.

Immediately after the war wage disputes were settled before arbitration tribunals, but these have since been discontinued and the State now intervenes only in the capacity of mediator.

6.5 MAIN ECONOMIC DATA

a. Principal aggregates of the national economic activity

Table 6.III shows principal aggregates of the national economic activity based on United Nations national accounts definitions to secure international comparability. The following points are, however, based on national definitions: Gross national product at factor cost = net national product at factor cost + provisions for the consumption of fixed capital. Gross national product at market prices = gross national product at factor cost + indirect taxes - subsidies.

(12) Source: Economic Survey 1900-1950

(13) Source: Taxation statistics for 1958

b. Foreign trade

Exports and imports have developed far more rapidly than gross production. The total volume of exports was more than fourteen times as great in 1964 as in 1900 and import figures show a similar trend. (14)

Freight earnings constitute a very large share of exports - in certain periods as large a share as total commodity exports. As a percentage of imports, freight earnings amounted to more than 40 per cent in 1900 and the same in 1964. Maritime transport's share of the gross national product was over 8 per cent in 1900 and over 10 per cent in 1964 and has on occasions been even higher. (14)

Imports corresponded to 40 per cent of the gross national product in 1900 and barely 40 per cent in 1964, while in individual years during the intervening period they have corresponded to 50 per cent or more. (14) Foreign trade is of relatively greater importance to Norway than to most other countries.

In most years of this century Norway has been a capital importing country and this applies not least to the post-war period. A considerable proportion of capital imports goes to covering part of the very high gross investment rate, and particularly to investment in the shipping industry.

c. Private consumption

Table 6.IV shows developments in private consumption since 1910. The figures for 1964 compared with those for 1910 indicate that there was particular expansion in the field of private travel and other transport. The large number of present-day car owners and the greater holiday opportunities have certainly been influencing factors here. Other groups which have shown rapid expansion within the sector "private consumption" are the various health services, beverages and tobacco, and clothing and footwear. On the other hand food products have increased much more slowly than consumption as a whole and expenditure on housing has shown no especially rapid rise.

6.6. PRODUCTION

a. Production in the most important sectors of the economy

Table 6.V gives a survey of developments in production in the different sectors of the economy since 1910. The survey indicates the relative redistribution of the various sectors. There has been especially rapid expansion in the groups construction and power and water supply. Transport also shows a big increase. Trade and manufacturing industry show a particularly large increase in production among the more important economic sectors. Agriculture and fishing both show a very weak production increase.

b. Investment in the most important sectors of the economy

Table 6.VI gives a survey of developments in gross investment (excluding changes in stocks) since 1930. It can be seen that there has been particularly rapid expansion in mining and manufacturing industry, in construction, power supply and trade. The latter sector, however, involves very limited fixed investment and is therefore of little importance in this connexion. Agriculture and forestry have had a considerable increase in gross investment in spite of the small production increase in these sectors. This also applies to some extent to fishing (cf. the decrease of the labour force of these industries).

c. Characteristic trends in the most important sectors of the economy

Small operating units are a characteristic feature of the greater part of the Norwegian economy. There are very few units of optimum size in the agricultural sector. In 1959 as many as 70 per cent of holdings over 0.5 hectares were less than 5 hectares and only 2 ¼ per cent were over 20 hectares. (15) It has therefore been one of the main aims of agricultural policy since the Second World War to increase the average size of holdings or to ensure co-operation which can reduce the harmful effects of too small units. This policy has, to some extent, succeeded but the problem remains the most important in Norwegian agriculture.

The fishing sector is also characterized by very small working units which are a hindrance to the effective rationalization necessary to make this activity competitive.

With a few exceptions, the same situation applies to manufacturing industry. In 1952 only 4 per cent of industrial establishments employed more than 50 persons, while these establishments at the same time absorbed over half of the total labour force. (16) The fact that manufacturing industry is so dominated by small operational units contributes to making it financially weak. Small firms have difficulty in utilizing modern techniques, which require large enterprises if they are to be effective. Such small firms must also necessarily be in a poor position when it comes to research, development and sales promotion. Establishments have been encouraged to amalgamate or work together in an effort to compensate for this situation. Such co-operation has also covered research and sales promotion.

(14) Sources: Statistical Survey for 1953. Economic Survey for 1964

(15) Source: Agricultural census of 1959

(16) Source: Industrial census of 1953

Minor operating units are also a feature of trade and commerce. The system of large stores and chain stores found in other countries is uncommon in Norway.

d. Technological progress

The high level of wages and the generally unfavourable operational structure of the Norwegian economy emphasize the importance of keeping abreast of technological developments and of contributing to them. There have been great changes in this field and, particularly since the end of World War II, Norwegian agriculture has become perhaps the most highly mechanized in Europe. It is probably correct to say that there has, to some extent, been over-investment in tractors and agricultural machinery in relation to the area cultivated. The reason for this is partly to be found in the small farm holdings. An important rôle in the introduction of modern production methods in agriculture has been played by the advisory services under the Ministry of Agriculture referred to in chapter 5.

There has not been a comparable rapid technical development in the fishing sector even though there have been great changes here also.

As in most other countries, there has been an almost complete replacement of old machinery in the mining and manufacturing industries since the war and continued very heavy investment in machinery, equipment and apparatus. However, a comparison of the different sectors shows that progress has been rather uneven because the export industries have previously had a far higher investment rate than industries producing for the home market. These variations are now in the process of being smoothed out.

