

## ***Technical specialists and scientific researchers: quality and quantity***

### **Summary of advisory report 11**

The availability of sufficient, excellently-trained technical specialists and researchers is of vital importance to the Dutch economy. They play a key role in the country's economic development which is becoming increasingly more dependent on knowledge-intensive activities. Various studies are indicating that the private sector, and industry in particular, is facing a structural shortage of technical specialists and scientific researchers. The Minister of Economic Affairs, also on behalf of the Minister of Education and Science, has asked the Council to advise him on this problem.

The Council takes the view that besides the quantitative demand for a certain number of technical specialists and researchers, their quality is of crucial relevance. The Netherlands not only needs more of them, it also needs technical specialists and researchers who are better prepared for the changes in their profession. To be able to train and keep talent in the Netherlands, we have no choice in that training other than to opt for superior quality of an international calibre. The Council focuses in this report on technical specialists and researchers with an advanced training. Analyses are largely based on interviews with representatives of forty technically-oriented businesses and institutions.

The picture that emerges broadly reveals a need for three types of technical specialists and researchers: the engineer who is capable of constructing technical systems or sub-systems on the basis of existing knowledge; the designer who is capable of designing and constructing new technical systems and can develop new products and processes; the researcher who is able to investigate and explain phenomena in technical systems.

The engineer will usually have been to a higher technical college. Industry on the whole is very satisfied with the standard of the engineers these colleges produce and their practical skills in particular are appreciated. For research posts virtually only those with a doctorate from a general or technical university have been appointed in recent years. People are satisfied with the standard. For posts acquiring specific design skills, people mainly turn to the university-trained engineers (ir.). Generally speaking, industry is not very satisfied with the capacity of this group of engineers to integrate and synthesize existing insights and communicate with people from different disciplines and backgrounds. It would appear that the present batch of university-trained engineers is no longer qualified to cope with the growing complexity of technical systems and business organisations.

The Council concludes from this that the training of engineers has to change. The training has to be better and different to the current and the past system. The training required is impossible within a four-year curriculum. The Council advocates a four plus two-year model which involves an initial period of four years, no more no less, for a solid grounding in the basic technical subjects after which those graduating would be awarded the title of 'doctorandus' in the technical sciences. After this the majority of students would go on to a two-year further training to become designers specialising in system-oriented designing. The title awarded upon successful completion of this part of the training would be ir.

The Council regretfully observes the blurring of the distinctions between the technical universities and the higher technical colleges. It is seeing a tendency among the higher technical colleges to make their teaching more academic. The emphasis on teaching scientific theory at higher technical college detracts from the distinctive features and strength of this training: a sound technical grounding coupled with practical experience (in industry). On the other hand, at the technical universities, management subjects are being included in the curriculum at the expense of training in the basic technical and scientific subjects both in depth and in breadth. It is thus that the courses end up being neither one thing nor the other, so that students and industry are both worse off than they were. The Council advocates that a clear distinction be made in the training of the different types of engineer.

In the Council's view the technical universities should primarily concentrate on training students to become design-ers. The technical colleges should largely provide in the quantitative demand of industry for engineers. This system can only work well with a process which selects students for courses which fit their capacities. Periodic assessment of the quality of courses will be a necessity.

The basic financing of the training is a responsibility of the government in the Council's view. For the second part of the university engineers' training, a contribution from industry is indispensable. This may take the form of offering traineeships, guidance and equipment. Industry is willing on this front, as the Council has found. The overall financial consequences of the proposed restructuring of the university engineers' training are difficult to specify. However the Council sees no immediate reason for assuming that its recommendations will inevitably result in structurally higher costs for the Minister of Education and Science.

For many years now students' interest in the natural sciences has been diminishing, as it has of late in the technical sciences as well. Practically everyone agrees that this fall in interest, which is in danger of continuing, must be halted. According to the Council this can only be achieved through closer cooperation between educational establishments and companies. The Council recommends that the KIVI and the NIRIA, the respective professional organisations of engineers from the universities and the higher technical colleges, should implement their plans to strengthen the ties between technical universities, the higher technical colleges and companies.

The subject of technology is currently being introduced in primary and secondary schools. Useful though this is, pupils have to be given a broader base. A sound grounding in the exact subjects at secondary school is crucial to an interest in the natural sciences and technology, perhaps resulting in the latter being chosen as a course of study or as a career. The Council is far from happy on this point. There are many signs which point to falling standards in general secondary schools, especially in the exact subjects. It recommends that a national commission be set up to assess present standards in pre-university education and to make recommendations on improvements. The commission should comprise representatives of government, business and industry and education.

