

Education in research : from student to independent researcher / report of the Research Schools Advisory Committee.

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EDUCATION IN RESEARCH

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report of
the Research Schools
Advisory Committee

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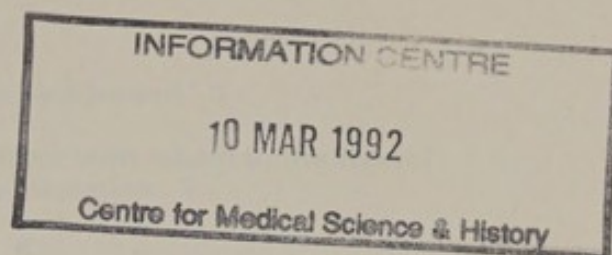


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From student to independent researcher



Report of the Research Schools Advisory Committee

3 October 1990

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1 Introduction and background

The rapid increase in the number of students and the growth in demand for highly-educated personnel led in 1982 – after many years of debate – to a major change in the structure of higher education in the Netherlands: the introduction of the two-tier system. The adage “higher education for the many” continued to apply for the first tier (undergraduate courses). However, the duration of the first-tier curriculum was shortened, often at the expense of the research component, particularly in the more research-intensive disciplines. As a supplement to the first tier a second tier – with a limited number of places – was introduced for the training of young researchers and the post of trainee research assistant (AIO) was created. In the disciplines of science and medicine, which have a long tradition of PhD programmes, the introduction of AIO posts brought few changes; in other disciplines, however, the creation of a substantial number of posts for trainee research assistants had a far-reaching impact. It was in these disciplines especially that initiatives were subsequently set in motion with the aim of arriving at a more detailed system for the training and supervision of trainee research assistants. A more definitive scheme was subsequently announced in the coalition agreement of the third Lubbers Government (in November 1989). The implication was that second-tier courses should preferably be accommodated in “research schools”, centres in which the training of researchers is coupled with advanced research. The mission of the second tier is the education of independent researchers, and will remain so.

The Minister of Education and Science requested the Research Schools Advisory Committee to submit recommendations on the further institutionalization of research training. The Committee was asked to formulate its opinion on two main points:

- what are the distinctive qualities of a research school?
- how can a system of research schools be established?

This faced the Committee with the task of setting out the structural characteristics of research schools. It goes without saying that this task did not include indicating the subjects and disciplines to be given priority by the research schools, let alone naming the specific schools themselves. The Committee will not therefore involve itself with considerations at the level of specific disciplines.

The task facing the Committee would probably have been a fruitless one had it been required to sit down at the drawing board and design a system of research schools from scratch. Luckily, this was not the case. Science for instance is often characterized by the presence of research schools *avant la lettre*. Science faculties have had a strongly developed research structure and culture for many years. The substantial financial support given to these disciplines in particular by the Netherlands Organization for Scientific Research (NWO) – the national science research council – and the existence of NWO institutes also played a major role.

Meanwhile, during the past few years the Ministry has granted a large number of initial subsidies for the specific purpose of shaping the second tier, mainly in the humanities and social sciences. The attraction of this funding facility was partly responsible for an abundance of proposals for second-tier courses without any additional funding being necessary. A survey carried out by the Association of Netherlands Universities (VSNU) shows that the total number of second-tier networks and schools is in the region of 110. These initiatives differ greatly in terms of form, scale and maturity. Thus, depending on the method of formalization, we see research institutes based on sections 93/98 of the present WWO (University Education Act), committees based on section 82 of the WWO, study groups based on sections 89/92 of the WWO, and research schools in the form of independent corporate bodies (e.g. foundations). In other instances still we see no statutory basis whatever, the initiative being founded on agreements made at university level or at department/faculty level.

During the short period of its existence the Committee found itself overwhelmed with requests from many disciplines to devote attention to new initiatives which had not yet been included in the VSNU list. Also worthy of mention here are the plans of the NWO with regard to the Stimulus Programme which aims at establishing a number of multidisciplinary research centres.

In short, there is a fecund basis on which to build. A great deal has already been achieved with regard to the formation of centres of excellence in research. In submitting its recommendations, the Committee hopes to perpetuate this basis and cultivate it further.

2 Points for discussion with regard to the second tier of university education

Before examining the starting points taken by the Committee and the typical characteristics of a system of research schools it would seem appropriate to give a short analysis of the present structure of the second tier of university education and research. As indicated in the previous chapter there are many centres and networks in which high-level education and research are combined. In many cases the second tier has already been given shape in this way and is operating quite satisfactorily. As a whole, however, it is not without its specific problems. A number of subjects require attention.

Bearing in mind the questions on which the Committee was requested to submit its recommendations, attention will be given below to the following points:

- a. the number of qualified researchers;
- b. specialization in the first-tier curriculum;
- c. the development of a distinctive identity by institutions of higher education;
- d. development of the second tier;
- e. the teaching and supervision of trainee research assistants;
- f. courses for design engineers.

a. Number of qualified researchers

The present first tier of the Dutch higher education system guarantees "higher education for the many" but offers very few opportunities for performing independent research. This is what the second tier is for. About 10% of all graduates move on to the second tier (this figure is closer to the 40% mark in a number of science disciplines). The labour market for academic researchers up to the year 2000 was discussed in the draft Higher Education and Research Plan (HOOP) 1990 (see Appendix II). This relates to qualified researchers and design engineers. Given that it is no easy matter to estimate the supply of and demand for academic researchers, the value of this exercise is relative only. No other data are yet available, however. The projections in the HOOP do however produce a quite striking picture: in all the various sectors the anticipated demand for academic researchers far exceeds the present supply. The expected shortage of researchers will be greatest in the engineering and technology, agriculture, science and economics sectors. The latter conclusion is further confirmed by a number of studies by foreign experts. In short, there is sufficient reason to take a critical look at the number of trainee research assistants and to treat the pool of talent here in the Netherlands with a great deal of respect.

b. Specialization in the first-tier curriculum

The research component in the first-tier curriculum is very small. Undergraduate students showing an interest in research have little opportunity to prepare themselves specifically for a research career. A consequence of this is that the curriculum offers no easy means of comparing applicants for AIO posts.

c. **The development of a distinctive identity by institutions of higher education**

Universities do little in the way of stressing their distinctive features at undergraduate level. Some faculties and disciplines have taken steps towards specialization and the creation of centres of excellence but the higher education system as a whole does not specifically promote this. A side-effect of the low degree of specialization is that within disciplines and subdisciplines the best researchers in a particular field are generally widely scattered about. This can have an adverse effect on the research as a whole.

