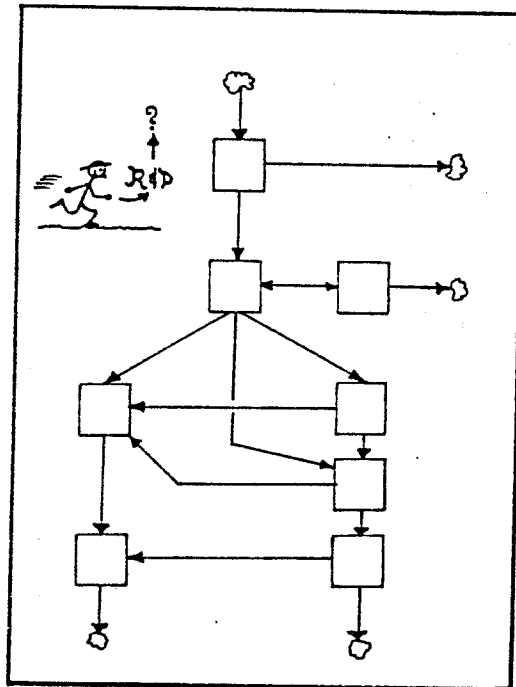


MOBILITY OF RESEARCHERS IN THE NETHERLANDS

(summary)



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1. BACKGROUND

At the beginning of the seventies, grave concern existed over low mobility of researchers due to the stagnation in the growth in the research capacity available. Through a strong expansion in research capacity prior to this condition of stagnation, the age of researchers was relatively low. It was feared that the small natural turnover (as the result of a low average age) together with the low mobility would lead to a collective aging of the research corps itself. This aging factor was considered to be a threat to research as a whole since it could lead to mental fixation and loss of creativity.

In addition to this, the expectations for making a career and the employment possibilities open to the then recently graduated university students had strongly decreased. This situation resulted in a loss of talent for research groups, and it was feared that there would be a decline in the motivation and development possibilities for researchers.

The developments briefly described here formed no phenomena exclusive to the Netherlands but also made their appearances in substantially all of the western countries.

This situation resulted in Mr. L. de Brauw, the Minister for Science Policy at that time, to ask advice from the Advisory Council for Science Policy (RAWB) on the following matters:

- the factors possibly influencing mobility in scientific education as well as in the other (research) institutes and,
- the measures which could be taken to promote mobility.

The Council tendered its advice in 1976 but, prior to its analysis and suggestions, pointed to a lack of statistical material and an insight into the problem. Moreover, and as a result of the Minister seeking advice, the Council (RAWB) took the view that mobility proposed as an aim in itself and not included in a broader cadre of causes and effects would be an impedimentary limitation, and thus it was offered to develop the study further. The Inter Ministerial Consultative Committee on Research and Development Policy set up a working party concerned with questions of mobility and whose task would be to advise on concrete measures to be taken on the basis of the proposals put forward by the RAWB.

The complete report (in Dutch) can be obtained from the Staffgroup Strategic Surveys of TNO, P.O. Box 541, 7300 AM Apeldoorn, Netherlands.

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2. THIS RESEARCH PROJECT

Currently herewith, the Minister for Science Policy instructed the Staffgroup Strategic Surveys of TNO to carry out a system-dynamic study of the mobility of researchers on the basis of a long-term perspective, and in relation to a background of the quality of research and employment opportunities for those engaged in research. This project was initiated in March 1979 and was concluded in September 1980. A summary of the final report now lies before you. The project was conducted through a commission which included representatives from industrial concerns (Shell, Philips), the Directorate General for Science Policy, and the Ministry of Social Affairs, the Universities, the Central Bureau for Statistics (CBS), the Advisory Council for Science Policy and the Central Planning Bureau (CPB).

The research project itself was finally directed to three areas: statistics and other data, the influence of mobility with respect to research and mobility in the cadre of the employment market for researchers. In carrying out the investigation, use was made of the System-Dynamics Method. This relates to a problem-directed system-analytic approach which is used namely for complex, long-term policy problems.

The project was begun with the gathering of background material by means of a literature study, interviewing and the analysis of statistical data. From the information obtained in this manner, it became rapidly clear that mobility was only one of the many factors influencing research. In this connection, and amongst other matters, the quality of the infrastructure (apparatus and buildings) and many managerial aspects (e.g. the drafting of research programmes, contacts with other establishments) played an equally important role.