Technological development has been considerably weaker in such fields as business organization, accounts analysis and sales promotion.

Technical innovation which requires especially heavy investment, for instance the more comprehensive forms of automation, has met obstacles caused by the particular nature of the structure of the Norwegian economy. Here too, research and development play an important rôle, as mentioned in relation to the Ministry of Industry in chapter 5. However, it is first and foremost the large and medium sized firms which have been able to benefit from such activity.

There has also been considerable technological progress within the trade sector, both with regard to retail and wholesale trade. The "self-service" system has been widely applied in the former and there is now extensive use of modern storage and transport systems in the latter.

6.7 THE PUBLIC SECTOR

a. Public finance

Tables 6.VIIa, and b, and 6.VIIIa, and b, survey developments in the revenue and expenditure of central and local governments during the present century. The figures are also presented as percentages of the gross national product in order to give an indication of their proportions and also of the relative development of the public sector compared with total production.

The figures show that while central government revenue, including social security receipts, measured as percentages of gross national product, increased more than four times between 1900 and 1964, local government revenue was only three times greater at the close of this period. Local government current expenditure (consumption) on the other hand, was more than doubled while central government current expenditure only increased by approximately 60 per cent (both reckoned as a percentage of the gross national product). Local government investment's share of the gross national product was nearly trebled during this period while the share of central government investment increased nearly four-fold. An important variation in central and local government finances is to be found in the size of transfers to other sectors. Local government transfers were more than doubled (proportionate to the gross national product) during the period under consideration but central government transfers and transfers through the social insurance system were nearly ten times as great. The explanation for this increase is to be found largely in the expansion of the social insurance schemes, and in the widespread assistance given to agriculture and other industries, and towards price subsidies.

b. Taxation

Central and local government taxation has developed somewhat unevenly during this century. Indirect taxes played an important part in central government revenue at the turn of the century but they decreased in significance up to the inter-war period. Since then their share of overall revenue has again risen and total indirect taxes today represent about as high a proportion of total central government revenue as do direct taxes. The most important single indirect tax is at present the general sales tax, while at the beginning of the century receipts from indirect taxation came mainly from customs duties.

As regards local government taxation, emphasis is placed almost entirely on direct taxation. Property taxes were still of considerable importance at the beginning of the century, particularly in the rural areas.

Generally speaking, revenue from taxation, as a percentage of the gross national product, has increased three times during the course of this

century. (17) Its influence on the distribution of income has also changed noticeably. A considerable redistribution of real income takes place today both through actual taxation and through the transfer payments which can be regarded as counteracting some elements of taxation. (17)

c. Total public activity

Total public consumption of goods and services amounted to 7.5 per cent of the gross national product in 1900, of which 5.8 per cent was accounted for by current consumption and 1.7 per cent by investment. The comparable figure for 1964 is 17.8 per cent, of which 12.4 per cent went to current consumption and 5.4 per cent to investment. (18)

From an international point of view these figures for public consumption of goods and services are not especially large. The Norwegian civil service is relatively small and military expenditure is of much less importance than in the larger countries.

d. Important fields of public activity

Table 6.IX gives a survey of developments in important sectors of public consumption as percentages of the gross national product.

Compared with 1938, the 1964 figures show a very rapid development in the sectors of education and research. The same applies relatively to the health services. The latter must be seen in relation to the fact that normal hospital services are financed chiefly through the social insurance system and are regarded as private consumption. The roads and other transport measures showed a very strong increase, particularly during the 1950's. An even greater increase can be seen in defence expenditure which was very low before the last war.

Increased expenditure on education and research, which occurred mainly during the 1950's and 1960's, went partly to the compulsory primary schools, which have been extended because of the larger number of children in the relevant age groups and also to raise standards in this sector. But there was especially rapid expansion in secondary schools and in higher education. Expenditure on research, as mentioned in chapter 3, has also increased considerably during the past ten years as a consequence both of extending the availability of higher education and also of widening the field covered.

The widespread ownership of private cars made its first real impact in Norway during the second half of the 1950's. Road construction was delayed during the years immediately after the

war, when priority was given to other projects, with the result that there was later a great need for improved and new roads. There has also been very heavy investment in other branches of communications as, for instance, in air transport, the telephone system and in harbours, and a corresponding increase in public consumption.

In the field of social activity developments since the war have been dominated by the expansion of the social insurance system which in this connexion can be regarded as a form of private consumption under public management. Public activity as such - the erection and operation of various social institutions and hospitals - also shows great expansion during recent years. According to available long-term plans this expansion is to continue and will cover many new fields of activity.

6.8 CONCLUDING REMARKS

From a social and cultural point of view, Norway is still closely tied to the old agricultural society characterized by the system of self-sufficient households and with strong traditional attitudes to social problems and economic conditions. Norway in the Twentieth century is in the large-scale process of becoming adapted to a modern society, dominated by a totally different economic structure and an urban way of life. From an economic point of view the old "mother" industries, especially agriculture, have ceded their positions as the most important elements within the economy. In the industrial sector, and particularly with regard to exports, Norway has concentrated on exploiting the country's natural resources such as timber and fish. These latter industries are now in a period of stagnation, and although this may be partially temporary these industries cannot be expected to contribute in any great degree to the desired economic expansion. This expansion will probably be related first and foremost to utilization of hydro-electric power but it must be assumed that, in the long run, it will be the skill of the labour force upon which expansion must be based. It is the highly skilled industries which will eventually ensure continued rapid economic development. For this reason, education, research and continued development must play an ever increasing rôle in Norway.

