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Scientists and Social Responsibility in the Netherlands

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As the role of science in society has become more important and more complex, scientists have become increasingly conscious of their social responsibility. For the same reasons the systematic study of 'social responsibility' has received increasing attention. However, this study is still in its infancy. This is perhaps more true in the Netherlands[a] than in Great Britain and the United States, where there exists a tradition in the study of science policy and the social history and sociology of science. In the Netherlands, however, there is an important reason why the systematic study of social responsibility should be encouraged. The Higher Education Act of 1960 contains an article enjoining the universities[1] to pay attention to the advancement of a sense of social responsibility. Contrary to expectation, this legislation has only very recently been used as an occasion for the innovation of courses and curricula.[2] The driving force for the recent interest

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[a] Lettered annotations can be found at the end of the paper (pp. 476-84).

[1] In this paper the term 'university' will include state, municipal and private universities (the latter two kinds of university are also completely financed by the central government, but have somewhat more freedom), technical universities and the agricultural university.

[2] Cf. Wessel Slot, *Institutionalization of innovations in higher education: social dimensions of science in the technological universities in the Netherlands* (M.Sc. thesis in preparation, History and Social Studies of Science, University of Sussex).

in the Netherlands in studies of the social situation of science and scientists, must therefore be sought in changes which have occurred in the status and attitudes of the scientific community and the universities.

It is the purpose of this paper to describe the development of the social relations of science, and related ideas on social responsibility of scientists in the Netherlands, as a background to the recent introduction of courses on science and society in the Dutch universities.[3] Given the absence of previous studies, our description must necessarily be provisional. In this paper, we shall limit our attention to the period 1918-70. The German occupation during the Second World War, together with the impact of the war effort upon ideas about the social role of science, form a break, and the post-war period will be treated separately. The origins of the legislation on social responsibility in the Higher Education Act and recent developments in science and society courses will then be discussed. The concluding section will indicate some of the main trends discernible at present.

THE SOCIAL RELATIONS OF SCIENCE BEFORE THE SECOND WORLD WAR

Until the end of the nineteenth century, the organization and the social relations of science in the Netherlands do not appear to have changed greatly from the pattern set in the seventeenth century, during the last stages of the Dutch 'Golden Age'.[b] The Enlightenment brought some popular enthusiasm for science, and a number of scientific societies were founded.[c] The association of many men of science with the French Revolution, however, led to conflicts, and the domination by the French was more an interlude than a reorientation in this respect.[d] The nineteenth century saw important scientific movements in Great Britain (the movements for the advancement of science, and for the endowment of science) and in Germany (the development of the Gesellschaft Deutsche Naturforscher und Ärzte)[4] which had no Dutch counterparts.[e] Not until the end of the century, when the Dutch industrial revolution began to acquire momentum, were there systematic efforts to secure the organization of science.[f]

In 1908, the leading Dutch newspaper *Het Nieuws van de Dag* asked, rhetorically, whether anyone would get a slice of bread more from Van der Waals' equations.[5] By implying that Van der Waals' theory should not be valued for its

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[3] The present authors are connected with experimental courses in science and society in the departments of natural sciences in the State University of Leiden (A.R.) and in the Free University in Amsterdam (E.B.), and are concerned with building up – in co-operation with others – a number of research areas in this field.

[4] See, e.g. R. M. MacLeod, 'Resources of Science in Victorian England: The Endowment of Science Movement, 1868-1900', in P. Mathias (ed.), *Science and Society, 1600-1900* (Cambridge: Cambridge University Press, 1972), 111-66, and F. R. Pfetsch, *Zur Entwicklung der Wissenschaftspolitik in Deutschland* (Berlin: Duncker & Humblot, 1974).

[5] *Het Nieuws van de Dag,* 2 April 1908.

utility, the development of physics was considered to be autonomous, although having some useful applications. In the Netherlands, physics (and nearly all science) before the First World War was cultivated as an art, and industrial applications were generally taken as a welcome 'extra'.

Before the First World War a number of professional associations and societies devoted to single scientific disciplines appeared. These took over the aims of the societies of the eighteenth and nineteenth century, but they also saw it as their task to promote the professional competence, and sometimes also the professional status, of their members. The possibility of using science for social ends was clearly recognized and accepted, but was not considered as a driving force for furthering scientific research. At that time, social responsibility in science was not an issue.

During the First World War, however, the supply of raw materials was restricted, and Dutch scientists felt obliged to use their scientific training to aid their country. The Royal Netherlands Academy of Sciences, on the initiative of the physicist H. A. Lorentz, organized an extensive advisory council for research in the interest of public well-being and defence.[g] After 1918 the importance of systematic applications of science was stressed by many scientists. Although the use of chemical weapons in the war had opened eyes to the possible abuse of scientific knowledge in exceptional circumstances, the benefits of science were thought self-evident. Socialist ideas did not get as much publicity as in England,[6] but during the thirties the technocracy movement, proposing management by science, found some adherents.[h]

In physics, the social aspects of science received little attention before the Second World War. The professional journal *Nederlands Tijdschrift voor Natuurkunde* made no mention of these issues (except for some general remarks on the application of physics in industry on the occasion of opening a new laboratory or establishing a new chair), and in private discussions there was little interest in the social function of science.[7] It is remarkable that a 1939 series of lectures on 'Science and Society', supported by Teyler's Foundation in Haarlem, treated biology, economics, chemistry, medicine and psychology, but not physics.[8]

In chemistry, the situation was somewhat different. The Dutch Chemical Society had, from its beginning in 1903, always taken a lively interest in the economic and social position of the chemist. The weekly journal of the society, *Chemisch Weekblad,* devoted considerable space to the application of science and science organization,[i] and treated such issues as chemical warfare[9] and whether to

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[6] The only Dutch book known to the authors which refers to these ideas is Sjoerd Hofstra, *De Sociale Aspecten van Kennis en Wetenschap (The Social Aspects of Knowledge and Science)* (Amsterdam: Scheltema & Holkema, 1937). Hofstra limits himself to the English and German publications and complains about general ignorance of this discussion in the Netherlands (p. 61). Hofstra was an ethnologist, and his book stresses anthropological aspects; this may be the reason why the book did not receive wide attention in scientific circles.

[7] H. J. Groenewold, personal communication to the authors, 1974.

[8] *Ned. T. Natuurkunde,* 6 (1939), 331.

[9] H. J. Prins, *Chem. Weekblad,* 19 (1922), 343-7, and comments, *Chem. Weekblad,* 21 (1924), 181-4.

socialize the chemical industry.[10]

From the twenties to thirties, articles on the social aspects of science disappeared, and even news items appeared haphazardly. It was characteristic that J. D. Bernal's book, *The Social Function of Science,* was not mentioned at all in the physicists' journal, while the chemists' journal only reprinted a short and cautious review taken from the *Nieuwe Rotterdamsche Courant* (a Dutch quality newspaper) in which the title was misquoted as 'The Social Influence of Science'.[11] Even in the journals where one would expect social responsibility to be treated – e.g. the journal *Geloof en Wetenschap* (*Faith and Science*) of the Christelijke Vereniging van Natuur- en Geneeskundigen in Nederland (Christian Association of Scientists and Physicians in the Netherlands) – there was little interest in the social aspects of natural science.

The general picture we find – a burst of interest in the social relations of science during the twenties, and a nearly complete absence during the thirties – is clear, but its explanation is not. Comparison with other countries is difficult, although there seems to be no doubt that British scientists were more active in this area than were their Dutch colleagues. Perhaps the most remarkable aspect of the situation is that during both decades Dutch scientists were very active in international organizations. For example, the physicist H. A. Lorentz tried very hard to promote co-operation between the former belligerent powers in the years after 1919. In addition to chairing the Conseils Solvay in 1921 and 1923, he became a member (in 1923) and chairman (in 1925) of the 'Comité International de Cooperation Intellectuelle' of the League of Nations. In these functions and in the meeting of the 'Conseil International de Recherches' in Brussels in 1925, Lorentz pleaded strongly for admitting the Central Powers to the new international bodies.[12]

In the Netherlands, as in other neutral countries, there was much opposition to the Allied boycott of the Central Powers. In 1923 the Dutch Physical Society decided not to join the International Union of Pure and Applied Physics, notwithstanding the fact that a man of Lorentz's stature was strongly in favour of doing so.[k] The Dutch Chemical Society (with men like E. Cohen[13] and H. R. Kruyt[14]) preferred to press its point of view from the inside and had, after some hesitation, joined the International Union of Pure and Applied Chemistry (IUPAC) in

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[10] G. de Clercq, *Chem. Weekblad,* 17 (1920), 17-9, and comments, 518, 533, 543.

[11] *Chem. Weekblad,* 37 (1940), 35. Bernal's book was nearly unknown in the Netherlands until 1947, according to some of the founding members of the VWO, the Association of Scientific Researchworkers in the Netherlands. The war and the German occupation probably accounted for this.

[12] Brigitte Schröder-Gudehus, 'Challenge to Transnational Loyalties: International Scientific Organization after the First World War', *Science Studies,* 3 (1973), 93-118.

[13] E. Cohen (1869-1944) was professor of inorganic and physical chemistry in Utrecht from 1902 to 1939.

[14] H. R. Kruyt (1882-1959) was professor of physical chemistry in Utrecht from 1916 to 1946, and head of the Dutch Organization for Applied Research (TNO) from 1946 to 1953.