d. **Development of the second tier**

A significant feature of the way in which the second tier has been developed with regard to those courses funded directly by the government (the direct funding mechanism) is that the AIO posts were introduced first (by cutting the number of permanent positions) and that the ministry then set initiatives in motion to structure AIO training in the form of AIO schools, networks and the like. The budget of NLG 13 million per year for temporary, initial subsidies, which the ministry had earmarked for this over the past few years, was transferred to the NWO in 1990. As a result of this development an increasing number of AIOs and OIOs (NWO trainee researchers) are receiving training and supervision through one of these schools or networks. This does not however mean that the organization of the second tier is complete. Completion of the second tier is also important not least with a view to the international profile of Dutch universities.

e. **The teaching and supervision of trainee research assistants**

Trainee research assistants have the right to a research environment which is both stimulating and challenging, and where supervision and the available facilities are well organized. With regard to the latter, surveys carried out by the national consultative committee for trainee research assistants (LAIOO) show a certain degree of dissatisfaction in a number of disciplines that do not have a long tradition of PhD programmes.

f. **Courses for design engineers**

Another special component of the second tier, in addition to the regular four-year AIO or OIO trainings posts, is the design courses. Training in design engineering is considered crucial for industrial development. These two-year courses in the engineering sciences are designed to equip graduate engineers with the additional skills necessary for solving technical problems in a multidisciplinary context. AIOs taking such a course complete their training with an original technical design.

It has meanwhile become apparent that despite the enormous demand for design engineers the number of trainees is way behind the numbers agreed by government and industry a number of years ago. This has to do with problems concerning the funding of design engineering courses. The Committee hopes that it will still be possible to reach a consensus between all the parties concerned (government, industry and the universities of technology).

In the following chapter the Committee outlines basic premises on which is based its description of the features that all research schools should have (chapter 4). This description covers the points raised in this chapter.

3 Basic premises

The terms of reference given to the Committee by the minister are very broad. The term 'research school' has still not been defined: different people attach different meanings to it, ranging from schools in the narrow sense (possibly with establishments at various locations) to AIO networks (joint, possibly national, educational facilities). The constructions chosen in practice reflect the diverse structure of the various disciplines. The Committee feels it would be wrong to impose a single model of a research school across the board. A system that allows a diversity of structures is preferable (national structures per discipline or sub discipline, para-university institutions, local multidisciplinary collaboration, etc.).

Even with a diverse spectrum of research schools, however, some degree of organization within the structure of the second tier is needed. We are concerned here after all, with the pooling of high-level education and research. A situation in which any ambitious project can adopt the label of research school must be avoided. The term 'research school' must be safeguarded and this requires a regulative mechanism. To ensure at least some level of protection for the name 'research school', the Committee considers it essential that research school initiatives are supported, recognized and publicized by the authorities of one or more universities (possibly in collaboration with the institutes of NWO, the KNAW (Royal Netherlands Academy of Arts and Sciences) or TNO (Netherlands Organization for Applied Scientific Research) or other research institutes such as the Large Technological Institutes, and in certain cases, industry and the Ministry of Economic Affairs). The parameters proposed by the Committee are thus procedural and do not relate to form or content.

A research school is the responsibility of a university institution (possibly in collaboration with others); consequently there is always a university as the administrative centre. The university authorities function as 'gatekeepers'; i.e. they control the process of establishing research schools. This makes it possible to reduce somewhat the large number of initiatives that have been put forward on the one hand, and on the other, to ensure effective involvement since the universities are thus made aware of the balance between the rights and privileges and the commitments and duties attached to research schools. The label 'research school' is thus assured of the required protection without the need for formal registration. The universities are encouraged to set priorities and make choices, both internally and in consultation with other universities and organizations like the NWO and TNO that fund research.

The common characteristics of research schools are described in detail in chapter 4. This list is intended as a guide for the university authorities, not as compulsory requirements. As mentioned earlier, the Committee wishes to promote a diverse system of research schools. A blueprint is therefore inapplicable. A model that suits one research field will be inappropriate for another. Nor is it the Committee's intention to imitate the American system of graduate schools. This is far too much part and parcel of the American higher

education system – which differs from the system in the Netherlands in many respects – and the social environment. The starting point is rather the Dutch system of undergraduate education, with its own specific structural and cultural features. The structure of the second tier must link up with the first tier. Conversely, the second tier will influence the first, by, for instance, stimulating greater specialization within the curriculum and thus encouraging students to take an interest in academic research at an early stage.

The Committee sees no reason to regulate the number of research schools in advance. The establishment of research schools is the responsibility of the university authorities (and any other parties involved). With regard to financial support, research schools will have to compete for funds from the indirect funding organizations, from contract research and from European subsidy programmes on the basis of merit. Trainee research assistant posts financed directly by the government may be added to this.

This structure allows for the necessary flexibility and selectivity. A research school which cannot, or is no longer able, to acquire sufficient outside funds withers and is no longer a credit to the relevant university or universities.

The university funding system operated by the Netherlands Ministry of Education and Science (in this case output-based funding) currently provides for 0.25 of a staff post per PhD, based on a supervision ratio of 1 academic staff post per 16 PhD students (Staffing and Resources Formula – PGM). The question is whether these funds are sufficient. Universities must be able to bear the financial responsibility for research schools without it being at the expense of the first tier. The costs of staff, equipment, buildings, etc., are often met at the expense of the first tier because structural funding is apparently inadequate. There is in any case no structural funding for post-doctoral positions, a factor which obviously affects research schools. The Committee therefore recommends that the norm per PhD should be based on a supervision ratio of 1 to 12 (the norm applied in the second tier for medical training) which would increase basic structural funding for research schools from quarter of a post per PhD to one third. This retains the simplicity of the output funding model while at the same time making more resources available to research schools for attending conferences, and purchasing high-quality equipment, etc.

The Committee anticipates that a large number of research schools of a diverse nature will emerge within the second tier. Because the system is an open one it is difficult to predict the number of schools at which a dynamic balance will have been achieved; considering present trends and the desired scale, a figure in the region of 100 (50-150) would seem realistic. These research schools will be expected to achieve high standards of research and teaching and to guarantee a high level of individual supervision for PhD students.

The Committee also assumes that national AIO networks that restrict their activities to the organization of joint courses and seminars will be able to continue to play this useful role without acquiring the name of 'research school'.