(17) Source: Retningslinjer for skattepolitikken (St. meld. nr. 54 (1960-1961))

(18) Source: National Accounts and Economic Survey for 1964 (preliminary figures)

**Table 6.I. Economically active population.
Percentage distribution by industry.**

Year	Economically active population	Agriculture	Forestry	Fishing sealing and whaling	Mining and manufacturing industry	Construction water and power supply	Trade	Communications	Public and private services	Other
1900	870,104	33	2	6	20	7	6	5	3	18
1930	1,163,007	26	3	7	20	7	10	8	5	14
1960	1,406,400	13	2	4	26	10	12	12	9	12

Source: Statistical Yearbook for 1964, Table 20.

Table 6.II. Factor income groups 1930-1964 as percentage of total private domestic factor income (current prices).

	1930	1939	1950	1964
Wages and salaries	46.7	48.5	54.9	64.9
Personal interest income	3.7	2.1	0.8	1.5
Income of self-employed in agriculture and fishing	8.7	8.0	10.2	7.1
Income from dwellings	6.0	4.6	1.0	0.3
Other private income from labour and capital	34.5	36.2	31.9	26.2

Sources: Statistical Survey for 1958.
Economic Survey for 1964 (preliminary figures for 1964).

Table 6.III. Principal aggregates of the national economic activity
(current prices and population¹).

	Year	Norw. Kr. ² Millions	\$ ³ Millions
Government budget (current expenditure)	1956	6 318	885
	1957	7 222	1 011
	1958	7 460	1 044
	1959	8 244	1 154
	1960	8 764	1 227
	1961	9 573	1 340
	1962	10 926	1 530
	1963	12 070	1 690
	1964		
Net national product at factor cost	1956	21 395	2 995
	1957	22 567	3 159
	1958	21 926	3 070
	1959	23 087	3 232
	1960	24 680	3 455
	1961	26 897	3 766
	1962	28 645	4 010
	1963	30 872	4 322
	1964	⁴ 35 539	⁴ 4 975
Gross national product at factor cost	1956	24 576	3 441
	1957	26 154	3 661
	1958	25 573	3 580
	1959	27 265	3 817
	1960	29 073	4 070
	1961	31 569	4 420
	1962	33 732	4 722
	1963	36 626	5 128
	1964	⁴ 45 396	⁴ 6 355
Gross national product at market prices	1956	27 090	3 793
	1957	28 788	4 030
	1958	28 658	4 012
	1959	30 417	4 258
	1960	32 340	4 528
	1961	35 241	4 934
	1962	37 771	5 288
	1963	40 252	5 635
	1964	⁴ 49 643	⁴ 6 950

Sources: U.N. Yearbook of National Accounts Statistics 1963 (N.Y. 1964)
Statistical Yearbook of Norway 1964.

1. Population at mid- 1961: 3,611 thousand; at end- 1963: 3,681 thousand.

2. 1 Norw. krone = \$0.14 at 1.3.1963.

3. \$ 1 = 7.143 Norw. kroner at 1.3.1963.

4. Figure derived from Norwegian national statistics (Economic Survey 1964), which are based on different definitions from those used by the United Nations, leading to values about 10% higher.

Table 6.IV. Percentage distribution of private consumption at current prices.

	1910	1930	1938	1950	³ 1964
Food	42.5	31.8	31.7	29.5	28.0
Tobacco and beverages	5.5	6.7	6.5	8.8	7.5
Rents, lighting and fuel	14.3	16.8	16.2	8.6	10.6
Household goods ²	8.4	8.5	6.9	8.6	7.9
Clothing and footwear	13.1	13.5	13.0	16.6	13.1
Travel and transport	2.3	4.5	5.6	5.8	9.1
Education and recreation			5.2	4.9	6.3
Other: ^{1,2}	13.9	18.2	14.9	17.2	17.5

Sources: N.O.S. XI 143, N.O.S.A. 24 and N.O.S. XII 160.

1. Including corrections.

2. There is a minor break in the series between 1930 and 1938

3. Provisional figures.

Table 6.V. Percentage distribution of gross national product at current prices.

	1910	1930	1950	¹ 1964
Agriculture and forestry	19.1	11.1	10.2	6.3
Fishing, etc.	4.4	5.6	3.7	1.7
Mining and manufacturing industry	22.2	23.7	27.5	24.9
Construction, electricity, etc.	3.8	6.4	8.6	10.8
Trade	16.1	13.9	15.2	17.9
Transport	11.2	12.7	16.9	17.0
Other industries	23.2	26.6	17.9	21.4

Sources: N.O.S. XI 143
National Accounts 1949-1962
Economic Survey for 1964

1. Provisional figures.

Table 6.VI. Gross investment by industry (excluding stocks)
(1930=100, current prices).

	1939	1950	1962
Agriculture	181	408	1 166
Fishing	100	412	794
Mining and manufacturing industry	206	798	3 031
Construction and power supply	206	1 252	-
Trade	270	1 070	-
Transport	121	517	1 310
Other industry ¹	223	584	² 2 030

1. Excluding government fixed capital formation.

2. Construction, trade, other.

Table 6.VII Central government and social insurance revenue and expenditure.

a. As percentage of gross national product (current prices).