1920.[15]

With a strategy of official proposals and informal meetings the Dutch chemists, together with their Scandanavian colleagues, succeeded in revoking the explicit exclusion of the Central Powers, and in replacing it with a condition of membership of the League of Nations.[l] Subsequently, a corresponding proposal to the International Research Council (IRC) was adopted in 1926, and Germany was invited to become a member of the League of Nations. On the level of the IRC, the boycott had created too many hard feelings to permit a solution within the same organizational structure.[16] On the level of the Unions, however, attempts at reconciliation went on, and the Dutch chemists succeeded in bringing Germany into the IUPAC in 1929.[m]

The contributions of Dutch scientists towards international co-operation were widely recognized. Lorentz's work in the Comité International de Cooperation Intellectuelle of the League of Nations and in the IRC has already been mentioned. Kruyt and Cohen both were vice-presidents and presidents of the IUPAC, while Kruyt was also vice-president (from 1937-1945) of the International Council of Scientific Unions (ICSU) (the new name of the IRC) and president from 1945 to 1946. Undoubtedly, Kruyt's influence was significant in fashioning the Royal Netherlands Academy's contribution to ICSU. In 1934, the Academy proposed a resolution that stressed the brotherhood of science in the face of nationalistic and particularistic feelings.[17] The Academy then followed up its initiative with a proposal to appoint a committee to coordinate work in relation to the social responsibilities of science and of scientific workers.[18] Finally, in the event, however, only a watered-down proposal was accepted, and the work of the Committee was explicitly limited to surveys of current scientific activities.[n]

It is remarkable that these discussions had little or no direct impact upon the Dutch situation, even though Kruyt played a prominent role in Dutch scientific life. Although the chemists' journal, *Chemisch Weekblad*, promised to come back to the subject of the ICSU Committee, it never did so.[19] In Great Britain, however, *Nature* reported the work of the Committee (now styled the 'Committee on Science and its Social Relations') on the occasion of its meeting in November, 1937, and also devoted a special supplement to the social relations of science in 1938.[20] At about the same time, the British Association for the

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[15] *Chem. Weekblad,* **17** (1920), 330.

[16] Details have been given by Schröder-Gudehus, *op. cit.* note 12. Before the IRC adopted the motion, a stormy meeting was held in 1925, where the French chairman Picard obstructed the motion with procedural questions, which nearly meant the end of the IRC. See Brigitte Schröder-Gudehus, *Deutsche Wissenschaft und internationale Zusammenarbeit, 1914-1928* (Doctoral thesis, Genève, 1966), 244, and *Chem. Weekblad,* **22** (1925), 386-7 and 417-20. Lampitt's account of the event appears to be wrong: L. H. Lampitt, 'Towards International Collaboration in Science', *Chem. and Ind.* (1951), 485-93.

[17] *Chem. Weekblad,* **31** (1934), 496.

[18] *Chem. Weekblad,* **34** (1937), 358; *Nature,* **139** (1937), 690.

[19] In the physicists' journal *Nederlands Tijdschrift voor Natuurkunde* the subject was not even mentioned.

[20] *Nature,* **140** (1937), 983, and *Nature,* **141** (1938), 723-42.

Advancement of Science founded a Division for the Social and International Relations of Science.

The contrast between cosmopolitanism and parochialism in Dutch society has been pointed out before,[21] and it is evident in the lack of follow-up of the proposals put forward in international councils. It would go too far, however, to seek an explanation exclusively in Dutch national characteristics; one must also consider such factors as the different economic situation during the thirties, and the fact that these international activities were confined to a few members of the scientific community.[22] For a satisfactory analysis, the whole inter-war period should be studied in much more detail.

THE SOCIAL RESPONSIBILITY OF SCIENTISTS AFTER THE SECOND WORLD WAR

Discussions on the social responsibility of scientists form a debate with no fixed agenda. What is important and what is irrelevant depends on the view one has of society and the role of science, and scientists have seldom been a coherent group with definite views on this point. It is possible, however, to find some recurring themes in the discussion – such as the role of scientists in military and industrial research, unionism *versus* professionalism, elitism *versus* solidarity, and democracy *versus* technocracy or meritocracy. The evolution of these themes since at least the First World War is a subject that deserves closer attention.

In viewing Dutch scientific life generally, two periods can be clearly distinguished in the years following the Second World War – a culturally rather stable time up until the beginning of the sixties and a time of change that continues today. We may refer to these periods as describing an 'heroic age' of science, ending somewhere in the sixties, and an 'age of reflection', beginning during the same decade.

During the Second World War, because of the German occupation there could be no sustained war-effort by Dutch scientists acting together. There was however, much time for reflection and discussion on the future organization of scientific research and higher education, and on the future role of scientists themselves. The possibilities and dangers of atomic energy and the public impact in Europe of the atomic bombs dropped on Japan in 1945 added impetus to this

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[21] For instance, by Arend Lijphart, *The Politics of Accommodation, Pluralism and Democracy in the Netherlands* (Berkeley and Los Angeles: University of California Press, 1968), and by William Z. Shetter, *The Pillars of Society: Six Centuries of Civilization in the Netherlands* (The Hague: Martinus Nijhoff, 1971).

[22] Prominent in this group would be H. A. Lorentz, F. A. F. C. Went, E. Cohen, H. R. Kruyt, and J. M. Burgers. Of this group, Lorentz, Went and Kruyt were also active in the preparations for an organization for applied scientific research during the twenties (see note i), and in its gradual realization during the thirties. The unaccommodating attitude of many government officials and academic authorities in the Netherlands to their plans may have made them more discreet with their ideas in their own country.

discussion so that an organization of scientists, proposed in 1945, met with wide appeal. In 1946 the Verbond van Wetenschappelijke Onderzoekers, VWO (Association of Scientific Research Workers) was established, in which scientists with different views and different political sympathies came together. This heterogeneous membership was reflected in the VWO's objectives:

(1) the greatest possible development of scientific research;
(2) a deepening sense among scientific research workers of social responsibility with regard to the soundness of their work, to the choice of research and to the consequences of their activities for society;
(3) a strengthening of the social position of the scientific worker; and
(4) an increase of the social influence of the scientific worker in order that science would attain the highest returns for man and society.[23]

In the beginning, differences in aims and views between left-wing members and more conservative groups within the VWO were obscured by its large number of activities, including a number of well-attended conferences.[24] The increasing social pressures of the cold war, from 1948 onwards, induced internal conflicts in the VWO itself. A report on the frustration of science,[25] proudly announced in 1954 at a conference of the Dutch universities on 'Freedom and Restriction in Science and its Aspects in Society' (see below), was not published because of doubts with regard to its scientific and political validity on the part of the editorial board of the VWO's journal *Wetenschap en Samenleving (Science and Society)*.[26] Bitter discussions took place on whether to issue a public condemnation of the communist regimes, and the VWO's membership of the World Federation of Scientific Workers was cancelled (to be resumed only at the end of the sixties). By contrast, the campaign against the development and use of atomic weapons (after 1957 in co-operation with the national Pugwash committee) was a more generally accepted political activity.[27]

In the first ten years after the Second World War, VWO, with its conferences and articles published in its journal, was something of a forerunner. This was

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[23] Translated from a brochure of the VWO published in 1947, called *De Achtergrond van ons Streven (The Reasons behind our Efforts)*.

[24] For example, on the organization of fundamental research in the Netherlands (1947), on the re-organization of higher education (1951) and on world energy resources (1954). The VWO also introduced an insurance and a book service. For much data on the VWO we gratefully acknowledge H. Blok, 'The History of VWO' (unpublished essay, Centrum Algemene Vorming, Free University, Amsterdam, 1974).

[25] Following the British example of 1935, and leaning heavily on the report of the U.S. National Resources Committee, *Technological Trends and National Policy* (1937).

[26] It was finally published in part in 1967 on the occasion of a reappraisal of the VWO during its twentieth anniversary.

[27] At a meeting in 1955, a number of papers were read on the dangers of atomic weapons. These aroused much interest and were published separately as *De Gevaren van de Atoombom* (Amsterdam: Wereldbibliotheek, 1956).

recognized in a wistful editorial in *Wetenschap en Samenleving* in 1967, which looked back on the first twenty years and noted that many proposals that sounded revolutionary around 1950 were now commonly heard or actually put into practice. During the fifties, in the Dutch scientific community, there was more emphasis on ethical reflection than on proposals for change. This can be clearly seen in conferences held during that time – for example, at the symposium on 'Science and Society', organized on the occasion of the bicentenary of the Hollandse Maatschappij der Wetenschappen.[28] More significant perhaps, was the congress, organized by the Board of Vice-Chancellors of the Universities in the Netherlands, on 'Freedom and Restriction in Science and its Aspects in Society', held in The Hague, on 17 and 18 September 1954. This congress resulted from a request made by Columbia University at its bicentennial, to consider the theme 'Man's Right to Knowledge and the Free Use thereof'. After deliberation it was decided that this was an occasion for the Dutch universities to show that they could work together. The chairman in his opening address described the theme of the congress as the tension between freedom and restriction, discharging itself in a critical consideration of responsibility. Well-known speakers were invited to consider this theme, distinguished scholars wrote discussion papers, and the Queen attended part of the proceedings. The congress was generally felt to be an important event, and the speeches and papers were translated and published.[29]

The three invited speeches – on the value of science (by J. M. Burgers); on the limits of science (by the metaphysical philosopher J. A. J. Peters); and on the boundaries of science (by the physicist R. Kronig) – converged in their anxiety about the accelerated development of the sciences and the social problems this entailed. They were all, however, convinced of the ultimate value of science in the scheme of things. This view was made very clear when Burgers quoted Smuts admiringly:

> Indeed, it may fairly be said that science is perhaps the clearest revelation of God to our age . . . One of the greatest tasks before the human race will be to link up science with ethical values, and thus to remove grave danger threatening our future.[30]

In the discussion papers the same theme recurred, sometimes seasoned with some relativism, as in G. E. Langemeijer's carefully reasoned essay on legitimate restriction of freedom in science. Exceptions included H. J. Pos, a philosopher, who emphasized the cultural role of science in the upholding of truth,[31] and W.