Within this large spectrum of research schools, the Committee wishes to cultivate natural differentiation and competition on quality by selectively funding on a temporary basis the obvious pinnacle of the pyramid (the top 10 to 15%). To this end, a national programme, the Snellius Programme, will be set up for research schools doing work of the highest standard in strategic fields of research. Grants will be made on the basis of proven quality, be of a temporary nature, and be

directed at those fields where extra stimulation of the research effort would be worthwhile. Proven quality, because quality cannot be regulated; temporary, because quality has to be regularly demonstrated. The additional criterion of 'strategic' research relates to the national science policy pursued by the government. The Committee recommends creating a fund for the Snellius Programme involving an additional annual sum of NLG 5 million, reaching a ceiling of NLG 25 million a year after five years. This recommendation is discussed in greater detail in chapter 5.

The establishment of research schools should, in the opinion of the Committee, be the responsibility of the universities. A high level of uniformity between research schools is neither necessary nor desirable. In practice it has been/will be found that in some cases a single, large faculty will provide sufficient basis for a research school; in other cases there will be ties with several faculties. Some research schools will be based at a single location while others will be spread over several locations. Sometimes it will be a matter for the universities alone; in other cases, universities will collaborate with NWO, the KNAW, TNO or other institutes. Some schools will offer design engineering courses or advanced postgraduate vocational training courses. Some research schools will be disciplinary, others multidisciplinary, and yet others, subdisciplinary. In short, in its multiformity, the spectrum of research schools will reflect the diversity of the structure of the research field. The establishment of research schools will largely involve the further development and formalization of existing arrangements.

Despite this multiformity every research school must be an identifiable entity. Research schools can be identified as such with reference to a number of fixed characteristics, characteristics which – and we stress this yet again – should not be regarded as compulsory requirements set at a central (i.e. supra-university) level: the Committee regards this as an unnecessary form of regulation. Any description of the features of research schools should be seen as a guide for the university authorities. In setting up research schools use should be made of the self-organizing capacity of the universities and faculties.

In the committee's opinion, there are ten characteristics that should apply to all research schools:

1. training of independent researchers;
2. centre for high quality research;
3. independent organizational unit with own budget responsibilities;
4. association with a university or universities;
5. adequate size;
6. careful selection of research proposals and AIOs/OIOs;
7. guaranteed supervision and teaching;
8. explicit policy on post-doctoral positions;
9. close links with the first tier;
10. accountability and evaluation.

The above characteristics are considered briefly below.

1. Training of independent researchers

Research schools train postgraduates to become independent researchers. The majority of these will be AIOs and OIOs for whom the doctorate they obtain will be evidence of their ability to carry out independent research work. The design engineering courses, the

research element of which involves independently producing a technical design, and the two-year AIO posts may also be based at research schools. This naturally assumes that by bringing design engineers into universities of technology the number of trainee research assistants will remain sufficient to be able to establish research schools of an adequate size. Advanced vocational training courses can also be linked to research schools (especially the training of clinical researchers in relation to medical research).

2. Centre for high quality research

In addition to the training of young researchers, research schools also fulfil a function as centres for high quality research. Careful selection of personnel will be required to achieve this. This will lead to a natural convergence of the tasks of teaching and performing research. Research schools will need to become national centres of excellence in their specific field of research, thereby contributing to task specialization and the establishment of a distinctive identity by the various universities.

3. Independent organizational unit with budget responsibilities

Research schools must be able to function as independent organizational units with their own budget responsibilities. In the opinion of the Committee the formal status of a research school should preferably be that of an official research institute in accordance with section 8.49 of the Higher Education and Research Bill (WHW) currently before parliament, the relevant sections are attached to this report as Appendix III. This implies that faculty boards determine which members of the academic staff will be attached to the research school. Which of the powers of the faculty council and the faculty board will be transferred to the research school will be established in the faculty regulations (section 8.53). The status of research institute also implies that a research school must have a board and a professor/director, and that it must be established under the administrative regulations. The Committee feels that it is of great importance that research schools acquire this university recognition. Legal status not only provides the schools themselves with sufficient power, it also guarantees that the university authorities make a commitment. This procedure lifts a recognized research school above other initiatives and aspirations which have not managed to get passed the 'gatekeeper'. When allocating funds the university authorities can make long-term arrangements with the faculties on those funds to be earmarked for research schools.

Section 8.54, subsection 2, of the WHW Bill provides the basis for collaboration between several universities. An interuniversity research institute of this kind requires that an agreement is entered into between the relevant governing bodies. The Ministry of Education and Science or the VSNU could help to simplify this complex procedure by drawing up basic model contracts and regulations.

4. Association with a university or universities

In the committee's view a research school should be part of one or more universities, having one university as its administrative centre. This is obvious for those research schools which are attached to one university only. In practice however, interuniversity collaboration will be common and, depending on the research field, a university may collaborate also with NWO, the KNAW, TNO or other research institutes. This can be in the form of long-term agreements which

guarantee these institutes an adequate level of involvement with research schools while allowing them to maintain complete independence. There should be one university serving as the administrative centre and focal point of the research school. As a rule, this will be the university that carries the most weight, can act as the initiator and is prepared to ensure that a sound infrastructure is created for the school. Universities will thus have to make a well-considered choice as to the initiatives in respect of which they wish to play such a role. This creates a situation in which all universities will be involved in a number of research schools in such a way as to reinforce the identity they have developed at undergraduate level. In such a situation it is appropriate that the university authorities should seek advice (for instance from the KNAW) when setting up a research school in a particular field. This would further national coordination.

5. Adequate size

The reason for organizing the second tier, where possible in the form of research schools, is to be found in the benefits offered by a larger institute with regard to joint curricula, joint recruitment procedures, facilities, contacts and ambience. Research schools will need to be of a certain size to realize these benefits. Although the figure could be lower for some disciplines the Committee estimates the minimum scale, in general, at a total of 40 to 50 AIOs and OIOs, a figure that corresponds with a minimum annual intake, all things being equal, of 10 to 12 trainee research assistants. It is at this level that a research school can make a niche for itself in the research system. Research schools of this size assume national importance in their branch of science and have more opportunities to participate in European programmes.

It is difficult to make any definitive statement on the average size of a research school except that the 'average' can be quite flexible. After all, the basic principle is multiformity, providing scope for various quantities in each research field both at the base and at the top of the pyramid, and also for differences in the nature of research in the various disciplines.

6. Careful selection of research proposals and AIOs/OIOs

Research schools must implement procedures that guarantee careful selection of research proposals (setting priorities, ranking) and those accepted for training. As a rule outsiders should also be involved in the assessment procedure.

The soundness of the selection procedures must be evident not only from internal procedures (concerning positions financed directly by the government) but also from the number of posts funded by the research organizations. This is a form of external recognition which should play a role in evaluation. Good research schools will also be seen as attractive training grounds for young researchers from abroad. This is another sign of recognition.