	1900	1920	1939	1950	¹ 1964
Revenue	5.5	7.3	12.5	28.4	24.7
Transfer payments	1.4	4.1	6.1	11.5	13.6
Consumption	3.6	3.2	3.9	4.5	5.7
Investment	0.5	0.4	0.9	1.0	1.9
Increase in (financial) assets	0	0.4	1.6	10.5	2.3

1. Provisional figures.

b. The same in absolute figures :

	1900		1920		1939		1950		¹ 1964	
	Kr. millions	\$ millions	Kr. millions	\$ millions	Kr. millions	\$ millions	Kr. millions	\$ millions	Kr. millions	\$ millions
Revenue	60	8.4	548	76.6	787	110.8	4,668	653.5	12,251	1,715.4
Transfer payments	15	2.1	305	42.7	386	54.0	1,891	264.7	6,751	945.1
Consumption	40	5.6	243	34.2	245	34.3	742	103.9	2,847	398.6
Investment	5	0.7	28	3.9	57	8.0	161	22.5	967	135.4
Increase in (financial) assets	-	-	- 28	- 3.9	99	13.9	1,725	241.5	1,131	158.3

1. Provisional figures.

Table 6.VIII Local government revenue and expenditure.

a. As percentage of gross national product (current prices).

	1900	1920	1939	1950	¹ 1964
Revenue	3.4	5.1	8.2	9.3	10.3
Transfer payments	0.8	0.9	3.2	3.0	2.1
Consumption	2.1	2.9	3.4	3.1	4.8
Investment	1.3	1.6	1.5	2.3	3.5
Increase in (financial) assets	- 0.8	- 0.3	0.2	0.9	- 0.3

1. Provisional figures.

b. The same in absolute figures :

	1900		1920		1939		1950		¹ 1964	
	Kr. millions	\$ millions	Kr. millions	\$ millions	Kr. millions	\$ millions	Kr. millions	\$ millions	Kr. millions	\$ millions
Revenue	37	5.2	382	53.5	515	72.1	1,535	214.9	5,137	719.2
Transfer payments	9	1.3	71	9.9	200	28.0	493	69.0	1,039	145.5
Consumption	23	3.2	218	30.5	211	29.5	507	71.0	2,403	336.4
Investment	14	2.0	116	16.2	93	12.1	375	52.5	1,718	240.5
Increase in (financial) assets	- 9	- 1.3	- 23	- 3.2	11	1.5	142	19.9	- 126	- 17.6

1. Provisional figures.

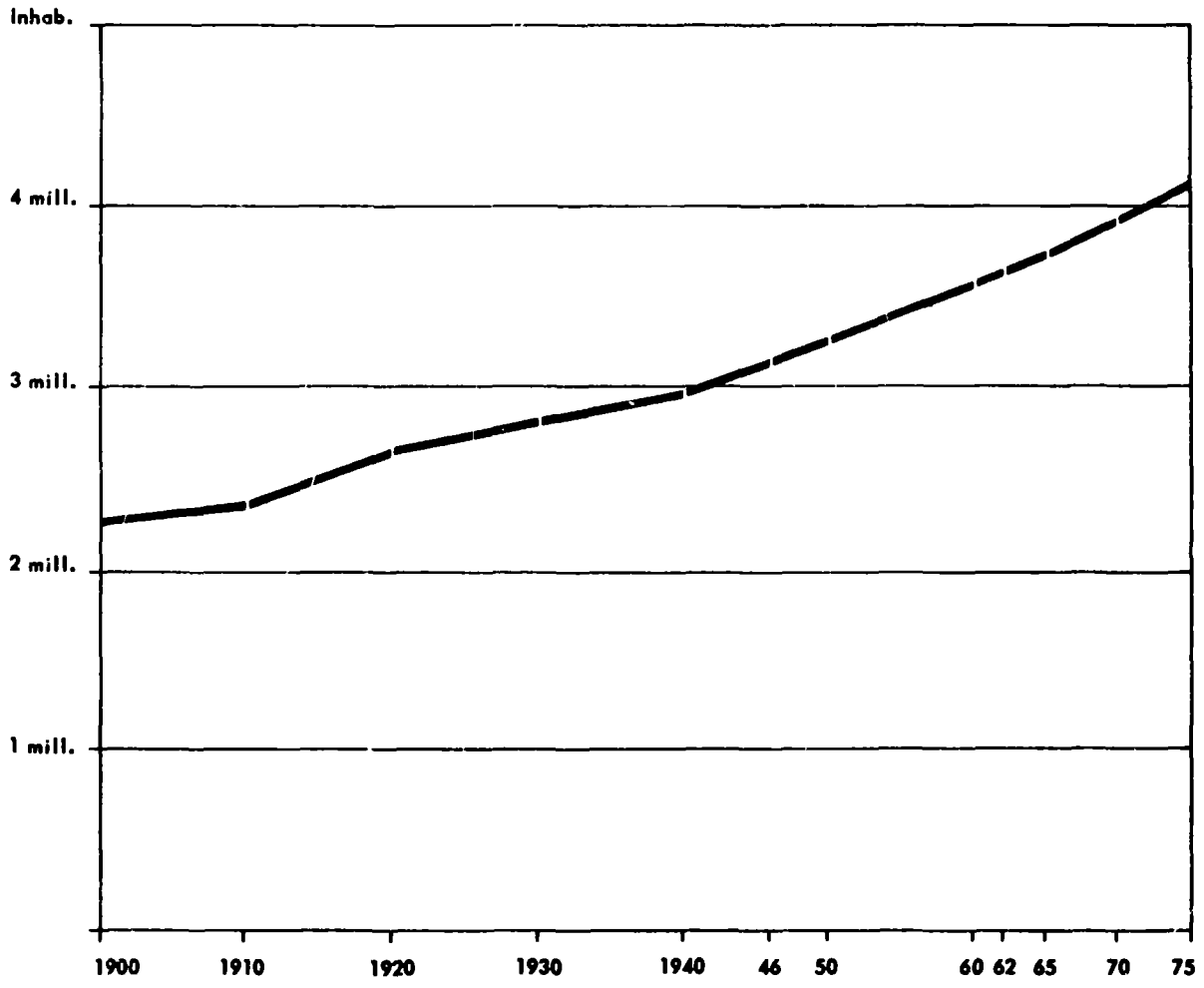
Table 6.IX Public consumption¹ as percentage of gross national product.