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[28] Published as J. Clay *et al., Wetenschap en Maatschappij* (Amsterdam: Noord-Hollandse Uitg. Mij., 1952). The Hollandse Maatschappij der Wetenschappen (Holland Society of Sciences) is the oldest surviving scientific society in the Netherlands.

[29] Published in English translation as *Freedom and Restriction in Science and its Aspects in Society* (The Hague: Martinus Nijhoff, 1955).

[30] J. C. Smuts, Presidential Address before the Centenary Meeting of the British Association for the Advancement of Science (London, 1931).

[31] '(The scholar) is called upon to serve truth in the clash of interests and their accompanying prejudices and delusions', *Freedom and Restriction, op. cit.* note 29, 154.

F. Wertheim, a sociologist, whose social criticism was immediately apparent in his opening sentences.[32] Wertheim's paper presented examples from the VWO report on 'Frustration of Science'.[33] His attitude towards the role of science in society was attacked by a Catholic scholar, who feared that ethical values would be neglected, and by an anti-communist crusader, who introduced the cold war argument that 'in order to maintain our own freedom and that of science we must be armed to the teeth'.[34] This open intrusion of politics, however, was outside the bounds carefully set for the congress, and met with wellbred disapproval.

On the whole, the congress showed the rather academic and contemplative attitude towards the issue of social responsibility characteristic of the period. Even inside the VWO, a tendency to stress the fundamental, ethical aspects of social responsibility became important. This trend was especially evident in a group of research workers connected with the Physical Laboratory of Philips at Eindhoven, where controversial activities could bring them into conflict with their employers. The spokesman for this group was C. J. Dippel, a chemist who had received an honorary doctorate in theology for his contributions to ethics,[35] and who had criticized Wertheim at the congress on 'Freedom and Restriction in Science' on a technical point with ideological overtones.[36]

The situation in the Physical Laboratory of Philips was much more liberal than in other industrial research laboratories. Symbolic of this was a series of lectures and discussions held in 1960 on research and ethics. This series was supported by the directors of the laboratory, and its proceedings were published in 1962.[37] The speakers (C. J. Dippel, J. Voogd, H. van Riessen, and R. Kwant) all spoke from a religious or humanistic point of view and the subjects of discussion were all of a general nature. From an employer's point of view however, they were 'safe' subjects, and there was no follow-up in definite actions.[O]

C. J. Dippel of the Philips group is an example of a generation of thinkers concerned with the social responsibility of scientists, all born in the first decades of the twentieth century, and having a predominantly ethical outlook Dippel argued that scientists tend to adapt, without much thought, to the dominating system of norms and values, in this case of a capitalistic consumer society. His remedy starts with small, interdisciplinary groups of natural and social scientists who analyse the social implications of scientific developments and who nucleate larger groups, in a process which would finally lead to an ideal society. Dippel's

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[32] Wertheim points out that freedom in science is often understood only negatively as the absence of formal restrictions, while it is much more a question of what the man of science is actually able to effect and whether science is free to develop its full potentialities; *Freedom and Restriction op. cit.* note 29, 89.

[33] See above and notes 25 and 26.

[34] *Freedom and Restriction, op. cit.* note 29, 111.

[35] C. J. Dippel, *Verkenning en Verwachting* (The Hague: Boekencentrum, 1962), and C. J. Dippel and J. M. de Jong (eds.), *Geloof en Natuurwetenschappen,* two vols (The Hague: Boekencentrum, 1966).

[36] The point involved was the determination of the optimum lifetime of light-bulbs, in terms of light yielded; *Freedom and Restriction, op. cit.* note 29, 191-6.

[37] C. J. Dippel *et al., Research Ethiek* (Haarlem: Erven F. Bohn, 1962).

argument was couched largely in theological terms, and his analysis never had much influence outside a small circle of Protestant thinkers. However, his attitude and his activities in Christian student associations, the Party of Labour and the VWO, did not fail to leave an impression.

A. G. M. van Melsen, one of the contributors to the congress on 'Freedom and Restriction in Science', emphasized that the only responsibility specific to the scientist is veracity. His other responsibilities are those common to all people; he cannot, for instance, be held responsible for possible or actual abuses of scientific results, because he is not in a position to foresee or prevent them. In later work, van Melsen has modified this view, and now believes that since the development of science has shown the order of nature and society not to be fixed but changeable (within certain bounds), and has produced means of change, scientists have the responsibility to strive after changes for the best. Nonetheless he argues, they will not be indicted for failure, because they are not responsible for their own (lack of) abilities, nor for the difficulties inherent in the inter-action of science and society.[38] Van Melsen and Dippel were connected with science by education and profession. This was not the case, however, with men like H. J. Heering and P. J. Roscam Abbing, who have taught ethics in departments of theology, and who have campaigned for the introduction of ethics in the university curricula.[39] They have seldom discussed the situation of the scientist explicitly, but have tried instead to find scientists (of different disciplines) who wish to examine the ethical problems of their discipline. This has resulted, to date, in a number of discussion groups and two books.[p]

These ethical discussions dominated the scene in the Netherlands in the first twenty years after the Second World War. During this period, no widespread debate on the 'planning of science' occurred. There were, of course, potential conflicts. The universities traditionally defended the autonomous, cultural role of science, while technical scientists and left-wing organizations tended to emphasize the role of science as a factor in production and thus were in favour of planning in science. But these conflicts have not, until quite recently, been pressed, partly in keeping with the Dutch tradition of pluralism and the ideal of an ultimate harmony between seemingly conflicting points of view. This ideal is undoubtedly connected with the influence of religious world-views in Dutch political life in general.

The beginning of the sixties, however, marks a transition in the Netherlands from a rather static society with a common aim of reconstructing a prosperous country, to a more dynamic society, where divergences of opinion are discussed publicly and where 'critical' becomes a fashionable term. Symptoms like the 'provo' movement (and, later, the 'goblins') have had press coverage all over the

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[38] A. G. M. van Melsen, *Physical Sciences and Ethics* (Pittsburgh: Duquesne University Press, 1967), and *Science and Responsibility* (Pittsburgh: Duquesne University Press, 1970).

[39] H. J. Heering, *Ethiek aan de Universiteit (Ethics at the University)*, Inaugural Lecture (Leiden, 1964); H. J. Heering, 'Ethiek in Wetenschap en Beroep' (Ethics in Science and in the Professions), *Universiteit en Hogeschool*, **16** (1969/70), 97-112; and Roscam Abbing's contributions to the books quoted in note p at the end of the paper.

world. For the issue of social responsibility in science, the influence of the Critical University movement has been important, first in student circles and later for young scientists, especially in the universities.

In the VWO, friction developed between more activist and more philosophically oriented wings of the association. The original membership, of about 500 around 1950, had not increased during the fifties and, after a short revival in 1962 and 1963 (occasioned by the two controversial reports on the protection of citizens against nuclear warfare and on secret service investigations into the political reliability of scientists), it began to decline.[40] At its twentieth anniversary in 1966, there was talk of a loss of purpose and of dissolving the association,[41] but five years later the situation had changed.[42] An influx of younger scientists, the appearance of another, comparable organization of scientists (the BWA, see below), and a period of reflection on the aims of the association resulted in increased activities. New statutory aims were formulated in such a way that the new ideas and activities could be accommodated.[43]

In the sixties, recognition of the political aspects of science, previously almost a prerogative of the VWO, became more general. A congress of the Royal Dutch Academy and the Academic Council (on which all universities are represented), entitled 'Living with Science', was held in 1968. This congress was similar in many ways to the 1954 congress on 'Freedom and Restriction in Science': almost the same organizing institutions, comparable speakers (sometimes the same), and a comparable audience. Significantly, however, it comprised a summing-up which could not have been made fourteen years earlier: the president of the Academic Council in his closing address said that anxiety in human life is not caused by natural forces or attributed to divine sources, but is directed towards the question of what Man, what our fellow-men will do with the power over nature given to us

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[40] A very rough estimate puts the membership of the VWO in 1950 at two per cent of the university graduates having some occupation. The number of members remained at about 500 during the fifties, and increased to about 650 around 1965. After a slight dip in 1966 and 1967, it rose quickly to about 800 in the seventies, of which about 200 are students. This can be compared with the number of university graduates having some occupation, 84,000 in 1970, almost two per cent of the total working population according to table 3.3 of a parliamentary paper on supply and demand of university graduates up till 1990 (Tweede Kamer der Staten Generaal, Zitting 1974/75, *13 323* nr. 2). See further H. Blok, *op. cit.* note 24.

[41] *Wetenschap en Samenleving,* **21** (1967), 1-8.

[42] W. F. Wertheim, '25 Jaar Geëngageerde Wetenschap' (25 years of Concerned Science), *Wetenschap en Samenleving,* **25** (1971), 141-9.