7. Guaranteed supervision and teaching

Research schools will have to guarantee both the quality of their teaching and a high level of individual guidance of AIOs by their supervisor (master/apprentice relationship will remain intact). For example, a training and supervision programme could be set up for each individual AIO, agreed upon by both AIO and supervisor.

Monitoring of supervision and progress will also have to be guaranteed. It goes without saying that foreign lecturers with a good research reputation will also make a contribution to the training programmes. It is also important that research school programmes be evaluated on a regular basis. This can be done internally, for example by asking AIOs their opinion on the content and quality of teaching. However, there must also be some form of external evaluation. Now that the university system is accustomed to review committees the simplest way to do this would be for the committees not to restrict themselves to evaluation of the first tier but to inspect second-tier courses as well. The second tier should be regarded as a standard component of the total package assigned to a university.

A trainee research assistant is a member of the university staff. This in itself should guarantee that the necessary attention is devoted to the training and supervision of AIOs. The Committee sees no reason within the scope of its terms of reference to re-open the discussion on the formal status of AIOs as this has no bearing on the implementation of its recommendations.

8. Explicit policy on post-doctoral positions

AIOs who have been awarded their PhD will form the recruitment field for post-doctoral positions (KNAW Fellows Programme; NWO PIONIER Programme) and for the permanent positions at universities and other research institutes. As far as the universities are concerned, research schools will have to reflect, and help shape, faculty and university post-doctoral policy. It may be expected that the majority of post-doctoral researchers appointed under the KNAW Programme will work in research schools. The presence of post-doctoral researchers is essential to performing high-risk, embryonic research. Many AIOs will naturally take up positions outside universities after obtaining their doctorate. Given society's need for researchers this is a realistic career start.

9. Close links with the first tier

Research schools should become a normal part of every university. They will have a fecundatory and stimulative effect on the first tier. The presence of research schools will promote specialization in degree options and programmes of study at undergraduate level. Feedback and interaction between the undergraduate curriculum and the curricula of research schools are therefore of great importance. The Committee would point out that departments are free to review the content of certain degree courses so that they offer more scope for experimentation and practical research. The resulting loss in theoretical training can be made up for in the second tier. The need for more research in undergraduate courses has become more acute since the restructuring of courses in connection with the introduction of the two-tier system. The need is especially great in science, engineering and medical courses, where a substantial part of the research component has been. The presence of a research component in the first tier would make transition from the first to the second tier a much smoother process. Moreover, it would provide a means of selection in the recruitment of AIOs and OIOs.

The Committee further recommends that research schools be physically part of a university and that the academic staff attached to them continue to be involved in undergraduate teaching. Their duties can however differ substantially from those of academic staff whose work involves teaching undergraduates only. This will facilitate a

tailored personnel policy while at the same time preventing research schools from finding themselves out on a limb.

The establishment of research schools must not result in a fall in quality in the first tier. Professors not attached to research schools will still be able to supervise PhD students. The *ius promovendi* is an essential facet of the appointment of a professor, and indeed will remain so. Obtaining a doctorate by virtue of research other than at a research school will remain possible.

10. **Accountability and evaluation**

Research schools must submit an annual report and an annual budget to the university or universities to which they are attached. The reports form a part of the university reporting procedure and are in principle public. A long-term research programme should also be established which should be evaluated at least once every five years. The functioning of the school should also be evaluated every five years; these evaluations will serve as the basis on which the associated university or universities decide(s) to prolong the school's existence for a further five years. Again, qualified outsiders must be involved in this evaluation. With regard to those research schools sponsored by industry and/or the Ministry of Economic Affairs, it goes without saying that they too will be involved in evaluation.

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5 The Snellius Programme

Over the past few years the Ministry of Education and Science has pursued an incentives policy aimed at establishing structures in all disciplines in order to give shape to the second tier. Initiatives, especially in the humanities and the social sciences, were encouraged, and initial subsidies awarded as a complement to the structured environments for training and research which often already existed in science and medicine. In the present phase of policy the main concern is to build upon that which has already been achieved. It is the task of the universities to develop further initiatives of a high standard so that a spectrum of high-quality research schools is created, the natural pinnacle of which will be formed by internationally recognized centres of excellence. The Committee recommends that a special fund be set up to stimulate and support those centres of excellence active in areas where additional stimulation is required. The Committee proposes naming this fund the Snellius Programme, after the famous Dutch mathematician and optician Willebrord Snell or Snellius (1580-1626).

The objective of the Snellius Programme will be to provide a number of proven top-level research schools with greater financial resources with a view to the gradual emergence of a number of research centres of European or international repute. This would have an enormous effect on the whole of Dutch research and attract scholars from other countries to the Netherlands.

The Snellius Programme should work as follows. Basically, all research schools with the features set out in the previous chapter may compete for the available funds. They must be nominated by their administrative university. The ten characteristics referred to above become prerequisites which must be complied with, and information on them will have to be supplied. A protocol could help in this respect.

Application for funds from the Snellius Programme is not like a project application which requires a detailed account of how the funds are to be spent. The school must submit its long-term plan, but the money is made over directly to the research school without being earmarked for specific items. It is a reward for proven quality, a premium that can be earned. The school awarded this premium can spend it on staff (posts, bonuses) or facilities (study trips, attending conferences, foreign guest researchers, workshops, seminars, summer schools, hardware, software, library facilities), wherever the need is greatest. The schools must also be permitted to spend the funds in their own time. This allows sufficient flexibility when undertaking commitments and thus avoids problems arising when the subsidy period ends.

On the basis of the combination of quality, temporary subsidies, and the criterion of strategic scientific importance, the Committee recommends a five-year start-up period in which to build up the Snellius Programme. This can be achieved by awarding a premium to two or three new research schools every year. In the view of the Committee the premium should be of the order of NLG 1 million, plus an additional NLG 10,000 per AIO/OIO per year, over a period of five

years. On average this will amount to approximately NLG 1.5 to 2.5 million per year for each research school awarded a premium. The subsidy period will end with a short evaluation. These funds will then be released for application elsewhere, and the same school can naturally compete for funds again.