	1938	1950	1964
Education and research	1.9	1.9	4.3
Social measures	0.5	0.4	0.7
Health services	0.7	0.7	1.2
Roads, transport measures etc.	1.1	1.1	² 2.6
Defence	1.0	2.1	3.0

Sources: National Accounts 38 and 46-53 and Economic Survey for 1964.

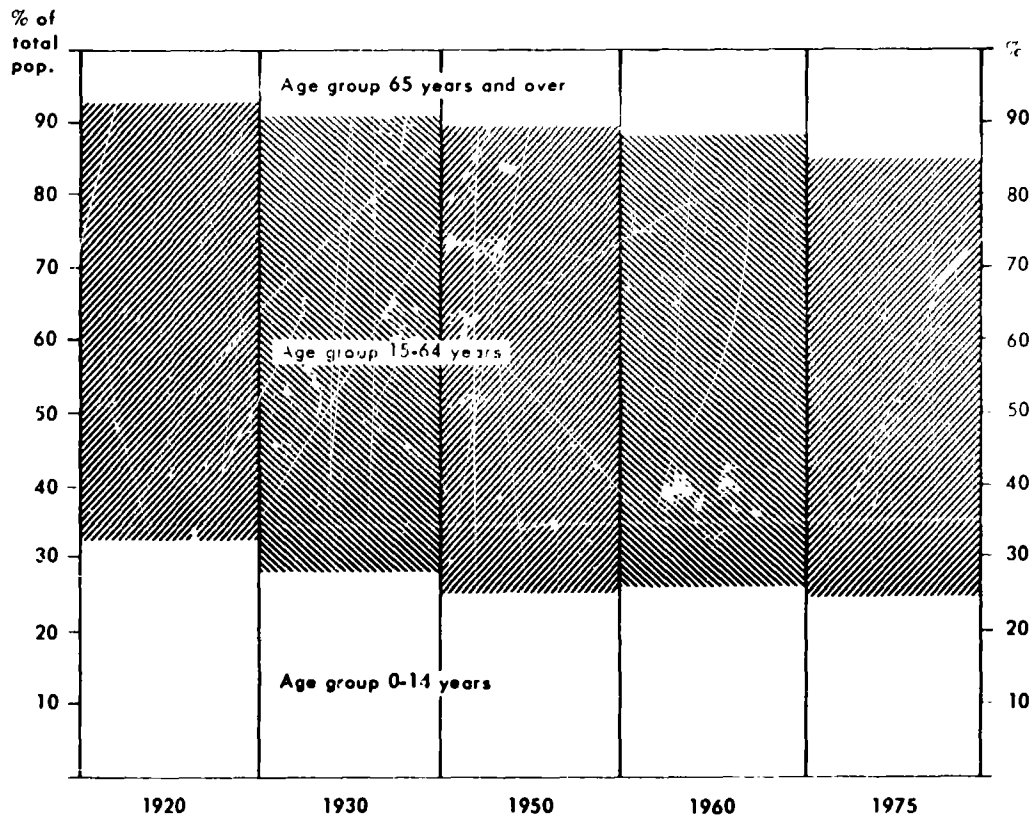
1. Consumption defined as net purchase of goods and services.
2. Roads.

Diagram 6.a Resident population in Norway (figures for 1965, 1970 and 1975 are forecasts).