Whilst in carrying out the research project it was not attempted to trace all these factors and unravel the effects on research itself, it was well attempted as far as possible to study the effect of mobility on research in relation to these other factors. In this sense then, the study presented here is limited¹⁾. This limitation was applied for two reasons. On the one hand, a limitation was imposed by the terms of the Minister's instructions relative to the research project wherein explicit reference to mobility was

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1) The study is also limited in the sense that it is not detailed in answer to the question - "What is the importance of research for society".

8. The hope that the mobility problem will be solved when the bulk of the researchers (around the year 2000) is pensioned, is not justified.

Through the expansion of the research system in the sixties, the number going on pension in the eighties and nineties will increase. From calculations made with the labour market model, it appears, however, that this number will not create the room that is needed to make an adequate influx of young researchers possible.

From the simulations, it came to the fore that the number of pensioning cases during the period extending to the year 2000 will never come to more than 2 to 3% of the total number of researchers. Pensioning of personnel will well contribute to the lightening of the mobility problem but will not obviate this problem.

9. If the present policy is continued, strong discrepancies will arise in the future concerning ages and conditions of employment between senior and other researchers.

The strongly increasing supply of academicians will lead to a lowering of the conditions of employment for researchers commencing their careers, and through this the average conditions of employment for researchers in the junior category will also be lowered. The conditions of employment for senior researchers are high, and these will also stay high since (through the low mobility of this group amongst other matters) only a few juniors will pass through to this group.

10. Correction in the composition of the personnel (through the ranks) will only be brought about by a laborious process.

Alongside the increase in the average age and the changes in the condition of employment (see previous conclusion), changes in the mobility and in the composition of the personnel also occur extremely slowly. Amongst other matters this delay resulted in this, that the incidental adjustment of the number of senior places via the transfer of senior places to junior places through considerations of the legal position, could only be realised by means of the natural course of events in the matter. We already mentioned in conclusion 8 that the outflow through pensioning is lower than some 2% which

means that a reduction in the number of senior places by about 30% will take at least 6 years¹⁾. Since it also appears that this instrument in itself is no quick-acting panacea it is of importance that the measures to be taken are taken quickly.

11. A policy directed to a strong increase in the share of researchers in temporary positions is no solution to the problem of finding work.

The increasing number of temporary researchers causes many problems. The mobility in this group often appears to rise extremely high since the chances of the temporarily appointed to obtain a permanent position are strongly decreasing. For the greater part, this decrease must be attributed to the expansion of the number of temporary positions because this expansion takes place to the cost of permanent positions. Through this situation, researchers use these positions as lookout-posts for those having more perspective. This has the result that temporarily employed researchers leave their employment quite some time before their "contract" expires. This situation has more than a disastrous effect on continuity of the research projects in which they are engaged.

Thus temporary appointments appear to be unattractive and thus are also often used incorrectly.

Furthermore, the transfer from permanent to temporary appointments occupies much time (see 9). During this time, little or no inflow occurs to the higher ranks. Due to this policy the aging of those in these higher ranks runs its course even faster than it would have done without it. This is to be considered as very undesirable.

12. Legislated early retirement offers no real solution to the mobility problem.

We have already seen in conclusion 8 that the increase in pensioning to the year 1990 offers no effective solution. Early retirement only means that the situation existing after 1990 will arrive somewhat earlier. Since this only affects the situation depicted at the tailend of the graph giving the

1) At the moment the total number of senior positions amounts to approximately 33%.

age structure (see fig. 3) the effect on the situation as a whole is but slight.

13. *The mobility can be well increased by increasing the number of juniors with tenure to the cost of the seniors.*

From the data available it appears that mobility of the permanently appointed is highest in the lowest ranks. An increase in the number of juniors with tenure thus leads to a growth of the category in which the mobility is high. Due to the fact that the junior places increase relatively with respect to the senior positions the chances of promotion to the senior positions become smaller. Because of the fact that a junior place will not very often be seen as the end of a career, the permanently appointed junior will try to find another position more than their senior colleagues.

This is also often a need for those who want to make a career, since in this situation the transfer of senior to junior positions will result in decreased probabilities to promote to a senior position.

Such a policy exhibits many resemblances to the policy which is exercised in industry. The policy in industry is also often directed to stimulating the outflow from research by excluding from the research the career peak (acquisition of the highest conditions of employment). Furthermore, such a policy could be of importance in the propagation of knowledge of technically-high value and perhaps through this the establishment of small companies can be stimulated.