The temporary nature of these awards ensures that the system maintains sufficient momentum, and prevents fossilization once a system of top-level institutes has been created. The programme makes it possible to respond to scientific developments and shifts in priorities. The Committee assumes that about 10 to 15% of all research schools will receive financial support under the Snellius Programme. After an initial period requiring NLG 5 million per year, the programme would require approximately NLG 25 million per year in additional resources. This calculation is based on the assumption that the direct funding system (first flow of funds) continues to make it possible for the universities to provide their full range of undergraduate and postgraduate courses. This does not, moreover, alter the fact that additional resources are required in the higher education system to give AIOs who have obtained their doctorates the opportunity to train further as postdoctoral researchers. The Committee regards the NLG 25 million estimate as necessary for the funding of top-level research schools as an essential investment in the research environment in the Netherlands. Indeed this is a fairly modest sum. The Committee assumes that this sum will be over and above the Education Budget and will not, for example, be deducted from the resources earmarked for the first tier. The Committee was supported in the latter view by many of the parties with which it discussed its provisional views.

There is also a possibility that funds will be made available from the budget of the Ministry of Economic Affairs for certain research schools active in areas of relevance to economic policy. The Committee would emphasize that where an incentive is offered by the Ministry of Economic Affairs, this may on no account be seen as a reason for the Ministry of Education and Science to reduce its own contribution. The Committee does however recommend that the funds made available by the former be allocated separately from those of the Snellius Programme; the Ministry of Economic Affairs should be at liberty to follow its own procedures.

The Committee recommends the following selection and adjudication procedure. Two or three research schools will be eligible for financial support under the Snellius Programme per year. In principle, this will be open to research schools in all disciplines. The Committee does not propose to restrict the field by allowing certain areas or sectors only to participate in a given year but to leave this matter to the adjudicators. Applications for support under this programme can be submitted by the administrative universities. Proposals will be taken into consideration if they meet the ten criteria named above.

The process of adjudication can then begin. This is based initially on the first two criteria: is it truly a centre of high-quality training and research? In addition consideration is given to whether the research field of a research school is of strategic importance to science in the Netherlands. These strategic considerations may be essentially scientific or otherwise.

The Committee proposes placing the task of adjudication in the hands of a highly qualified and impartial jury composed of six members, two nominated by the KNAW, two by the NWO and two by the Science

Policy Advisory Council (RAWB). These members would act in a personal capacity and be nominated annually. This creates sufficient possibilities for varying the composition of the jury over the years and thus ensures a certain turnover. The jury would request the advice of national and international experts with regard to proposals accepted for adjudication. The jury must account for its decisions.

Research schools awarded a premium may indicate the grounds on which scientific indicators (publications, citations, patents, etc.) they wish to be assessed and may submit the relevant quantitative data. This procedure does justice to the diverse ways in which scientific progress and scientific achievements are being measured in the different disciplines. Adjudication and deliberation of proposals cannot be standardized. Quantitative data are simply means of facilitating the judgment by peers.

To assist the jury in reaching its decision, the schools must submit data demonstrating their achievements and external reputation, i.e. the amount of research funded by the research organizations, review committee reports on teaching at the school, KNAW assessments of the research performed under the conditional funding system in which a school is participating, etc. The schools must also submit their long-term research plans, plus figures showing the commitments of the universities associated with them. It is up to the jury to decide whether it requires additional information. A proficient jury which requests advice from the most appropriate sources will be able to limit the amount of bureaucracy involved.

A secretariat is required to facilitate the flow of information and to ensure the professional handling of that information. This can be provided by the NWO. The budget for the Snellius Programme can be added to the NWO budget, and earmarked as such. The monies awarded would be transferred to the administrative university. After the relevant period each research school must give an account to the respective university or universities of how the funds were spent. These reports will be open to public inspection.

As estimated above, the introduction of the Snellius Programme will involve a relatively modest sum in additional resources. If a decision is made in 1991 on the first two or three research schools to receive support, funding could start in 1992. An additional annual sum of approximately NLG 5 million would therefore be required from 1992 to 1996, when a ceiling would be reached of NLG 25 million. However, these limited additional resources can result in a dynamism which will have an enormous effect on the entire system. In many ways the Snellius Programme will have a knock-on effect, bringing benefits not only to the small group of research schools which have been awarded a premium but also to the larger group of research schools which jointly form the second tier.

The benefits are evident with regard to those schools which have been awarded a premium. An annual premium averaging NLG 2 million will enable them to substantially increase their activities in the area of research in which they are engaged. Moreover, in the words of Matthew: "whosoever hath, to him shall be given". The prestige attached to a Snellius award will give those who receive it a headstart in the acquisition of funds from the regular funding channels (direct and indirect funding mechanisms, contract research, and to an increasing extent, EC subsidies). A Snellius award will also be advantageous in acquiring funds for capital investment and equipment.

Since the selective awards made under the Snellius Programme are by their very nature temporary, there is no loss of face to weigh against the benefits. Losing the cachet of a Snellius award is in no way a disgrace and does not therefore mean a loss of prestige.

The Snellius Programme should promote those universities whose research schools have not yet been awarded a premium to develop them more fully and to raise their standard to such an extent that they too become eligible for an award. It should moreover motivate them to give sufficient attention to the content and structure of second-tier courses funded through the regular channels and to establishing their priorities and developing an individual identity. This represents a major challenge for the university authorities.

6 Financial aspects

The Committee would like to comment briefly on the financial aspects of research schools. These comments in some cases summarizing what has been said before, relate to the direct funding mechanism, indirect funding organizations, the Snellius Programme, the funds made available by the Ministry of Economic Affairs and other funds.

1. With regard to the direct funding mechanism, it can firstly be assumed that the AIO posts will in many cases be attached to research schools.

Universities receive funds via the regular funding system for one quarter of a staff post per PhD. The question is whether this funding is adequate. Universities must be able to bear the cost of research schools without it being at the expense of the first tier. In this context, the Committee recommends increasing the ratio from one quarter of a post per PhD to one third. This will give research schools sufficient resources for attending conferences, purchasing high-quality equipment, etc.

A third aspect is the funding of courses for designer engineers. Given that at present the funding formula allows a small sum only (NLG 3,000.—) per qualified engineer, there is little incentive for universities to set up design engineering courses. (Compare the incentive of one quarter of a staff post per PhD). It is hoped that consensus will be reached on this matter between all those concerned (government, industry and the universities of technology).

2. It is anticipated that the indirect funding organizations will be able to make a substantial contribution towards the financing of research schools by funding OIO posts. This will ensure a high standard of for posts. Considering the important role of the NWO in this respect it is all the more important that the procedures are short and as non-bureaucratic as possible. The Committee would draw the attention of the NWO to this matter.

The Committee would also suggest that the funding component in the direct funding system for NWO positions be directed as far as possible into the research schools. It would seem appropriate at this point to mention the NWO plans concerning the Stimulus Programme which aims to help establish a number of large, multidisciplinary research centres.