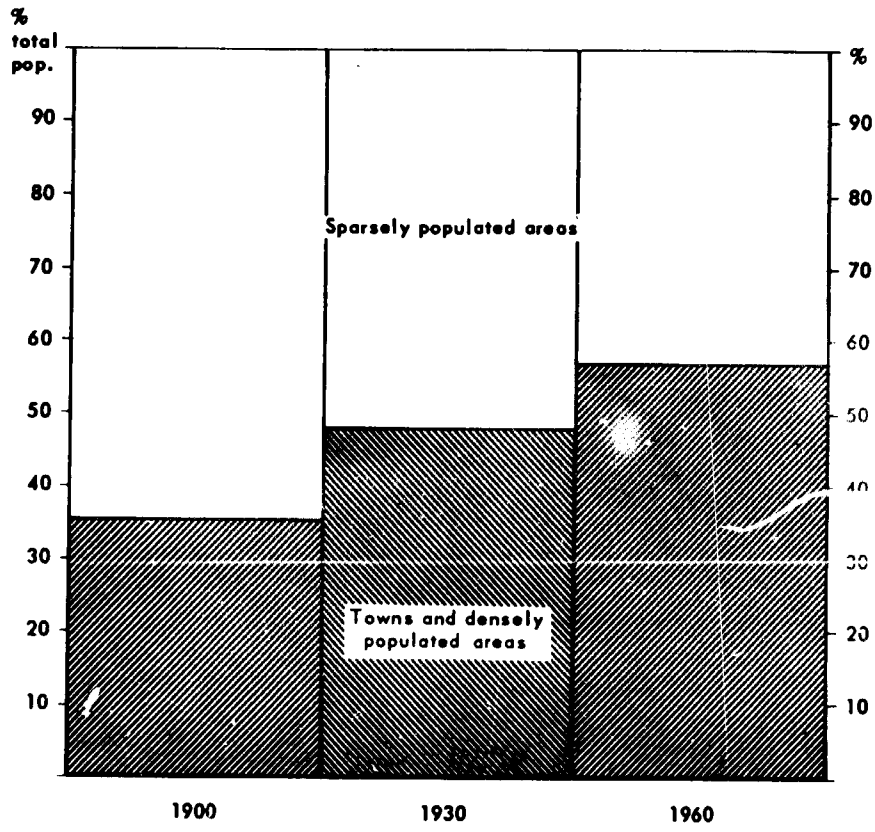
Sources: Statistical Yearbook for 1962 (figures for 1900-1960).
Figures for 1962-1975 are based on material from the Central Bureau of Statistics.

Diagram 6.b Age groups as percentage of total population.



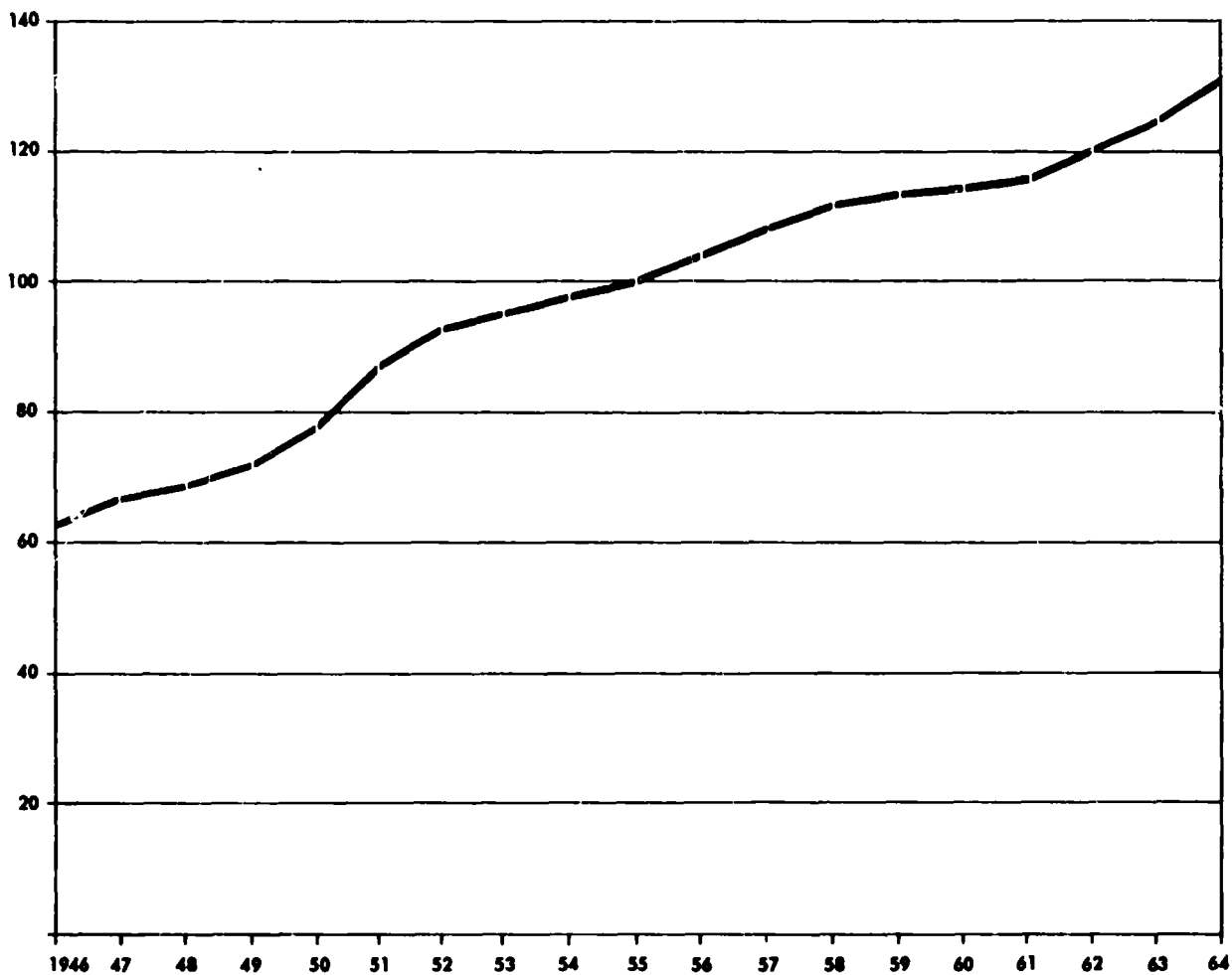
Sources: Population census for 1950, volume 2. Forecast prepared by the Central Bureau of Statistics for the Long-Term Programme 1966-1969 (St. meld. nr. 63 (1964-1965), annexed Table V).