The category "permanent junior" is also on the increase in relation to the group of juniors in temporary service. Thus, due to this situation, the chances of this last quoted group being taken on permanently has become greater, and so that it has become more attractive to serve out the contract whereby the continuity of the research is ensured. Finally since relatively more people are being taken on permanently, there will be less wastage of the experience that has been built up. As an extra advantage of such a policy, it can even be reported here that from the simulations it appears that there is a supple transition to a situation in which those of the juniors taken on permanently are in the majority as compared with a transition to a situation in which more juniors are being taken into temporary service.

3.3. CONCLUSIONS BASED ON THE R & D MODEL.

The R & D model comprises two more or less hard sectors (researchers and infrastructure, namely apparatus) and a softer sector relating to the level of research. The revelations from the hard sector relating to the researchers completely support the conclusions which were obtained with the assistance of the labour market model. Thus we do not repeat this part of the study and limit ourselves to other sectors. For the rest, it can be commented that the R & D model is adjusted to the needs of the physical and technical sciences

14. *Whilst the research system may be quoted as being robust up to a certain level it is unstable in its essentialities.*

In general, small changes in the circumstances (age, level of the apparatus used and suchlike) only give rise to proportionately small adaptations to the level of the research. However, if the circumstantial pressures applied to the system are great enough (bad apparatus, an aging of the knowledge and an increase in the average age) then these can lead to relative small alterations which, as it were, break internal resistance and positive feed-back processes are initiated which have the result that the level of the research continues falling.

At this point we can say that the research system can take a knock under normal circumstances, but that if the external circumstances become too bad a fall in the level of research automatically leads to further falling. Several positive feed-back chains play an important role in this process, these are outlined in figure 5 (see also figure 2).

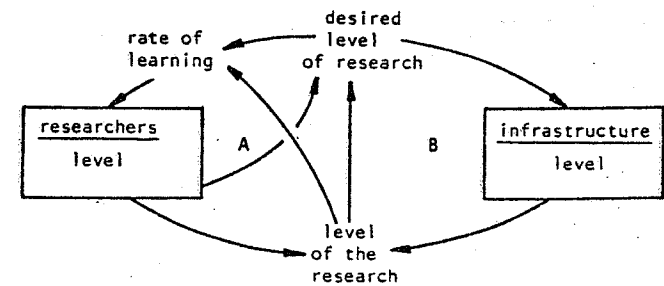


fig. 5.

The interconnecting loops (A) illustrate that the level of the research personnel is dependent on the level of the research via the desired level of research. A fall in this level leads to a fall in the level of the researchers which, in its turn, again leads to a fall in the level of the research itself.

Loop B is illustrative of a similar process for the level of the infrastructure.

15. *It is of great importance to continuously monitor the research system.*

From simulations made with the model it appears that a decrease of the level of research is brought about slowly, and it often goes unnoticed because together with the level of the research also the "norms" of the researchers are lowered. In view of the fact that it also appears from these simulations that recovery takes a very long time, continuous monitoring of the research is necessary. Moreover, it may yet be commented that it would seem very unintelligible to put one's trust in an "automatic" correction of the system.

16. *Low mobility and aging can form a great problem for the level of the research.*

In this conclusion we use the word "can" for two reasons. In the first place no rigorous theory exists concerning the connection between age and level. This means that we must make some assumptions on this point in our model. These assumptions can be formulated as follows:

- If a research group works over a long period on the same subject with the same composition of personnel then the level of the group will fall because the personnel becomes, amongst other things, less ambitious and less studious.
- Low mobility leads to less exchange of ideas and thus to a lower rate of learning.

Neither of these two effects have been accentuated in our model.

In the second place, the effect of the low mobility and aging depends on other influences on the research system. If the circumstantial pressure caused by these factors is slight then low mobility and aging exercise little influence. However, should the research system be subjected to heavy pressure then the low mobility and aging may be likened to the final straw that broke the camel's back (see also 14).

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17. *Mobility is only one of the many factors which determine the level of the research. The influence which the level of the apparatus and the policy have on the level of the research also needs to be looked at.*

The level of the apparatus is determined by the investment policy herefor, the rate at which apparatus becomes obsolescent and the moment at which it is taken out of service. In the model, bad apparatus exercises only a modest¹⁾ influence on the research. The level of the apparatus can be improved by either purchasing more new and modern instruments or by taking obsolescent apparatus out of service.