[43] According to the statutory aims, the VWO wants to contribute to the humanization of global society, in particular by signalizing potentialities and dangers of science; by examining and critically reviewing guiding factors in the development and the application of science and by shaping the individual and collective responsibilities of scientific workers. It should be remarked that in this statement of aims there is no sign of the increasing emphasis on solidarity with other organizations, especially labour unions. This trend is in marked contrast with the rather elitist attitude of the VWO in its earlier years.

by science and technology. The responsibility, once enthroned on Olympus, has descended towards the Earth.[44]

In the universities, a transition from an emphasis on autonomy to an emphasis on social awareness is reflected in the themes and speeches of commemorative congresses. In 1956, the University of Utrecht organized a congress on 'Scientific Research and Society', where the main issue was whether applied research was allowable in the universities, and whether contract research should be done.[45] When in 1970 the University of Leiden organized a congress on 'Science and Wellbeing', however, the themes centred on the political role of the university, and the possibility of doing 'critical' scientific research.[q] The change in the universities, although it had been making itself felt earlier, came into the open with the student movements of 1968 and 1969. One sign of the times was a memorandum on 'Academic Freedom and Social Responsibility', signed by forty professors and lecturers from Leiden, in which an attempt was made to integrate the academic's double loyalty towards science and towards society.[46]

When the students who had been active in the student movements (and also earlier in a syndicalistic *Studenten Vak Beweging* (Students Trade Union)) graduated, the need was felt for an organization of scientists with a more explicit anti-capitalistic character and more emphasis on direct action, than had been usual in the VWO. In 1969, the Bond van Wetenschappelijke Arbeiders, BWA (Union of Scientific Workers) was founded: from the beginning a small but devoted cadre worked towards a radicalization of the scientific community and a confrontation of 'establishment science' with 'critical science', with the long-term aim of fighting capitalism.[47] The developments inside the VWO sketched above have brought the older organization closer to the aims of the BWA in recent years, although the different attitudes (oversimply put as contemplation *versus* action) can still be recognized. The recent combination of the VWO journal and the BWA newsletter into one periodical is a sign that increasing co-operation between the two organizations is becoming necessary, and possible.

At present, discussions on the social responsibility of the scientist are not confined to congresses or specialized organizations like the VWO. In university curricula, attention is being paid to social responsibility and the debate on the limits to growth has led many people into a re-appraisal of the responsibility of the scientist.

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[44] *Leven met de Wetenschap (Living with Science)* (Utrecht: Oosthoek, 1968).

[45] Discussion papers were published in *Universiteit en Hogeschool,* 2 (1955/56), 193-275.

[46] *Acta et Agenda,* 14 May 1970, 359, 366. In reply, other professors defended the traditional values of the university.

[47] A number of books and articles on military research, food research and technology, cosmetics, science policy, and the class position of the scientific worker have appeared as a result of BWA activities. They have also been influential by voicing criticisms in scientific associations and at congresses.

SOCIAL RESPONSIBILITY IN UNIVERSITY CURRICULA

In the Netherlands there is probably a unique situation where the law requires the universities to pay attention to social responsibility. According to the Higher Education Act[48] of 1960, the definition of a scientific education and the goal of the university are as follows:

Art. 1: Scientific education comprises training for the independent cultivation of sciences and humanities, and the preparation for occupations in society for which a scientific education is required or may be expedient, and it promotes the understanding of the interconnectedness of the sciences.

Art. 2.1: The institutions for scientific education are distinguished in universities and other institutions.

Art. 2.2: Apart from teaching, the universities in any case have the aim of performing research; they also pay attention to the advancement of a sense of social responsibility.[49]

The origin of article 2.2. *in fine* is intricatedly bound up with the Dutch political situation. After the German occupation during the Second World War, the Dutch greeted their new-found independence in a spirit of reconstruction and renewal. Many felt that a 'breakthrough' should dissolve the old order of 'verzuiling' (pillarization),[50] and a Dutch Popular Movement was formed to propagate the ideas of personalistic socialism, ideas that should be a meeting ground for liberals, protestants, catholics and socialists alike. Apart from socialism, contributions to personalistic socialism came from Catholic personalistic philosophers (e.g. Jacques Maritain) and from some of the new, socially oriented movements in the Protestant churches; the emphasis was on a new, spiritual order, founded not on the mystique of race, class or political party, but on a concrete sense of personal responsibility.[51]

The 'breakthrough' was not realized in the first election in 1946, and the old 'pillars' regained their hold in Parliament, and were not to lose it for another

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[48] The literal translation of the Dutch term, *Wet Wetenschappelijk Onderwijs,* would be 'Scientific Education Act'. 'Scientific' here must be taken to include the social sciences and the humanities, as in the German expression 'Wissenschaft'. To facilitate reading, we have chosen to translate the name of the Act freely as the 'Higher Education Act'.

[49] It should be noted that this translation is not authorized and cannot be taken to give the full implications of the original Dutch text. Among other things, the word 'university' here includes schools of technology, of medicine, of economy, and of theology.

[50] A vertical division of society into blocs with their own ideology and organizations, and communicating only at the top. See Arend Lijphart, *op. cit.* note 21; William Z. Shetter, *op. cit.* note 21; and Johan Goudsblom, *Dutch Society* (New York: Random House, 1967).

[51] H. M. Ruitenbeek, *Het Ontstaan van de Partij van de Arbeid (The Origins of the Party of Labour)* (Amsterdam: Wiardi Beckman Stichting, no date), 273.

twenty years. G. van der Leeuw, Minister for Education, Art, and Sciences in the transitional Cabinet of 1945-1946 (which leaned heavily on the Dutch Popular Movement), was one of the promoters of the new order of personalistic socialism.[52] In 1946 he installed a governmental Commission on the Renewal of Higher Education (Commissie Reinink) in which some of the exponents of the philosophy of personalistic socialism (e.g. the socialist and theologian W. Banning) played prominent parts. Thus, it is not surprising that the report of the Commission contained the proposal to:

> include as a goal of the universities the advancement of the spiritual and moral training and of the sense of social responsibility of the students, as related to those spiritual values that have characterized our nation in its history, that are determined by Christianity and Humanism, and are expressed particularly in respect for one's fellow-men.[53]

According to the Commission, this spiritual foundation of the university had never been formulated explicitly, although it should be seen as an essential element of the university, as the experiences during the German occupation had taught.

The Commission's proposal was incorporated, in a weakened form, in the Higher Education Bill of 1952, but the spirit of national unity and a common foundation had been lost. The political parties did not like goals that could be interpreted as favouring one or other of the 'pillars', and would disturb the equilibrium between neutral, 'public' schools and confessional schools – although some praise was voiced for the clause on social responsibility. The whole atmosphere was unfavourable to change and the government let the Bill lie quietly for nearly a decade.

In the Revised Bill of 1960 all reference to the spiritual foundation of Dutch culture, personality development and social responsibility had disappeared. But now the Socialist Party protested that the good had been rejected with the bad. Social responsibility (conceived as an active interest in the social aspects of science and the role of the university in society) should be re-introduced, especially because it was thought to be conspicuously absent in the universities. Conservatives, on the other hand, declared that they saw no need for such an article in the Bill, since the university education would – and did – by itself impart a sense of social responsibility. For the same reason, however, they would not oppose the socialists' amendment: it would not change anything, and would only make explicit something already present. The amendment was carried almost unanimously, with only the Communist Party voting against it.[54]

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[52] G. van der Leeuw, *Balans van Nederland (Balance-Sheet of the Netherlands)* (Amsterdam: Paris, 1945).

[53] *Rapport van de Staatscommissie tot Reorganisatie van het Hooger Onderwijs* (The Hague: Staatsdrukkerij, 1949).

[54] The spokesman for the Communist Party, M. Bakker, pointed out that definitions of social responsibility differ according to differing political views, and that the inclusion of this article in the Bill would lead to political indoctrination, more particularly indoctrination with the views of the ruling classes. He therefore opposed the introduction of the clause on social responsibility.

It is remarkable that the clause on social responsibility appeared in the Higher Education Act on the basis of political considerations and without specific pressure from the universities themselves. The play of power between different parties, neither of which had sufficient votes by itself to carry through its point of view, determined the fate of the clause on social responsibility, and in agreement with Aubert's analysis,[55] in the universities themselves nothing changed as a result of this new formulation of their goals.[56] Only when social developments in general had brought about a new atmosphere, were the possibilities of advancing a sense of social responsibility as a part of the university curriculum taken seriously.

When the cold war of the fifties had lost some of its spell, there was room for discussion of social and political issues. This influence reached the universities through different channels: the confessional student associations and the professors in theology and ethics; the social sciences with their methodology debate (e.g. Popper *versus* Adorno); the influence on students of the Frankfurt School and the Critical University Movement in Germany; social problems raised in connection with some disciplines.[57] In 1968, the major Protestant Churches made a request to the Academic Council to introduce ethics into all curricula. This led to the convening of a working party of the Academic Council in 1969, which published its final report in 1972.[58]

In the meantime, student movements all over the world had become increasingly active. In the late spring of 1969, Dutch university authorities went through a hectic time when students occupied university buildings and held meetings calling for more democratic administration and study reforms. In the science departments, one of the demands was for a more liberal curriculum, including the study of social, ethical, and philosophical aspects of science. To allay the storm, almost all universities allowed experimental courses or seminars in these subjects to be set up, sometimes with the help of the departments of philosophy or adult education, and often supported by individual staff-members interested in these problems.[I]

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[55] V. Aubert, 'Some Social Functions of Legislations', *Acta Sociologica,* **10** (1966), 99-110, points out that in a situation where 'progressive' and 'conservative' parties neither have sufficient power by themselves, a compromise text will be agreed upon, allowing for a 'progressive' as well as a 'conservative' interpretation. It then depends on other developments which interpretation will prevail.