Diagram 6.c Population distribution between urban and rural areas.



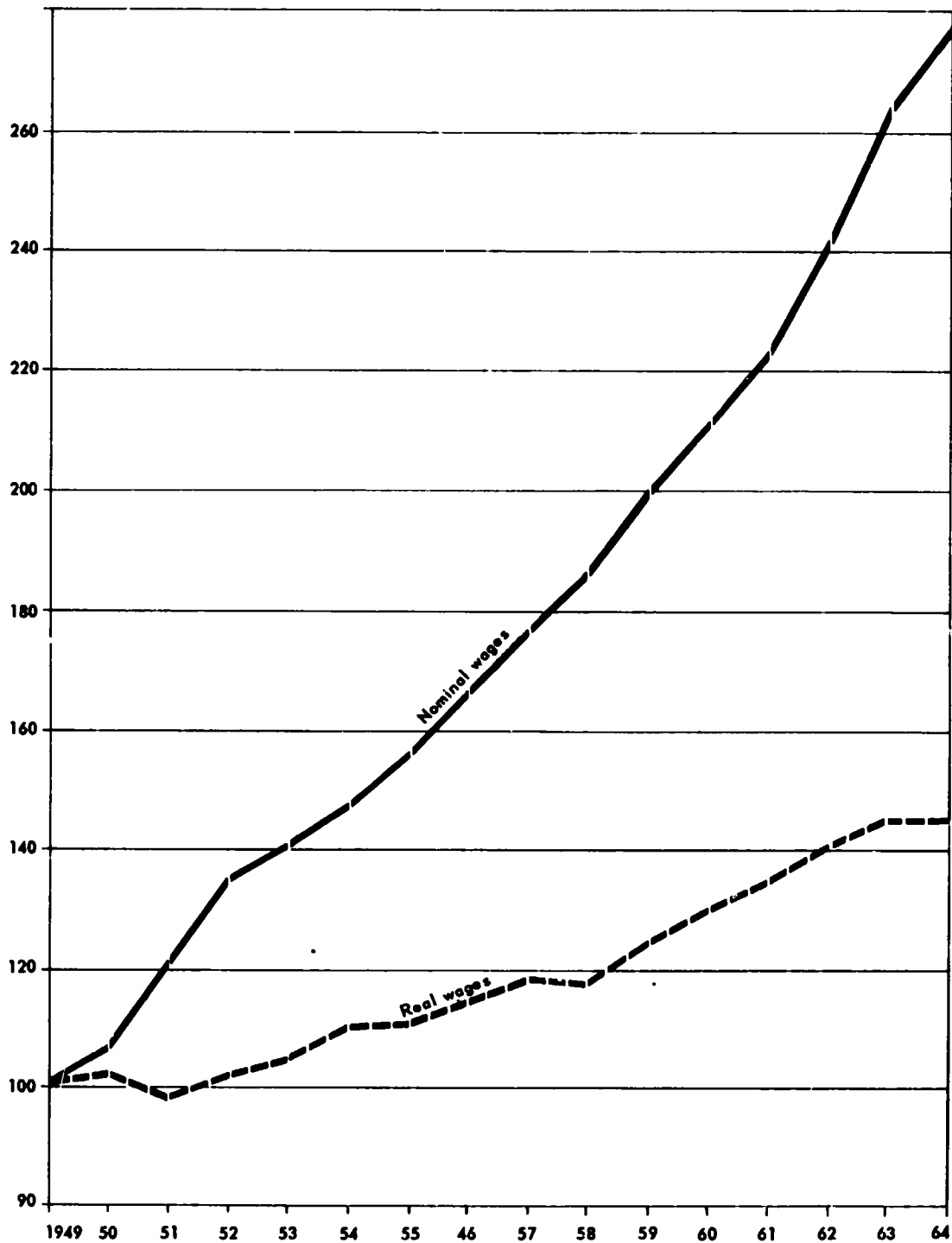
Sources: Population census for 1950, volume 1. 1960 figures: Statistical Yearbook for 1964, Table 8.

Diagram 6.d Consumer price index (1955 = 100).



Sources: National Accounts 1938 and 1946-1958.
Economic Survey for 1962.
Monthly Bulletin of Statistics 1965, No. 3.

Diagram 6.e Wages index in manufacturing industry and construction (adult males, 1949 = 100).



Sources: Statistical Survey for 1958.
Statistical Yearbook for 1962.
Statistical Monthly 1963, 7.
Statistical Weekly 1965, 14.

BIBLIOGRAPHY

GENERAL:

- Ahlmann, H.W.: Norge, natur og næringsliv. Oslo 1957.
- Eide, Kjell: Utdanning og forskning i 1960-årenes Norge. "Tiden", Stockholm 1960. (Education and Scientific Work in Norway in the 1960's. "Tiden", Stockholm 1960.)
- Hove, Olav: An outline of Norwegian Education. Oslo 1958.
- Norway Yearbook. Oslo 1962.
- Scandinavian Research Guide, Vol.I-II. Oslo 1961. Directory of Research Institutions within Technology and Science exclusive of Life Sciences.
- Skattelov for landet av 18. aug. 1911. (Ordinary Taxation Law for Rural Areas.)
- Skattelov for byene av 18. aug. 1911. (Ordinary Taxation Law for Urban Areas.)