In the event of resort to the last action, one must take care that the instrumentation remains at an adequate level. It is namely in this area that age and policy play an important role.

18. *The extension of the number of temporary positions especially for junior researchers offers no solution for the problems caused by aging.*

From the model results it appears that, making the assumptions, temporary positions create no problems for the level of the research. This result is presumably unrealistic for two reasons.

In the first place we have always assumed that the temporarily employed researchers are completely integrated in research. Presumably this is incorrect since, in this case, a research employee taken on in a temporary appointment expends a good deal of the time available to him in settling himself in.

In the second place a problem plays a role here insofar that very often the research policy is determined by the permanently employed researchers (the temporarily appointed never often reach this stage during the period of their temporary appointment). The transfer of positions in this category to the temporarily employed group reduces the inflow to the permanently employed group and thus causes an accelerated aging of the latter. Furthermore much time and attention is needed to educate and allow for the settling in of a continuous influx of new people, and due to the high outflow from the temporary group much experience and knowledge is prematurely lost. Finally here we will yet indicate the consequences of a policy, directed to increasing the number of temporary positions, on the age distribution of the researchers. Figure 6 is illustrative of the (bi-polar) age

1) Modest because as much (see 16) great uncertainty exists over these relationships.

distribution which can result from such a policy. From the view point of organisational-theory¹⁾ and also in the interests of the research (see 3.1) such a distribution must be considered as undesirable.

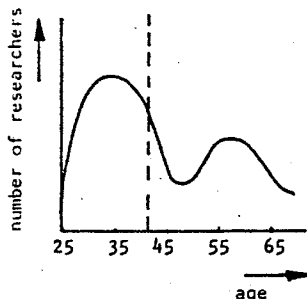


Fig. 6.

19. *Extra funds are needed in order to maintain the level of research.*

Concerning the infrastructure, the simulations are very explicit. Some deterioration in respect of the growth situation is unavoidable and this must also be accepted. However, too great a slip needs to be avoided and therefor a good policy for the replacement of apparatus is necessary. Further hereto extra means must become available in order to give extra stimulation to promising researchers, to finance guest researchers and study trips to other institutions (also those located abroad) and to free researchers from other tasks such as teaching for example. A part of these costs will be financed from savings accruing from the measures taken in the area of personnel in general.

3.4. CONCLUSIONS CONCERNING THE NEED OF DATA AND FURTHER RESEARCH

During the course of this study we came into contact with many areas of activity over which little was known but which are, in our opinion, well of great importance to the investigated problem. Owing to this some of the parts of this study could not be worked out sufficiently. These sectors

1) In an organisation in which such an age distribution exists the 'middle' ... there is often talk of a strong

are briefly given below. Finally, those points on which existing data is lacking are set out in the second part of this section.

Further parts of this study still to be worked out

- The Research & Development investment policy.
- Fuller sensitivity-analysis of the models.
- Breakdown of research organisations into types.
- Detailed personnel planning for longer periods.
- Firm establishment further of direct measures for promoting mobility.
- Firm establishment further of the measures having the aim of stimulating renewal of the research.

Improvement of the data

From the study it appeared that insufficient data was available relating to:

- Personnel, separated into ranks, age classes and disciplines.
- Turnover, reasons for turnover and new sphere of activity.
- Level and extent of the infrastructure per researcher.
- Availability of the infrastructure per researcher.
- Academicians per age group, discipline and sphere of activity.
- Number of employment vacancies open to academicians¹⁾.
- Conditions of employment for academicians.
- Changes in the conditions of employment during the last 20 years and the influence hereof on the demand for academicians.
- Career-course of academicians.
- Potential careers for academicians.
- The need of industry and local government institutions for academicians and data relative to the knowledge and proficiency which are required herefor.
- Forecast of the academicians required per discipline.
- The reasons for following a scientific education, influences on the influx of students.
- Percentage of fall-out and duration of the period of scientific education.

1) In connection with this it is interesting to point out that, in the near future, shortages are to be expected in certain disciplines (chemical engineers, mechanical engineers).

Furthermore, it appears useful at this juncture to point out the small degree of uniformity of the data available through which it is difficult or impossible to compare information provided by different organisations.

4. RECOMMENDATIONS FOR THE MEASURES TO BE TAKEN

A series of concrete recommendations can be derived from the conclusions discussed in the foregoing paragraphs. It should be commented on here that these measures will very often only achieve the desired effect if they are pushed-through at research group levels. We will now quote the main of these measures with a brief explanation. The first eight recommendations more or less relate to the policy to be exercised in respect of personnel, the others are more generally concerned with the improvement of the functioning of the research groups.