Finally, a budget of NLG 13 million for the initial funding of new AIO schools is administered by the NWO.

3. A sum rising to NLG 25 million per year should be made available as additional funding for the top 10 to 15% of research schools. The purpose of the Snellius Programme will be to reward high-quality research schools and encourage them to establish an international reputation.

4. Where research schools of an adequate size (see chapter 4) succeed in establishing a distinctive identity for themselves and thus become national focal points for research in a particular discipline, a subdiscipline or research field it is conceivable that financial support from the Ministry of Economic Affairs may be channelled – by way of a separate procedure – into the relevant schools to fund research in priority areas within the scope of technology policy. Funds from the Ministry of Economic Affairs are of particular importance given that research schools engaged in engineering and technology research generally require substantial sums, especially for equipment. To be able to guarantee sufficient continuity these grants will need to be on a long-term basis.
5. Finally, good research schools may be expected to acquire a certain amount of funding through contract research and European funding organizations in their field.

7 Conclusions and recommendations

In April 1990 the Minister of Education and Science requested the Research Schools Advisory Committee to submit recommendations on the further institutionalization research training within six months. The Committee was asked to formulate its opinion on two main points:

- what are the distinctive qualities of a research school?
- how can a system of research schools be established?

The Committee would first like to draw attention to the following features of the current situation.

- a. The anticipated demand for academic researchers in all sectors of academic research exceeds the present supply, the main problems being found in technology and engineering, agriculture, science and economics.
- b. With the introduction of the two-tier system of higher education in the Netherlands the duration of undergraduate courses was shortened. As a consequence the research component has more or less disappeared from the first tier, and with it a potential means of selecting candidates for the position of trainee research assistant (AIO) has also been lost.
- c. Too much uniformity in the higher education system militates against specialization in certain disciplines and the formation of centres of excellence. Moreover, the quality of research funded directly by the government leaves room for improvement.
- d. The development of postgraduate courses has been relatively ad hoc to date. Consequently, the system of postgraduate education is not yet complete.
- e. There is a certain degree of dissatisfaction with the training and supervision of trainee research assistants, especially in those disciplines that do not have a long tradition of PhD programmes.
- f. The number of design engineers admitted for training has remained below the numbers estimated. This is partly due to a difference of opinion between the government, the universities of technology and industry on the subject of funding.

In delivering its opinion, the Committee does not wish to produce a blueprint of a research school. Nor is there any reason to start from scratch. In practice, many initiatives have already been taken which may be regarded as research schools *avant la lettre*: long-standing institutes or other organizational forms in the sciences and medicine, the more recently established AIO schools and networks, especially in the humanities and social sciences, etc. Various other structures have also been set up (national structures per discipline or subdiscipline,

para-university institutes, local multidisciplinary collaboration, etc.) reflecting the structural diversity of different fields of research. The Committee wishes to build on this multiformity and thus ensure continuity in the system. It does not wish to impose a single model of a research school across the board.

To establish some degree of order and ensure at least some level of protection for the label 'research school' the Committee considers it essential that research school initiatives are supported, recognized and publicized by the authorities of one or more universities, possibly in collaboration with NWO, KNAW or TNO institutes or other research institutes such as the Large Technological Institutes, and in certain cases, industry and the Ministry of Economic Affairs. The parameters proposed by the Committee are thus procedural and do not relate to form or content.

Accordingly, the Committee regards the establishment of a research school as the primary responsibility of a university (possibly in collaboration with others). Without the commitment of the university authorities research schools will never be able to operate on an adequate scale. The Committee anticipates that a large number of research schools will be established within the framework of postgraduate education, each having its own character.

In the Committee's view there are ten characteristics that all research schools should share. These criteria should, however, be regarded as a guide for the university authorities and not as compulsory requirements.

1. **Training of young researchers.** While the majority of these will be trainee research assistants (AIOs) and trainee researchers (OIOs) with posts at the school, research schools may also provide courses for design engineers and advanced vocational training courses. The existence of research schools should help to make up the anticipated shortage of qualified researchers
2. **Centre for high-quality research.** Research schools will need to become national centres of excellence in their field of research, for instance through careful selection of personnel.
3. **Independent organizational unit with budget responsibilities.** Section 8.49 of the Higher Education and Research Bill (WHW) guarantees such independence.
4. **Association with a university or universities.** A research school should be part of one or more universities, having one university as its administrative centre. To further national coordination the university authorities should seek advice (for instance from the KNAW) when setting up a research school in a particular field.
5. **Adequate size.** A large institute offers certain advantages over a smaller one. The Committee estimates the minimum total capacity required at 40 to 50 trainee research assistants, i.e. an annual intake of 10 to 12 trainee research assistants.
6. **Careful selection of research proposals and AIOs/OIOs.** Priorities must be established and a ranking system applied to facilitate the selection of research proposals (thesis assignments). One important external selection criterion is

the volume of funds research schools are able to acquire from the national research organizations and other sources.

7. **Guaranteed supervision and a high standard of teaching.** Research schools must guarantee the quality of their teaching (specialized top-level training) and a high level of individual guidance of AIOs by their supervisors.
8. **Explicit policy on post-doctoral positions.** Post-doctoral positions funded through the KNAW Programme or by other means will probably be allocated primarily to research schools. A research school with post-doctoral researchers will be able to conduct high-risk, innovative research.
9. **Close links with the first tier.** Research schools should have their roots in the universities. The academic staff attached to them should continue to be involved in undergraduate teaching. The *ius promovendi* will still apply to all professors. All possible means must be deployed to strengthen the research component in the first tier in order to motivate students and facilitate the selection of talented future researchers.
10. **Accountability and evaluation.** Research schools must submit an annual account and/or annual budget to the university or universities to which they are attached.

It is the task of the universities to take these criteria and use them to develop further existing initiatives of a suitably high standard so that a spectrum of high-quality research schools is created, the natural pinnacle of which will be formed by internationally recognized centres of excellence. The Committee recommends that a special programme, called the Snellius Programme, should be set up in order to stimulate and support these centres of excellence. A limited number of research schools would receive extra financial support from this fund for a period of five years. Each school selected would receive an average of approximately 2 million guilders per year (NLG 1 million + NLG 10,000 per AIO/OIO). Two or three research schools would be selected to take part in the programme each year. After an initial five-year period ten to fifteen top-level institutes would receive financial support under this programme at a total annual cost of around 25 million guilders.