INSTITUTIONS:

- Amundsen, Leiv: Det norske videnskaps-akademi i Oslo 1857-1957, Vol.I-II. Oslo 1957. (The Norwegian Academy of Science and Letters in Oslo 1857-1957, Vol.I-II. Oslo 1957.)
- Devik, Olaf: NTH femti år. Oslo 1960. (The Norwegian Institute of Technology 1910-1960. Oslo 1960.)
- Joint Committee of the Norwegian Research Councils: The Research Councils of Norway. Oslo 1960.
- Norges landbrukshøgskole 1859-1959. Sarpsborg 1960. (The Norwegian College of Agriculture 1859-1959. Sarpsborg 1960.)
- Shetelig, H.: Norske museers historie. Oslo 1946. (The History of Norwegian Museums. Oslo 1946.)
- Universitetet i Oslo. Festskrift til Universitetets 150-års jubileum, Vol.I-II. Oslo 1961. (The University of Oslo. History of the University of Oslo in Connexion with its 150th Anniversary, Vol.I-II. Oslo 1961.)

STATISTICS:

- Forskningsrådenes fellesutvalg: Om tilgangen på og behovet for akademisk arbeidskraft, 1956-1965. Oslo 1957. (The Joint Committee of the Norwegian Research Councils: Supply and Demand for Professional Manpower, 1956-1965. Oslo 1957.)
- Forskningsrådenes fellesutvalg: Oversikt over stillinger ved norske universiteter og høyskoler den 30. juni 1959 og den 30. juni 1961. Stensil. Oslo 1961. (The Joint Committee of the Norwegian Research Councils: Scientific and Technical Personnel at Norwegian Universities and State Colleges, 30 June 1959 and 30 July 1961. Mimeograph. Oslo 1961.)
- Kirke- og undervisningsdepartementet: Innstilling om den videre utbygging av våre universiteter og høyskoler 1961-1970. Universitets- og høyskolekomiteen av 1960. Oslo, Mars 1960. (The Ministry of Church and Education: Report of the Committee for the Expansion of Universities and University Institutions 1961-1970. Universities and University Institutions Committee for 1960. Oslo, March 1961.)
- Stortingsmelding nr. 91 (1961-1962): Om den videre utbygging av universiteter og høyskoler. (Report No.91 (1961-1962) to Parliament on the Further Expansion of Universities and University Institutions.)
- Kirke- og undervisningsdepartementet: Budsjettforslag for 1963. (The Ministry of Church and Education: Budget Proposals for 1963.)
- Langtidsprogram (Long Term Programmes): Appendix nr. 11 til statsbudsjettet for 1945-1946. (Appendix No.11 to the Fiscal Budget 1945-1946, for the Post-war Reconstruction Period.)
- Stortingsmelding nr. 54 (1948). (Report to Parliament No.54 (1948).)
- Stortingsmelding nr. 62 (1953) for perioden 1958-1961. (Report to Parliament No.62 (1953) for the Period 1958-1961.)
- Stortingsmelding nr. 60 (1960-1961) for perioden

- 1962-1965. (Report to Parliament No.60 (1960-1961) for the Period 1962-1965.)
- Stortingsmelding nr. 63 (1964-1965) for perioden 1966-1969. (Report to Parliament No.63 (1964-1965) for the period 1966-1969.)
- Lindbekk, Tore: Rekrutteringen til forskning i Norge. Institutt for Samfunnsforskning. Stensil. Oslo 1962. (Recruitment for Research in Norway. Institute for Social Research. Mimeograph. Oslo 1962.)
- Norges almenvitenskapelige forskningsråd, Utredningsavdelingen. Tilgang på nye studenter og samlet antall studenter ved norske og utenlandske læresteder i 1962. Melding nr. 2, 1963. (The Norwegian Research Council for Science and the Humanities, Specialized Manpower Department: Recruitment of New Students and Total number of Norwegian Students at Norwegian and Foreign Universities and University Institutions in 1962. Report No.2, 1963.)
- Statens lånekasse for studerende ungdom: Oversikter over antall norske studenter som studerer i utlandet. Stensil. Oslo 1962. (The State Loan Fund: Survey of Norwegian Students Studying Abroad. Mimeograph. Oslo 1962.)
- Statistisk Sentralbyrå (The Central Bureau of Statistics):
- Folketellingen 1. desember 1950, heftene 1, 2 og 4. (Population Census 1 December, Volumes 1, 2 and 4.)
- Jordbruksstatistikk for 1959. (Agricultural Statistics for 1959.)
- Skattestatistikk for 1958. (Tax Statistics for 1958.)
- Statistiske månedshefter 1963, nr.7. (Monthly Bulletin of Statistics 1963, No.7.)
- Statistiske ukehefter 1962, nr.40. (Weekly Bulletin of Statistics 1962, No.40.)
- Statistisk Arbok for Norge 1943-1945 og 1964. (Statistical Yearbook of Norway for 1943-1945 and 1964.)
- Statistiske oversikter for 1948 og 1958. (Statistical Surveys for 1948 and 1958.)
- Økonomisk utsyn over årene 1900-1950 og 1964. (Economic Surveys for 1900-1950 and 1964.)
- United Nations Yearbook of National Accounts Statistics 1963. N.Y., 1964.