1. Bring the career perspectives of the researchers more into conformity with those of the employees with the same level of education ("higher-grade personnel").

It still often occurs that researchers have better conditions of employment than other employees with a similar level of education. This holds good not only for the primary conditions of employment but also for the secondary thereof and this can act as a brake on mobility to (often at lowered alaried) functions outside of research. The present situation impedes mobility because an older person engaged in research will often lose-out if he transfers to a higher-grade function.

2. Endeavour to achieve a personnel build-up in which the permanently appointed category of juniors have a greater share of the posts available (for example, 25% temporarily employed juniors, 50% permanently employed juniors and 25% senior-grade employees).

In the matter of this recommendation, we refer to conclusions 11, 13 and 18. We expect the following advantages to accrue from the implementation of this recommendation:

- Less unrest in the organisation.
- The younger of the researchers will also be able to determine the

research policy jointly with others.

- There will be a lessening in the loss of experience.
- Career perspectives for temporarily employed personnel will become more favourable and there will be a lesser turnover of personnel in this group, a situation which will be all to the good of continuity of the research.
- There will be a build-up of personnel which will be more in keeping with the "ideal" composition (see conclusion 2).
- Savings will be made in salaries in relation to the present system.
- An increase in mobility, especially if this recommendation is realised in practice in combination with the three earlier quoted recommendations.
- There will be a better distribution of mobility over the age classes.

3. Tighten up the selection requirements prior to promotion to senior ranks of the researchers. In the exercise of this selection, consider aspects other than research capacity and namely managerial ability.

Many of the present problems have arisen due to the fact that many of the researchers have been able to pass through to the ranks of the senior researchers too easily (often, even more or less automatically). In order to remove this sort of problem in the future, it is also recommended that there will be a tightening-up in the selection requirements. One of the principal tasks of the seniors consists of research management, little account was taken of this aspect of the function on the appointment of seniors in the past. This situation has given rise to our recommendation that more attention should be paid to managerial capacity in the future.

4. Improve the quality of management in non-industrial research organisations.

The great importance of good research management has already been commented on at different times here in. It seems that industry itself is thoroughly conscious of this and has invested much time and money, by regularly sending research managers to acquire education and attend courses herein. This is probably one of the reasons why industrial research management has been more successful in maintaining its researchers better motivated (by continuously offering them challenging problems) than university research managers. Whilst university management cannot exercise an influence on research policy

such as is exercised by industrial managers and whilst, through the oppressive financial situation, one and another things have still happened in this area of activity lately (better research proposals, tighter selection, development of assessment criteria) we are of the opinion still that too little has been achieved in this field within the universities and other (semi-)governmental organisations.

5. *It deserves recommendation that the practice of demotion (a change to another appointment, an advisory function for example) be resorted to in the case of older research managers.*

Resort to the demotion of older research management personnel opens the possibility for younger researchers to flow-through to management functions. This flow-through will increase the vitality of the management which is essential for the research itself and concurrently, through demotion, the older researchers will contribute to the solution of the mobility problem. Further the build-up proposed in recommendation 2 can be realised more quickly.

6. *Stimulate the outflow of the more experienced researchers to functions outside of research.*

As already commented on herein this outflow is of great importance since, through this, possibilities are created for the inflow of the recently graduated as well as flow-through of young researchers. Furthermore, a more effective distribution of research results is to be expected from a similar outflow of personnel.

The project team itself realises that it will not be easy to meet these recommendations and suggests several ideas which follow hereon and which can be helpful in the matter.

- Connection hereto can be sought from the investigation that is to be carried out by Twente University of Technology. The object of this investigation is to determine in what manner the universities of technology can be helpful to the engineers desirous of starting a business.
- In view of the fact that breaks in the pension build-up still act with a great braking effect on mobility, it is useful in this connection to refer to the report of the working group occupied with matters relating to the

legal position of TNO personnel. This report explains in which manner the TNO pension provisions must be adapted in order to take care that employees can leave the organisation before their 65th year without problems of too great a magnitude arising in the matter of their pensions.