Those research schools to receive financial support under the programme will be chosen by a jury. In principle, any research school in any discipline, will be eligible provided it meets the ten criteria given. The Committee does not propose to restrict the field by allowing certain areas or sectors only to participate in a given year. The task of adjudication would be placed in the hands of a highly qualified jury composed of six members, two nominated by the KNAW, two by the NWO and two by the RAWB. Adjudication would be based primarily on scientific quality, a secondary consideration being the strategic importance to the Netherlands of the area of science in which the school is engaged. These top-level research schools will therefore also reflect national science policy. The budget for the Snellius Programme should be in addition to existing funds and should be added to the NWO budget earmarked for this purpose. The secretariat of the Snellius Programme can also be provided by the NWO.

The temporary nature of the Snellius awards will ensure that the system maintains sufficient momentum and will prevent fossilization

once a system of top-level institutes has been created. The programme makes it possible to respond to scientific developments and shifts in priorities.

The advantages of receiving a Snellius award will go beyond the immediate financial benefits alone. The prestige attached to such an award will give those who receive it a headstart in the acquisition of funds from the regular funding channels (direct and indirect funding mechanisms, contract research, and to an increasing extent, EC subsidies).

Since the selective awards made under the Snellius Programme are by their very nature temporary, there is no loss of face to weigh against the benefits. Losing the cachet of a Snellius award after five years is in no way a disgrace and does not therefore mean a loss of prestige.

With regard to the financial aspects of research training in the second tier, it must be made quite clear that the establishment of research schools should basically be part and parcel of the regular responsibilities of universities. This should not occur however at the expense of the first tier. With this in mind the Committee favours an increase in the existing ratio from one quarter of a staff post per PhD to one third. Research schools will also be expected to compete for OIO posts funded by the NWO, etc., in the direct funding formula. The NWO will thus make a major contribution towards the funding of research schools in general. Certain schools may also receive funds from the Ministry of Economic Affairs via a separate procedure.

Appendix I: Composition of the committee and procedure followed

Composition

The Committee was composed of the following members:

Prof. A.H.G. Rinnooy Kan, professor of operations research, Erasmus University, Rotterdam, chairman

Prof. C. Datema, rector magnificus, Free University of Amsterdam

Prof. L.A. van Es, professor of internal medicine, University of Leiden

J.K.M. Gevers, chairman of the Executive Board, University of Amsterdam

Prof. P.M.E.M. van der Grinten, member of the Board, DSM

Prof. A.R. Miedema, deputy director, Philips Research Laboratory

Prof. C.T. de Wit, professor emeritus of theoretical production ecology, University of Agriculture, Wageningen

Dr. C.A. Hazeu, executive secretary of the NWO Foundation ECOZOEK (Organization for the Promotion of Research in the Economic Sciences), secretary

Procedure

The Research Schools Advisory Committee was set up by the Minister of Education and Science on 2 April 1990 for a period of six months. During this period the Committee met five times.

For the purpose of sounding out its ideas the Committee organized a number of meetings with the various scientific and academic bodies (NWO, KNAW, VSNU, RAWB, TNO) and, at the Minister's request, with the Council of Employers' Organizations (RCO), the national consultative committee for trainee research assistants (LAIOO) and the Advisory Committee on Non-Western Languages.

Appendix 1: Composition of the committee and procedures followed

The committee was established in 1997 to review the effectiveness of the current system of regulation of the health professions. It was composed of representatives of the professions, the public, and the government.

The committee was chaired by Sir John Peel, a former senior civil servant and a member of the House of Lords. It was supported by a secretariat of civil servants.

The committee's terms of reference were to review the effectiveness of the current system of regulation of the health professions, and to make recommendations for improvement. It was to report to the Secretary of State for Health.

The committee's first report was published in 1998. It recommended a number of changes to the current system of regulation of the health professions.

The committee's second report was published in 1999. It recommended a number of changes to the current system of regulation of the health professions.

The committee's third report was published in 2000. It recommended a number of changes to the current system of regulation of the health professions.

The committee's fourth report was published in 2001. It recommended a number of changes to the current system of regulation of the health professions.

Appendix II: Labour market for academic researchers up to the year 2000

Annual additional demand and supply and shortfall on the Dutch labour market for university graduates in the field of research and development (number of persons, period 1985-2000)

Sector	Demand	Supply	Shortfall
agriculture	110-190	20-80	90-110
science	540-960	140-430	400-530
engineering/ technology	640-1,130	70-220	570-910
health	160-310	90-280	30-70
economics	100-140	20-70	70-80
law	60- 90	30-80	10-30
behaviour and society	250-420	100-240	120-210
language and culture	110-180	40-140	40-70
Total	1,980-3,420	520-1,600	1,460-1,820
(average)	(2,700)	(1,100)	(1,600)

(source: draft Higher Education and Research Plan 1990, p. 76)

Appendix II: List of names for students responsible up to the year 1000

The following list of names is based on the records of the
University of Cambridge, which are the only records of
the names of students who have been admitted to the
University since the year 1000.

Year	Name	Year	Name
1000	John	1001	John
1002	John	1003	John
1004	John	1005	John
1006	John	1007	John
1008	John	1009	John
1010	John	1011	John
1012	John	1013	John
1014	John	1015	John
1016	John	1017	John
1018	John	1019	John
1020	John	1021	John
1022	John	1023	John
1024	John	1025	John
1026	John	1027	John
1028	John	1029	John
1030	John	1031	John
1032	John	1033	John
1034	John	1035	John
1036	John	1037	John
1038	John	1039	John
1040	John	1041	John
1042	John	1043	John
1044	John	1045	John
1046	John	1047	John
1048	John	1049	John
1050	John	1051	John
1052	John	1053	John
1054	John	1055	John
1056	John	1057	John
1058	John	1059	John
1060	John	1061	John
1062	John	1063	John
1064	John	1065	John
1066	John	1067	John
1068	John	1069	John
1070	John	1071	John
1072	John	1073	John
1074	John	1075	John
1076	John	1077	John
1078	John	1079	John
1080	John	1081	John
1082	John	1083	John
1084	John	1085	John
1086	John	1087	John
1088	John	1089	John
1090	John	1091	John
1092	John	1093	John
1094	John	1095	John
1096	John	1097	John
1098	John	1099	John
1100	John	1101	John

The following list of names is based on the records of the
University of Cambridge, which are the only records of
the names of students who have been admitted to the
University since the year 1000.

Appendix III: Sections of the draft Higher Education and Research Bill relating to research schools

Section 8.49. Establishment of a research institute; staff

- 1 Research institutes may be set up for the purpose of promoting by means of an amendment to the university regulations.
- 2 Without prejudice to the powers of the executive board referred to in section 4.2, subsection one, and taking into account the appointments ruling, the faculty board shall determine which members of the academic, support and management staff shall be employed in the institute and which students shall be regarded on the basis of their contribution to the activities of the institute as belonging to it. Insofar as such members of staff belong to a department, the faculty board shall first consult the relevant departmental board.