[56] This has been documented by Van Ginkel for a traditional part of the university education, the Studium Generale (general lectures); M. V. van Ginkel, *Het Studium General te Leiden* (unpublished essay, Department of Sociology of Law, Leiden, June 1972).

[57] E.g. nuclear physics and radioactive fall-out; phytopathology and insecticides; polemology (peace studies); and adult education and its possible integration in the university curriculum.

[58] The working-party was chaired by H. J. Heering (cf. note 39) and its report was entitled (in English translation) 'The Changing Place of Science in Society and the Implications for Ethics in Scientific Education'. The report was published in the university bi-monthly *Universiteit en Hogeschool,* 19 (1972/73), 147-94, and sent for comment to all universities. Since the report is issued by the Academic Council, this implies that the university councils at all levels must discuss it.

Only under these circumstances was the existence of the last clause of article 2.2. of the Higher Education Act of 1960 finally recognized. Then it was used whenever a formal justification was required. As might be expected, there were few attempts to deduce from the rather equivocal clause more definite guidelines for the new courses; the driving force for the experiments was the recognition of the social and ethical problems of science and, of course, the political problems of the university.

Most of the experiments succeeded in developing into workable forms by trial and error. This happened more or less independently in the different universities, but by 1972 informal contacts between different groups and individuals (almost all in the science departments) led to the formation of a Working Party on Science and Society Courses. This working party has been engaged in promoting courses, and in defining the problem-area of 'science and society'; it also serves to exchange information and to stimulate personal contacts.

According to an article in the bi-monthly journal of the universities[59] 'science and society' is problem-oriented, and is concerned with the situation of scientists and the role of science in society in the broadest respects. Problem areas to be studied include science policy and research policy, professionalization and the status of the scientific worker, science and technology assessment, and science and development. In this definition, 'science and society' has prescriptive as well as descriptive aspects, and the relation between these aspects will be one of its main problems. In the same way, there are two sets of contributing disciplines. On the one hand, we have the history and sociology of science, the economics of innovation, etc.; the contribution of this set of disciplines can be called 'applied science studies'.[60] On the other hand, we have ethics, philosophy of science, critical analyses of society and normative forecasting. The inclusion of the latter set of subjects clearly shows the influence of confessional groups, as well as of the Critical University Movement.[S]

THE SEVENTIES

Discussions about social responsibility entered a new stage in the seventies. They were affected partly by growing concern about the finiteness of resources and the interrelation between growth, pollution and the depletion of resources; partly by concern about the increasing mismatch between university education and the uses to which society puts its scientists: partly by the call for policies for science and for scientific research, and partly by the democratization of university councils, and the subsequent call for more democratic research councils in other research institutes.

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[59] A. Rip, O. A. de Vries, E. Boeker, W. F. Slot, '"Wetenschap en Samenleving" in de Natuurwetenschappelijke Fakulteiten en Technische Hogescholen' (Science and Society in the Departments of Natural Science and the Technical Universities), *Universiteit en Hogeschool,* 19 (1972/73), 301-9.

[60] The term 'applied science studies' has been used by R. Aron to denote the use of the results of science studies for science policy; see A. de Reuck, M. Goldsmith, J. Knight (eds.), *Decision Making in National Science Policy* (London: J. & A. Churchill Ltd., 1968), 284.

The importance of the discussions on growth, pollution and resources is shown by the reception of the Club of Rome Report (the 'Meadows Report') on *Limits to Growth.*[t] The Meadows Report was studied systematically by a number of computer experts and economists who tried to improve it.[u] One reason for this wide interest was that the Netherlands are among the most densely populated countries in the world – and prosperous enough to afford worrying about the long term future. Within a year, 200,000 copies were sold, and a working party of top people from industry, science and administration was formed. The working party published a report (*Work for the Future*),[61] sent policy proposals to the Dutch government, and organized a number of discussion meetings.[62]

Limits to resources were also felt in the field of higher education. Over the years 1955 to 1970 the number of students in Dutch universities grew by nine per cent p.a.;[63] this exponential growth, together with the increasing costs of other forms of education, amounted to total educational costs reaching a level of around 10 per cent of GNP in 1970.[64] Increasing costs contributed to the reasons why the government commissioned K. Posthumus to design a revised structure of scientific education.[65] In 1971, this resulted in a Bill which proposed a drastic reduction in the time a student is allowed to spend on his scientific education: to four (or sometimes five) years instead of an average of seven years as is now the case. Due to vigorous opposition from university circles, decisions in Parliament were postponed several times; a final discussion is expected sometime in 1975.[v]

After Posthumus' endeavours, a committee[66] worked out the educational aspects of his proposals, keeping in mind the kind of careers scientists were expected to choose. This committee recommended a combination of a reduced curriculum and early specialization. Besides the traditional curricula for research and teaching jobs, they also considered liberal curricula for general jobs. In their recommendation, they tried to adapt university education to the needs of society,

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[61] W. J. Beek *et al., Werk voor de Toekomst (Work for the Future)* (The Hague: Stichting Maatschappij en Onderneming, 1973). English, French, and German translations are available (P.O. Box 5859, The Hague).

[62] The meetings were held in the Royal Palace in Amsterdam with a carefully selected audience (including the Queen, who attended all the lectures) on 27, 28 April and 18, 19 May, 1973. The proceedings were published in Dutch under the title 'Tussentijds Bestek', by the Stichting Maatschappij en Onderneming, The Hague.

[63] C. le Pair, 'Grote Groei van Studentenaantallen veroorzaakt Tekort aan Academici: Puzzels rond de Exponentiële Groei' (Big Increase in Student Numbers causes Shortage of Graduates: Puzzles of Exponential Growth), *Universiteit en Hogeschool,* 18 (1971/72), 529-34.

[64] J. Tinbergen, 'Onderwijsplan en Numerus Fixus' (Educational Plan and Numerus Fixus), *Universiteit en Hogeschool,* 16 (1969/70), 189-93.

[65] Posthumus published a discussion report (*De Universiteit, Doelstellingen, Functies, Structuren,* 1968), a first reaction to the criticisms (*id., Eerste Voortgangsnota,* 1969) and final proposals (*id., Tweede Voortgangsnota,* 1970). All reports were published by Staatsuitgeverij, The Hague (Christoffel Plantijnstraat).

[66] The Committee was named the Wiegersma-Committee after its chairman, and was appointed by the Academic Council in 1973.

as well as making it cheaper and more efficient.

In the meantime, the government tried to decrease the rate of expansion of its education budget by frequent stops in the recruitment of staff. A simultaneous tightening in the budgets of the industrial research laboratories at the beginning of the seventies (caused by the levelling off of industrial expansion) resulted in a sudden, and by many scientists, unexpected unemployment.[W] The unemployment problem pointed to the necessity of planning in higher education. The planning of research has received more attention since the foundation of the Science Policy Advisory Council in 1966, and has received additional impetus from the belief in government circles that research in the universities has been getting out of control. Starting with research in the universities, discussions have now been extended to other government-financed institutes, and even to the industrial research laboratories of the big multinational companies.[X] In a recent *Memorandum on Science Policy,* the Minister for Science Policy has proposed a reorganization of the existing government-financed institutes and advisory bodies in such a way that much more coordination of research, as well as closer adaptation of research to government goals will become possible.[67]

A complementary development is an increasing emphasis on democratization in all sectors of public life, which has gone farthest in the universities. In 1972 a new Act came into force, according to which a university is controlled by a University Council where members come from all groups – senior and junior academic staff, students, administrative and technical staff. The departments are governed by similar councils in which educational and research policies are determined, planning and budgeting is approved and the functioning of the department is discussed.[68] The reorganized universities have started to develop and apply planning and accounting procedures, partly in response to the criticisms of the government and of the general public.

The democratization of the universities, which has now been under way for two years, opened the way at all levels to public discussion of university policies, including research policies.[69] Non-academic interests are now in most cases represented on University Councils by crown-appointed members, and effectively also on other levels by students and junior staff, who will in general be more willing to take up other causes because of the absence of vested interests. To date, no essentially new policies have been formulated from which a conception of the social responsibility of the scientist can be deduced; however, a number of

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[67] F. H. P. Trip, *Beleidsnota Wetenschapsbeleid (Policy Memorandum on Science Policy)* (The Hague: Staatsuitgeverij, 1974).

[68] The Act is called *Wet Universitaire Bestuurshervorming* (Reorganization of University Administration). Cf. H. Daalder, 'The Dutch Universities between the "New Democracy" and the "New Management" ', *Minerva,* 12 (1974), 221-57; Daalder's negative appraisal of the functioning of the Act may be correct for the Faculties of Social Sciences and Humanities, but is certainly not applicable to the Faculties of Natural Sciences.

[69] With the example of the universities in mind proposals have been made for a more democratic structure of research organizations, sometimes including industrial research laboratories. An example is the 'Democratic Counter-Proposal' of the VWO and BWA, published in *Wetenschap en Samenleving,* nr. 6 (1974).

decisions that have been taken (e.g. to offer scientific support for North Vietnam, and to reject NATO grants) show that it is possible for the reorganized universities to take a stand on social and political issues in science.