- Often, and certainly if it is attended with a domestic move, external mobility brings with it costs for the employee which are only very partly covered by the so-called removal costs arrangement. It thus deserves recommendation that this reimbursement be increased so that the employee is no longer punished financially for his mobility.
- The offer of an appointment with another organisation brings with it an attendant risk for the employee since he is giving up a permanent position, and is often required to serve a probationary period first with his new employer. It must be determined just how much this risk can be obviated. To this end then agreements can be made between the two organisations concerned for example, and through which the probationary period may be conceived as a sort of detachment.
- It should be endeavoured to make functions outside of research more attractive for researchers.
In view of the fact that obscurity still leads to unpopularity, a first step to improve situations¹⁾ between organisations should be taken through communication (via contract research for example). In parallel with this, it should be determined which knowledge and which skills researchers themselves should acquire before transferring to functions outside of research. The research organisations must consider how far they must go in offering researchers the possibilities of acquiring this additional knowledge and skill themselves.

7. *The promotion of internal mobility.*

The importance of internal mobility in conducting alert research policy has been under discussion in the foregoing. Here we shall permit several ideas and suggestions to follow:

- The following should serve as a basis for conducting a policy of mobility: an inventory of currently running research, the potential of the researchers the desires of the researchers and the desires of the management. On the basis of these inventories answers can be obtained to the questions

1) On a somewhat longer-term basis, this communication can also lead to a better directivity of the research to the demands of the surroundings.

- as to whether there is a willingness, a possibility and a demand for internal mobility.
- It will require much attention and time to free the term internal mobility from the stigma "failure". To this end it is desirable amongst other things that internal mobility is explicitly placed in the cadre of a well-founded research policy.
 - It deserves recommendation that internal mobility be made financially attractive and to fit into a career policy (to be internally mobile is good for your career!).
 - Internal mobility is very often braked by organisational difficulties, these difficulties should be overcome.

8. *The manner in which data concerning mobility can be gathered in a more adequate and uniform way needs to be investigated by the universities and the Central Bureau of Statistics.*

During the course of this study, it seemed more than once that data concerning mobility was absent (for example, where do new employees come from or whereto do those employees go?). Such data coming from different organisations was often difficult to compare.

9. *It deserves recommendation that a part of the government subsidies to institutions for applied research be channelled through the (potential) "clients" of these institutions.*

This recommendation aims at coupling the research carried out by the quoted institutions to the problems existing in society and thus, by doing so, improving the relationship between these institutions and their "clients" by using the financial means (partly) to determine in which fields of activity research is to be carried out.

10. *Increase the number of detachments and take on more guest-teachers.*

If it appears that it is not adequately possible to get the outflow of the older personnel under way, then it will not be a simple matter to bring new knowledge in house (by an inflow of new personnel for example). The expedients of detaching personnel and taking on guest-teachers can be of help in attempting to bring in new knowledge. From this point of view, fellowships for study abroad can play an important role. In this connection, a Canadian

initiative is worth reporting. In Canada, it is possible to obtain a fellowship abroad if one (on the basis of a worked-out research proposal) shows that they can go and work on a project with one or more foreign people engaged in research).

11. *In the interests of safeguarding the level of research, it is to be recommended that a "research-monitoring system" be developed.*

As appearing from the foregoing discussion on the R & D model, the changes executed in the matter of the level of research are slow and often go unnoticed by researchers. In order to react to changes in the level of research in a more alert manner, it also deserves recommendation that a "research-monitoring system" be instituted and which closely follows these changes. Through this, and for example, thought can be given to the establishment of a management information system within the different research organisations and/or at a national level from which information concerning current research can be extracted rapidly.

Such systems can play an important role in assessing the quality of various research projects, and through which the norms established therefor can be better or more objectively maintained.

Contacts with top-functioning groups abroad can also be of great importance. On one hand, researchers from these foreign-based groups can be more easily co-opted into the evaluation of research carried out in the Netherlands or research proposals originating herefrom. On the other hand, these contacts are of importance because attention will be attracted more quickly herethrough if there is a lag and at the same time it will be easier to "catch-up" again.

12. *Make extra means available to solve crucial bottle-neck problems.*

In view of the fact that many of the measures previously proposed herein will only have their effects over a long period, it can occur that short and medium term research will be threatened with involvement in the problems and good researchers will possibly be subjected to frustration because they will not get the chance to realise their plans. In order to prevent these problems having disastrous consequences for the functioning of the research carried out on a long term basis, it deserves recommendation that these problems be solved through direct additional financing which, for example, can be used to temporarily free good researchers from the task of teaching. In this matter, thought can also be given to extra means for apparatus and personnel and the stimulation of efficiently functioning research groups.