Section 8.50. Size and composition of the board of the research institute; director of research

- 1 The board of the research institute shall comprise a chairperson and a maximum of four other members. The faculty council shall appoint the chairperson from among the professors, from within or outside the faculty, and the other members from among the academic staff, from within or outside the faculty. Notwithstanding the previous sentence, one or more of the members, apart from the chairperson, may be appointed from persons who do not belong to one of the universities but have proven their expertise in the relevant field of research. The majority of the members of the institute's board shall be drawn from the academic staff.
- 2 The daily affairs of the research institute shall be managed by the director of research on behalf of the board of the institute. The faculty board shall appoint the director of research from among the professors, after consulting the board of the institute. The appointment must be approved by the executive board and shall be for five years.

Section 8.51. Allocation of duties within the research institute

Without prejudice to the powers of the executive board and taking into account the appointments ruling, the board of the research institute shall allocate duties to those employed in the institute. It shall decide, with the agreement of those concerned, with which professor each of the other members of the academic staff of the institute shall organise their research and who shall supervise each of the remaining members of staff and each of the students belonging to the institute. If agreement cannot be reached, the relevant other member of the academic staff may submit the dispute to the board of the institute, which shall decide on the matter.

Section 8.52. Duties and powers of the board of the research institute concerning the general research programme and detailed research programme

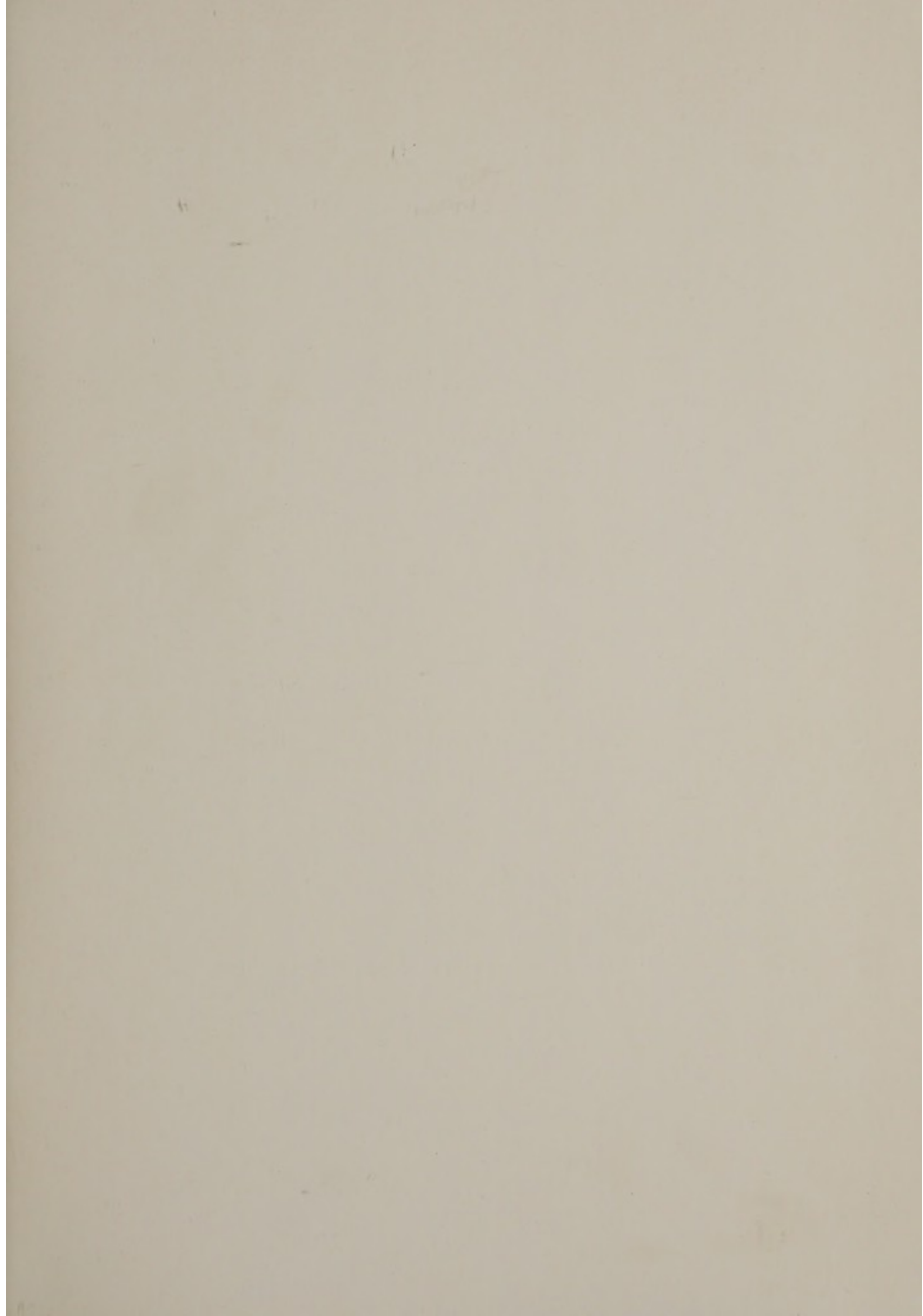
- 1 The faculty council shall lay down a research programme for the research institute once every five years. Taking this programme and the research guidelines into account, the board of the institute shall lay down a detailed programme of research each year. The general research programme and the detailed research programme cannot be finalised until a permanent committee on research has been consulted.
- 2 The board of the research institute shall be accountable to the faculty board for laying down and implementing the detailed research programme and shall supply the said board with any information it may require.

Section 8.53. Transfer of powers to the board of the research institute

It shall be laid down in the faculty regulations which of the powers of the council and the board of the faculty, insofar as these relate to the research institute, shall be exercised by the board of the institute.


Section 8.54. Research institutes set up by two or more faculties of the same or different universities

- 1 Sections 8.49 to 8.53 shall apply *mutatis mutandis* to research institutes set up by two or more faculties, with the proviso that the university regulations shall indicate which faculty shall exercise the powers regarding the research institute conferred by or pursuant to the present Act on the faculty council, the faculty board and a permanent committee on research subsection one. The university regulations shall also stipulate how these powers are to be exercised.
- 2 Research institutes may be set up by two or more faculties of two or more universities by agreement between the executive boards. This agreement shall regulate the matters referred to in sections 8.49 to 8.53.









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