There also appears to be a widespread feeling in the Netherlands that – apart from the cultural task of science – scientists should do more 'relevant' research, particularly of a kind relevant to the global problems of hunger, pollution and depletion of resources. The contrast between perceived research goals and the difficulty in actually changing directions of research – and also the unemployment of scientists in the face of research needs – have raised doubts with regard to simple or technocratic solutions, and have focused attention on the social situation of science. The need for better and more coordinated research policies in this respect is often stressed. On the other hand, opposition against proposals to streamline university education to fit social ends, as well as the experience of limited self-government in the universities, has re-awakened the wish for social as well as intellectual autonomy. Indeed, when the University of Leiden celebrated its 400th anniversary in 1975, the key-note was 'Freedom and Restriction of Science', echoing the congress of twenty-one years ago.[70]

As a final point we note that growing experience with democratic decision-making in the universities, and with environmental problems has enabled scientists in the Netherlands to initiate a wider debate on the relation between specialist knowledge and social aims, and on the role of experts in decision-making. The changing social situation of scientists and research has put ethical discussions about the social responsibility of the scientist into a much more practical context. Much larger groups of scientists than those in the VWO are now facing the problems of science in society.

In the present situation, it is not easy to choose between a new servitude to social aims or a new autonomy that makes criticism possible. To our minds, a very important first step towards introducing a sense of social responsibility into the work of scientists is an awareness of the social situation of science. To this end, the results of systematic study of the social and historical context of scientific research, science policy studies, the economics of science and the study of science and development will have to be made available to scientists. 'Science and Society' courses in the universities, supported by social studies of science, will therefore be very important. Perhaps, they will, in time, result in an implementation of the long-standing article on social responsibility that featured so significantly in the Higher Education Act of 1960.

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[70] *Freedom and Restriction, op. cit.* note 29.

NOTES

[a] In the field of science studies as such there are very few contributions. See J. V. Meininger, *Wetenschapskundige Verkenningen (Reconnoitrings in Science Studies)* (published privately, 1968). With sociologists, the sociology of science has not attracted much attention; a recent attempt to rouse some interest is W. Zweers, 'Naar een Kritische Wetenschapssociologie' (Towards a Critical Sociology of Science), *Mens en Maatschappij* (1973), 122-47. See also the contributions by C. J. Lammers, W. van Rossum, A. Mok, and A. Westerdiep in R. D. Whitley (ed.), *Social Processes of Scientific Development* (London: Routledge and Kegan Paul, 1974). Neighbouring disciplines have contributed to the field – in the history of science (R. Hooykaas, E. Dijksterhuis, R. J. Forbes, and, from a Marxist point of view, A. Pannekoek); the philosophy of science (E. W. Beth, H. J. Pos, C. A. van Peursen, A. G. M. van Melsen, and J. M. Burgers; a recent review is given by C. A. van Peursen and R. J. A. van Dijk in *Z. f. allgem. Wissenschaftstheorie*, 3 (1973), 372-9). Contributions from the sociology and philosophy of culture include P. J. Bouman, 'De Invloed van Overheid en Maatschappij op Doel en Middelen' (The Influence of Government and Society on Goals and Means of Science), in *Vrijheid en Gebondenheid in de Wetenschap* (Groningen: Wolters, 1948), 89-108; F. L. Polak, 'Wetenschap en Maatschappij als Probleem van Maatschappijwetenschap' (Science and Society as a Problem of Social Science), in *Wetenschap en Maatschappij* (Amsterdam: Noordhollandse Uitg. Mij., 1952), 103-60; C. A. van Peursen, *Strategie van de Cultuur* (Strategy of Culture) (Amsterdam: Elsevier, 1970). In the sociology of the professions a doctoral dissertation by B. S. Witte, *De Wetenschappelijke Ambtenaar aan de Nederlandse Universiteiten en Hogescholen (The Scientific Staff-Member in the Dutch Universities)* (Assen: Van Gorcum, 1963) can be cited, while the work of A. L. Mok has also been directed to scientific professions; see A. L. Mok (ed.), *Jonge Academici in het Bedrijfsleven (Young Graduates in Trade and Industry)* (Rotterdam: University Press, 1972) – which contains some interesting contributions by other sociologists and economists – and A. L. Mok, *Beroepen in Actie (Professions in Action)* (Meppel: Boom, 1973).

[b] The whole development of Dutch society from the seventeenth to the nineteenth century can be seen as the spelling out of a pattern set during the war of independence against Spain, and has been aptly described as that of a 'country without a history living in the past' (J. H. Plumb, Introduction, in: C. R. Boxer, *The Dutch Seaborne Empire, 1600-1800* (Pelican edition, 1973)). Protestant bankers and merchants formed the ruling elite of 'Regents', and the government was decentralized. The tolerance for which the Netherlands were famous was the tolerance of urban businessmen 'who saw that their valuable contacts with all kinds of people could only be successfully carried on by treating business as business and treating niceties such as religion, politics or regional origin as not particularly relevant to everyday social interaction' (W. Z. Shetter, *The Pillars of Society, Six Centuries of Civilization in the Netherlands* (The Hague: Martinus Nijhoff, 1971)).

[c] An example of the activities of one society is the prize, offered by the Provinciaal Utrechts Genootschap van Kunsten en Wetenschappen (Provincial Utrecht Society for Arts and Sciences) in 1784, for an essay on the following questions (in English translation): 'What are the real reasons why chemistry stands in higher esteem and is cultivated more widely with our neighbours, and especially with the Germans, than in our own country? What is the best way to cause the elements of chemistry to be taught, at least in the principal towns of our United Republic? What are the most accomplished means to effect a general cultivation of that necessary and salutary art among the pharmacists? And, finally, how should one best examine the soundness of the chemical preparations, especially those imported from abroad, with a view to prevent the adulterations? ' Two contributions were received, entitled *'Salus populi suprema lex esto'* (The welfare of the people must be the highest law) and *'Kunsten en Wetenschappen, willen ze bloeien moeten rijke beloningen genieten'* (For arts and sciences to flourish, they have to be provided richly) – the two titles pointing to two aspects of science policy that determine the debate even today (*Verhandelingen van het Provinciaal Utrechts Genootschap van Kunsten en Wetenschappen* (1786), quoted by E. Cohen, *Chem. Weekblad,* **1** (1903, 1904), 651). Actually, in the following decades, town lecturers in chemistry were not uncommon.

[d] But it was a very important interlude for the centralization of government and codification of civic and penal law. After the French example, the Koninklijk Institut van Wetenschappen, Letteren en Schone Kunsten (Royal Institute of Sciences, Letters, and Fine Arts) was founded in 1808, and it was retained after the restoration in 1813. In 1855, it was changed into the Koninklijke Nederlandse Academie van Wetenschappen (Royal Netherlands Academy of Sciences), which was, and still is, the most prestigious scientific organization in the Netherlands.

[e] Dutch scientists, however, kept abreast of developments, and even mixed in the debates. The Utrecht physicist G. Moll, for example, wrote an anonymous reaction against Charles Babbage's *Reflections on the Decline of Science in England,* entitled *On the Alleged Decline of Science in England. By a Foreigner* (London, 1831), in which Moll declared that State protection for science would be bought with enslavement. Moll was supported by Faraday, who wrote an introduction to the pamphlet (see Faraday's letters to Phillips and Schönheim in Silvanus P. Thompson, *Michael Faraday, his Life and Work* (London, 1891), 110, and Kahlbaum and Darbishire, *The Letters of Faraday and Schönheim, 1836-1862* (Bâle and London, 1899), 59-61, quoted by E. Cohen, *Chem. Weekblad,* **2** (1905), 97-111).

[f] In 1887 the Nederlandsch Natuur- en Geneeskundig Congres (Dutch Scientific and Medical Congress) was founded on the lines of the German Gesellschaft Deutsche Naturforscher und Ärzte (E. Cohen, *Chem. Weekblad,* **25** (1928), 337-42). In 1895 J. H. van 't Hoff addressed the meeting of the Congress with a carefully reasoned speech on the necessity of increased support of scientific research (E. Cohen, *J. H. van 't Hoff, sein Leben und Wirken* (Leipzig: Akademische Verlagsgesellschaft, 1912), 331 ff.). Van 't Hoff had already obtained a new chemical laboratory from the city of Amsterdam, and now analysed the situation of science in the whole of the Netherlands. His use of the studies of de Candolle (Alphonse de Candolle, *Histoire des Sciences et des Savants depuis deux siècles, précédée et suivie d'autres études sur des sujets scientifiques et en*

particulier sur l'hérédité et la sélection dans l'espèce humaine, 2e éd. (Genève-Bâle, 1885)) on the eminence of scientists of different countries, and his analysis of the Dutch situation (a commercial atmosphere, brain-drain to the colonies) makes his speech an early example of 'applied science studies'. Van 't Hoff's argument was interpreted, however, as an attempt to get more for himself, and did not result in important changes (see A. Rip, *Chem. Weekblad,* 70 nr. 22 (31 May 1974), 11). It should be noted that the new eminence of Dutch physics and chemistry (with men like Van der Waals, Lorentz, and Van 't Hoff) began around 1870, before the main period of industrialization in the Netherlands.

