

**DELFT UNIVERSITY OF TECHNOLOGY
THE NETHERLANDS**

Office for Education and Research Policy

1. INTRODUCTION

In 1993, the Executive Board of Delft University of Technology (DUT) formulated a new strategic plan “Towards a new Engagement” which outlined the university policy for the next decade. This plan positioned DUT as a leading technical university in Europe and focused on total quality in an international dimension: quality of education, quality of research and quality of university management. Many different initiatives were launched in order to implement the various ambitions specified in the strategic plan. One of these ambitions was the accreditation of all DUT education programmes by an international organisation. In 1995, the initiative was taken to combine the national assessment of the quality of education and research at DUT’s Faculty of Aerospace Engineering, as an experiment, with an international accreditation procedure executed by the American Accreditation Board for Engineering and Technology (ABET). Another ambition of the strategic plan was to make the responsibilities for the quality of education more clear and transparent within the university organisation. As part of the more-systematic development of a internal system for quality control, in 1995 also the initiative was taken to appoint so-called Curriculum Directors.

This paper addresses aspects of these two initiatives in the field of quality assessment and quality control. They are important examples of the way in which DUT deals with the issue of quality assessment and quality control. As these activities are predominantly in the realm of education, this paper focuses on education, but the assessment and control of the quality of research is conducted mostly along the same lines. At the same time, an attempt is made to describe the relation between these two initiatives and the national system of quality assessment. Therefore, in chapter 2 of this paper a short description of the Dutch system of quality assessment is given for a better understanding of the situation at DUT. In the next chapter the experiment of DUT to have a international quality assessment, by ABET, at the Faculty of Aerospace Engineering is described, while chapter 4 is dedicated to the DUT system of quality control in general and to the Curriculum Directors in particular.

2. THE DUTCH SYSTEM OF QUALITY ASSESSMENT

The Dutch system of quality management was initiated in the mid-eighties with the publication of a policy document of the Ministry of Education and Science called “Higher Education: Autonomy and Quality”. According to this document all institutions of higher education themselves are responsible for the quality assurance of their education programmes and are therefore accountable for their internal evaluation. The document signalled a new era with regard to the higher education policy of the Dutch government, which was henceforth based on the principle of ‘remote control’.¹

In response to this government decision, the Dutch universities, united in the Association of Universities in The Netherlands (VSNU), started in 1987 with a system of reviewing the quality of each education programme in a six-years' cycle. This system, which was also extended in 1992 to all university research programmes, is primarily based on a self-analysis of the educational programme itself and on peer reviews. After a faculty has compiled a self-analysis, which is a performance report on the contents, management and academic level of the programme, a review committee of independent external experts pays a site visit to gain in situ information about the programme and the management processes. The committee interviews staff and students and evaluates the level of exams and final theses of the students. This procedure of external quality assessment of educational programmes is monitored by the Inspectorate of Higher Education, which has been established by the Ministry of Education, Culture and Science. The Inspectorate advises the Ministry on the follow-up of the assessment and visits the institutions involved two years after the assessment in order to investigate which activities have been taken in response to the assessment.

The first cycle of quality assessments has been completed in 1996. Over the past six years all educational programmes of DUT have been reviewed and for some faculties their second assessment has already been scheduled. Also, most faculties have been visited by a review committee for research.

3. DUT AND THE INTERNATIONAL CONTEXT

One of the goals of DUT, which was announced in the 1993 strategic plan, is the accreditation of all DUT education programmes by an international accreditation board. DUT chooses to supplement the national system of quality management with an international one. In this chapter the experiment of combining the ABET accreditation procedure with the national quality assessment procedure and the impact of this experiment on the faculty involved is described. Also the future plans of DUT regarding international quality assessments are set out.

The Dutch system of quality assessment is basically a national operation, though foreign peers often participate in the visiting committees, in particular in the committees for research. Given its ambition to achieve quality in an international dimension, and to be recognised internationally as a top-level technical university, a national quality assessment is not enough for DUT; the quality of the university should be established in an international perspective. Therefore, DUT plans to have the education, research and management performance of all faculties periodically evaluated by an internationally qualified and authoritative body. As a first step towards this goal the national assessment of the quality of education and research at DUT's Faculty of Aerospace Engineering was combined, as an experiment, with an international accreditation procedure executed by the American ABET. A major reason to select the Faculty of Aerospace Engineering for this experiment was the fact that its programme has a strong international orientation and is unique in The Netherlands, which made the effort all the more fruitful.

3.1. ABET

ABET is an American organisation that is responsible for university engineering programme evaluation and accreditation in the USA. Graduation from an ABET accredited programme is a basic requirement for professional licensing in the US. ABET reviewers are experienced US engineering educators and professionals, and are all members of the major engineering societies. The ABET evaluation process includes a review of the curriculum, course content, and the performance of the

students. ABET is also involved in international consulting and evaluation activities and is a member of the Washington Accord, which is a mutual recognition agreement that applies to about 2 500 first-professional degree programs in six English speaking countries. For example, the Engineering Council of the UK is part of that agreement. ABET has assisted other countries in developing an accrediting system, like it recently did in Mexico. These accrediting systems may also provide a basis for bilateral or multilateral recognition. It should be stressed that an accreditation by ABET is not equivalent to a real quality assessment procedure; it only indicates whether or not the education programme meets certain standards set by the ABET organisation. Nevertheless, a positive judgement by ABET may be considered a minimum requirement for an international recognition of the education programme.

3.2. Combining the national quality assessment and ABET accreditation: the experiment of aerospace engineering

From 18 to 24 June, 1995, a Review Committee for Aerospace Engineering paid a visit to the Faculty of Aerospace Engineering. The review committee was composed very internationally: eight reviewers from five different nationalities. The three US (ABET) participants participated in the formulation of both the VSNU review report and of the separate ABET report.