[g] The 'Wetenschappelijke Commissie van Advies en Onderzoek in het belang van Volkswelvaart en Weerbaarheid' consisted of 27 members (mostly university professors, but also five members from industry) and a separate board of Academy members. The council started to function only when the war ended, so did not do much itself; however, it was in 1923 followed by a committee, chaired by F. A. F. C. Went, that considered how the application of science could be turned to the service of the Dutch people. This in its turn stimulated a Bill on national institutes for applied science, which passed Parliament in 1930. See further note i.

[h] In 1934 a Nederlandsch Technocratisch Verbond (Dutch Technocratic Society) was founded to study, propagate and apply ideas like those of Thorstein Veblen (*The Engineers and the Price-System*) and of Howard Scott (announced in *Chem. Weekblad,* 31 (1934), 227; *De Ingenieur,* 49 (1934), A102-3). Its chairman, E. H. F. van der Lely, had introduced the technocratic idea into the Netherlands with his book *Arbeidsorganisatie-Technocratie-Welvaart (Organization of Labour – Technocracy – Wealth)* (Assen: Van Gorcum, 1933). In the engineer's journal *De Ingenieur* economic relations of technocracy were emphasized, and Van der Lely's book and translations of American books (Allen Raymond, *What is Technocracy?* (New York, 1933), translated as *Wat is Technocratie?* (Utrecht: Bijleveld, 1933), and Stuart Chase, *Technocracy, an Interpretation* (1933), translated as *Technocratie* (Amersfoort: Valkhoff, no date)) were reviewed as important and controversial (*De Ingenieur,* 48 (1934), T110, and 49 (1934), T7, T8, T38). The chemists' journal *Chemisch Weekblad,* on the other hand, saw the idea of the supremacy of technical expertise as the most distinctive feature of technocracy (see also *Chem. Weekblad,* 34 (1937), 307). A reason for the difference in treatment may be that the importance of placing engineers in a governing position was self-evident to the engineering community. In this connection, two editorials of the engineers' journal, published after the Second World War carefully noted that the then governing Cabinet counted one agricultural and four technical engineers among its members (*De Ingenieur,* 57 (1945), A44), and compared the 'struggle' to have an engineer in the Raad van State (Council of State) with the eighty years war of independence in the sixteenth and seventeenth century (*De Ingenieur,* 57 (1945), A61). This point of view seems to be common among engineers and has been called 'engineerocracy' (Bart van Steenbergen, Eduard van Hengel, *Technocratie, Ideologie of Werkelijkheid (Technocracy, Ideology or Reality)* (Groningen: Wolters-Noordhoff, 1971)).

[i] C. J. van Nieuwenburg, 'De Nationale Organisatie van Wetenschappelijk-Technisch Werk' (The National Organization of Scientific-Technical Work), *Chem.*

Weekblad, 17 (1920), 70-5. In this paper, Van Nieuwenburg compares the organization of applied research in Germany, Great Britain and the United States, and proposes the founding of an institute on the lines of the Mellon Institute in Pittsburgh. The institute, to be supported by a government endowment, would perform contract research and would also rent laboratory space to industries. It would be managed by a committee of technical scientists and engineers who should be in touch with and trusted by industry. The institute could also advise the government on scientific and technical matters, and would co-operate closely with the Technical University in Delft. A critical reaction to this proposal was requested by the Minister of Education from his special adviser, Iz. P. de Vooys, who prepared a memorandum advising the appointment of a small committee to study the possibility of co-operation, with the public interest in mind, of all state and private institutes for applied scientific and technical research. This committee, when installed, was actually a continuation of the efforts of the Royal Netherlands Academy (see note g). At this point, however, the impetus of the scientists' movement was nearly spent and insufficient to maintain the rate of progress in the face of official reluctance. When the committee was set up in 1923, it produced a report in less than a year; the report outlined the organization of applied research through a state-financed, but not state-controlled, institute, governed by a council consisting of spokesmen for science and for society, and a few representatives of the government. The lack of state control was the big stumbling block. It was not until 1927 that an adviser to the Minister was appointed to prepare, in co-operation with the committee, a Bill on the organisation of applied research. In 1929 the Bill was completed; it was called the TNO Bill and created the charter of the Organisatie voor Toegepast-Natuurwetenschappelijk Onderzoek (Organization for Applied-Scientific Research). In 1930 Parliament passed the Bill, but it was not enacted until 1932. See Jan Al, *Research als Overheidstaak* (Research as a Concern of Government) (doctoral thesis, Technical University Delft, 1952), and Th. J. van Kasteel, in *Een Kwarteeuw TNO (A Quarter of a Century TNO)* (The Hague, 1957), 10-11. Another influential article on the organization of research, arguing in the same direction as Van Nieuwenburg, was written by H. R. Kruyt, *Chem. Weekblad,* **20** (1923), 541-4.

[j] The Association existed from 1897 to 1971, with the aim (according to the 1930 statutes) of cultivating the natural sciences and medicine in the light of God's word, and of advancing the applications of the sciences (cultivated in this way) in social life. The ethical problems discussed by the Association concerned medicine (e.g. eugenics, population control). Usually, the Association took a rather conservative position in these issues. Up to 1940 the Association devoted only one, badly attended, meeting to the role of science and technology in society (*Geloof en Wetenschap*, (1936/37), 5).

[k] W. de Groot, *Ned. T. Natuurkunde,* 37 (1971), 122. Lorentz's point of view was expressed as early as 1913 in a short note 'The International Cooperation of Scientists Stimulates Peace' which he published in a journal called *Vrede door Recht (Peace through Justice)*. It is remarkable that this paper is not reprinted in Lorentz's collected papers or mentioned in his official bibliography (Zeeman and Fokker (eds.), *Collected Papers of H. A. Lorentz* (The Hague: Martinus Nijhoff, 1938/39)). On a national level, Lorentz had also been the driving force behind the advisory council of the Academy (note g). He further chaired the committee which supervised the impoldering of the Zuiderzee (now IJsselmeer). His insight

into the hydrodynamical problems of the changing floods through the estuary was essential for the smooth progress of the impoldering, and his interest in the matter was so great that he retired early from his professorship in Leiden to a more or less honorary position in Teyler's Museum to have more time for his work. See A. D. Fokker, in T. P. Sevensma (ed.), *Nederlandse Helden van de Wetenschap (Dutch Heroes of Science)* (Amsterdam: Kosmos, 1946), and *De Gids*, **116** (1953), 147 ff.

[l] Following a private conference in 1921 in Utrecht, where a select international group met to discuss the possibilities of international cooperation in chemistry (*Chem. Weekblad*, **18** (1921), 427), an international congress was organized in Utrecht in 1922. Chemists from the Allied Powers, the neutral nations and the Central Powers were invited, and only the Belgians and the French declined. Speeches and reports struck a careful balance between the main languages – including French – and high hopes were expressed of continuing the international scientific links (*Chem. Weekblad*, **19** (1922), 418-25). The next year the occupation of the Ruhr by the French set back these attempts, and it was only after an initiative by the American chemist W. A. Noyes (see W. A. Noyes, 'Political Platform for the International Union of Pure and Applied Chemistry', *J. Soc. Chem. Ind.*, **43** (1924), 454) that steps were taken so that during the IUPAC congresses in 1924 and 1925 a compromise agreement could be reached with the Belgians and the French (*Chem. Weekblad*, **21** (1924), 409-18, and *Chem. Weekblad*, **22** (1925), 417-20).

[m] Again, more or less informal meetings played an important role. In 1928, German and Austrian chemists received personal invitations for a IUPAC congress in the Hague (*Chem. Weekblad*, **25** (1928), 590-608), while in 1929 a special meeting of the Verband Deutscher Chemischer Vereine with 'prominent people from different countries' was convened under the auspices of the Chemical Council of the Netherlands in The Hague (*Chem. Weekblad*, **26** (1929), 594-6). At this meeting the different claims had to be reconciled, which was accomplished through timely adjournments by the chairman (Kruyt), followed by lobbying in corridors and restaurants (E. Cohen, *Chem. Weekblad*, **30** (1933), 414-30; compare also H. R. Kruyt, 'International Cooperation in Chemistry', *Chem. and Ind.*, (1955), 608-11). One of the main results of the meeting was a change of name of the IUPAC, which now became the International Union of Chemistry. Germany felt that it could join this 'new' organization without loss of face, and the problem was solved (at least for the time being).

[n] The proposed resolution of the Netherlands Academy read as follows:

> The ICSU, already at a former occasion having expressed its faith in the possibility and the necessity of peace between the world's peoples, and being convinced that the 'brotherhood of scientists' can be an important factor towards the establishment of a desire for mutual understanding and helpfulness, considers it to be a part of its task to give attention to the opinions brought forward from various sides concerning the attitude which should be taken by scientists in relation to the dangers which at present menace the future of our civilization. The ICSU therefore decides to appoint a Committee, which should attempt to arrive at a coordination of what has been proposed in respect to the social responsibility of science and of scientific workers.

The final resolution agreed upon had a different emphasis; it proposed a Committee, and said:

> The Committee, at suitable intervals, should prepare a survey of the most important results obtained and of the directions of progress that are opening and of points of view brought forward in the physical, chemical and biological sciences, with reference to:
> 1. their interconnections and the development of the scientific picture of the world in general;
> 2. the practical application of scientific results in the life of the community.

The work of the Committee is limited strictly to scientific activity *(Nature,* 139 (1937), 870). Actually, the Committee on Science and its Social Relations that resulted worked more or less along the lines proposed by the Netherlands Academy, especially after the Second World War. An active role in the work of the Committee was played by the Dutch physicist J. M. Burgers, who was secretary (see R. M. MacLeod, 'The Historical Context of the International Commission for Science Policy Studies', in *Contributions to Science Policy Studies* (Commission for Science Policy Studies, International Union for the History and Philosophy of Science, 1974)).

[o] In 1971, the Philips Laboratory again showed its liberal nature by permitting its research workers to organize a new series of discussions on the social role of industry and industrial research. Reports of the discussion groups were published as: 123 Philips research workers, 'Wetenschap en Maatschappij' (Science and Society), *Nat. Lab. Technical Note,* 274/72. No reference was made to previous discussions, but this time, emphasis was placed much more on problems referring to the work-situation at Philips: the relation between research, industry and society; the development of a research policy directed towards the general interest; and the role of industry in the developing countries. The fact that the report has been treated by the directors as a collection of opinions that are not definitive, indicates that no direct follow-up should be expected. The report has however, made a large public impact, especially in science policy circles.

[p] P. J. Roscam Abbing (ed.), *Om de Mens, Ethiek in Wetenschap en Beroep (Concerning Man, Ethics in Science and in the Professions)* (Leiden: Sijthoff, 1968), and P. J. Roscam Abbing (ed.), *Ethiek en Wetenschappen (Ethics and Sciences)* (Leiden: Sijthoff, 1971). The more important (though still not very influential) book is *Om de Mens*, in which the legal, medical and natural sciences, linguistics, economics, social sciences, technical and agricultural sciences are treated extensively. H. J. Groenewold, in a chapter on natural sciences, expounds a view in the tradition of the VWO, while J. J. Broeze, in a chapter on technical sciences, presents an 'engineerocratic' argument. In both these chapters, the emphasis on global problems and the political situation of the world, and the actual contributions that science and technology can make to the solution of these problems show that a new, less contemplative period has begun for scientists in the Netherlands.

[q] This time, the invited speakers were all well-known critics of the establishment, and their speeches appeared in a non-scientific journal, *De Gids,* **183** (1970), 91-185. Working-parties had prepared congress papers on environmental

issues, multinational companies in developing countries, etc., and a coordinating committee was established to stimulate this type of research in the university after the congress (*Acta et Agenda* (Leiden University Journal), 29 October 1970, 101, 104). However, the committee as such never functioned as intended, and soon all attention was devoted to the problem of the democratic reorganization of the university.

[r] A number of the interested staff-members had been engaged previously in giving lectures for student associations, or had participated actively in VWO affairs. The call for study reforms often went much further than lectures and seminars on science and society. One of the goals was so-called 'project teaching', in which staff members and students of different years work together on a project defined by the group. It was assumed that the projects chosen by these groups would be socially relevant. In this way, in fact, the few experiments with project teaching were linked to the science and society programmes in the universities.

[s] There is a wide diversity of courses on science and society in the different universities. In a short report in *Nature* ('Science Studies in Amsterdam', *Nature*, **250** (1974), 281), the courses of the Centrum Algemene Vorming (Centre for General Education) of the Faculty of Mathematics and Natural Sciences of the Free University, Amsterdam, are described, and courses in some other universities are mentioned. In the chemistry departments of the universities of Leiden and Utrecht, both with a record of courses and other activities in the field of science and society dating from 1969, a special compulsory programme is being set up for first and second year students, and an optional 'minor' for students after their third year, in which much attention is paid to student participation, to reflection on problems of chemistry and society, and to the responsibility of the chemist. Comparable activities are taking place in the department of technical physics of the Technical University of Eindhoven.

In the Municipal University of Amsterdam there is an optional course on philosophy and social situation of science, which may be the beginning of a larger programme in which the interdisciplinary study of the role of science in society will be stressed. An interdisciplinary course is also offered, leading to a minor in environmental studies, in which the relations between science and society are emphasized. In the University of Groningen a major in the field of science and society has already been instituted in the chemistry department; there, in their fourth, fifth and sixth years, students take courses in chemistry, sociology, economics, and political science, and take part in research centred around the energy problem.

In departments of biology in the Netherlands, biology and society courses have only recently been introduced, while in other departments (i.e., physics, mathematics, geology, pharmacy) few wish to go further than allowing students time for extra-curricular activities. Recent developments, however, based on decisions of the University Councils and of the Academic Council, point to the possibility that science and society courses will be actively stimulated.

It should be noted that the situation in the Technical Universities and the Agricultural University at Wageningen is different because of the existence of departments of philosophy and social sciences, which have been formed specifically to redress the onesideness of technical education. This laudable aim has met with varying success, but in recent years the presentation of the courses around problems of science and society and the use of course structures allowing greater

participation of students, have been important improvements. Competition with the Studium Generale units, which are often more active in the Technical Universities than in the other universities, has also played a role. For further details, see Wessel Slot, *op. cit.* note 2.

The staff members and senior students concerned with courses on science and society, with Studium Generale activities, and with 'vormingswerk' (personal and adult education) form the hard core of the Working Party on Science and Society Courses. All interested people are welcome to attend the meetings of the Working Party, however, and attempts are being made to encourage a wider and more diverse constituency.

[t] Dennis L. Meadows *et al.*, *The Limits to Growth* (New York: Universe Books, 1972). The Dutch pocket edition was titled *Rapport van de Club van Rome (Report of the Club of Rome)* (Utrecht: Spectrum, 1972). The book was sold at a popular price of Dfl. 2.50, where comparable books would cost at least twice as much. The sale of the book and the other activities of the Club of Rome were very well publicized. The only Dutch member of the Club of Rome at that time was C. J. F. Böttcher, a professor in physical chemistry at the University of Leiden from 1947, who became interested in science policy and science administration. He became the first chairman of the Raad van Advies voor het Wetenschapsbeleid (Science Policy Advisory Council) from 1966 to 1973, after having been adviser to Royal Dutch/Shell. Since 1973, he has been liaison member of the Raad van Advies voor het Wetenschapsbeleid and the Wetenschappelijke Raad voor het Regeringsbeleid (Scientific Council for Government Policy). He organized a bureau, 'Club of Rome Nederland', Lange Voorhout 16, The Hague (compare also 'Club of Rome Associations', *Nature*, **249** (1974), 403) that publishes a bulletin and occasionally organizes expositions about 'Club of Rome' problems. The first one, at Rotterdam in 1972, drew 40,000 visitors. In 1973, A. E. Pannenborg, of the Board of Directors of Philips, also joined the Club of Rome.

[u] Criticisms have been published by T. W. Oerlemans, M. M. J. Tellings and H. de Vries, *Nature*, **238** (1972), 251-5, working at the Shell Research Laboratory, and by P. M. E. M. van der Grinten and P. J. de Jong, *Chem. Weekblad*, **67** (10 Dec. 1971), 9-11, and **68** (10 March 1972), 9-11, who are connected with DSM, another multinational company. Some groups are working out more detailed models in co-operation with the Club of Rome. For example, R. Timman *et al.* at the Technical University of Delft are constructing a model for Western Europe, and H. Linneman *et al.* at the Free University, Amsterdam, are studying the requirements for sustaining a doubled world population (see Bulletin 4, Club of Rome Nederland (note t)). Other Dutch work with dynamic models has been surveyed in *Chem. Weekblad*, **69** (10 August 1973), 5-7.

[v] It should be noted that in Posthumus' proposals for a shortened university education no indications were given as to how these reductions should be accomplished. With a view to the danger that new subjects (like science and society courses) would be the first to be cancelled, the Working Party on Science and Society Courses attended the Parliamentary Hearings on the so-called Posthumus Bill on 6 June 1972, and argued that at least three months of a student's time should be devoted to science and society subjects. At about the same time, the Working Party of the Academic Council on Ethics in Curricula in its report

also proposed that in the new Bill more detailed specifications should be given to guarantee that time will be left for social and ethical aspects of science. The Academic Council, however, in its decision on the proposals of the report in February 1975, thought that the article on social responsibility in the Higher Education Act would be sufficient.

[w] Lucas Reijnders, *Chem. Weekblad,* **67** (13 August 1971), 12, points to the fact that in 1970, the editor of the *Chemisch Weekblad* did not expect unemployment among chemists, which in fact occurred within a year. For physicists, the 'unemployment committee' published its estimates in *Ned. T. Natuurkunde,* **39** (1973), 106, when two per cent of the physicists were already unemployed. It was forecast that this might increase to 20 per cent in 1980, even though the number of active physicists was taken to increase by only three per cent yearly. Le Pair (*op. cit.* note 63) showed by means of a numerical model how sensitive the employment situation is to government policy on university positions, and Reijnders argued that increased government spending on socially useful projects is the only way at present to ensure employment for scientists.

[x] In 1970 the Minister for Higher Education and Science Policy, M. L. de Brauw, had the McKinsey Company draw up an organizational structure for planning, budgeting and evaluation of university education and research, which met with much resistance from the universities and has not been put into practice. Furthermore, the Minister chaired a working party to work out proposals for the national organization of university research. In 1972, the government changed, and the new Minister for Science Policy, F. H. P. Trip, started the discussions anew. His first step was to consult all interested parties by way of a questionnaire on the organization of research, and through personal visits. The questionnaire could be obtained on request, and more than 200 answers were received from political parties, universities, institutes, industries and private citizens.