Right from the beginning it was realised that a VSNU assessment and an ABET accreditation procedure would have different needs and constraints. The frames of reference of both committees and the applicable criteria for assessment are different. In addition, the ABET accreditation concentrates on the question whether an education programme meets certain (minimum) American standards, while the national assessment tries to evaluate the true quality of education and research programmes. For DUT a boundary condition was that the dual assessment/evaluation should not create a significant extra workload, neither for VSNU nor for the faculty involved. These conditions and constraints posed an interesting challenge to all parties involved. Fortunately, ABET was already familiar with the Dutch system of engineering education, having done in 1993 a comparative study of engineering education in The Netherlands and four other European countries for the Dutch Ministry of Education and Science.

After intensive discussions between VSNU, ABET and DUT, certain conclusions about the reviewing procedures were reached:

- The organisation of a VSNU programme review and an ABET programme evaluation can be done without significant changes in the existing VSNU procedures.
- It is possible to integrate the two review committees in one coherent group, under the supervision of one chairman.
- The ABET and VSNU sub-committee chairmen should meet with faculty representatives in advance for planning and co-ordination of the visit.
- The faculty should prepare a combined self-analysis to serve both the VSNU and ABET reviewers; additional information on programme features, curriculum and courses should be needed for ABET to perform a proper programme evaluation.

- The review committee, including the ABET reviewers, should be responsible for one report prepared and published by VSNU.
- The ABET evaluation team will produce a separate report to the faculty and administration, in which the question is addressed whether or not the education program has a “substantial equivalency to a US degree”.

3.3. Impact of the ABET and VSNU reports on the faculty of aerospace engineering

Thanks to the flexibility of VSNU and ABET, the preparations and the actual site visit proceeded smoothly, with an excellent co-operation among the members of the review committee. The results were positive: the education and research programmes at the Faculty of Aerospace Engineering were assessed as “good” by VSNU and the education programme was found to meet the ABET standards for “substantial equivalence” to accredited programmes in the USA. The 24-page educational part of the VSNU report was very positive about the level of the graduates and the excellent research facilities of the faculty. Critical remarks were made, however, about the average duration of the study, as students take on average almost six years of studying instead of the official five years. General practical comments were formulated about the study programme and a variety of specific subjects, such as internal quality assurance and internationalisation.² Separately, ABET reported about the declaration of “substantial equivalency” of the Aerospace Engineering programme to US programmes. A number of more general comments were made by the ABET reviewers from their ‘US point of view’.³

Both reports were seen as a fruitful basis for a more fundamental discussion about the medium- and long-term planning of the faculty, not only with regard to the curriculum but also to the faculty organisation. The chairman of the ABET visiting committee was even invited to participate in an advisory committee to prepare a medium- and long-term working plan for the faculty. In this working plan, which was presented to the Executive Board and the Inspectorate of Higher Education a year after the site visit of the peer-review committee, the faculty proposed a significant change in the structure of the faculty. The departments or sections within the faculty were to be restructured and for the organisation of the educational process a Curriculum Director was to be appointed. This Curriculum Director should become responsible for the co-ordination, content and management of the curriculum, while giving special attention to the selection and performance evaluation of students and the duration of the study. A more detailed description of the position of Curriculum Director will be given on page 10 of this paper.

The faculty also announced changes in teaching methods and curriculum structure. As said, both ABET and VSNU had concluded that the duration of the Aerospace Engineering study is rather long. The review committee had also identified the theoretical and practical work courses in the curriculum which were too time-consuming for students in relation to the time and credits allotted. In response to these conclusions, the faculty decided, for example, to introduce the teaching method of ‘problem-based learning’ in small groups of students and to extend the official period allowed for thesis research and writing from six to 12 months. It is clear that the willingness of the faculty to change was, to a large extent, based on the reports from ABET, VSNU and the committee of outside experts. This willingness was also stimulated, however, by the reduced enrolment of students and the financial planning and future of the faculty. The faculty is currently in the process of implementing the plan.

3.4. Future plans of DUT

Based on the results of the pilot project DUT is already preparing itself for more international accreditation's. ABET will be invited to participate in the national reviews of a number of DUT disciplines. The selection of a particular faculty will be based on the international scope of the education and research programmes of that faculty. In the end, all faculties should be internationally assessed. It has been agreed that for future reviews ABET and VSNU will work along the lines which have been developed for the pilot project.

Recently, DUT has taken the initiative to invite the Conference of European Schools for Advanced Engineering Education and Research (CESAER), as a European organisation dedicated to quality in engineering education, to act as a forum for a European Accreditation Board in Engineering Education. The method used in the VSNU/ABET experiment could be a model for the implementation of such a European accreditation system. DUT hopes that in the long run, this may even lead to a situation where a European reviewing system, similar to the ABET procedure, will supplement the existing national systems for quality assessment. DUT also actively participates in a EU sponsored project, which is a joint effort of CESAER with the two other major European associations for engineering SEFI and BEST, to develop guidelines for a flexible European system of external quality assurance for technical universities, operating in the next century in harmony with the national system of quality assessments.

4. Internal quality control at DUT

Quality is an integral part of DUT's overall mission, as formulated in its strategic plan. To establish the quality of the programmes and management of DUT a quality assessment is a prerequisite. And a system of external quality assessment can not function properly if it is not complemented by a coherent system of internal quality assessment and quality control. The development of such a system has therefore been, and still is, a high priority on the agenda of DUT. As has been in the case of the Faculty of Aerospace Engineering, the faculties of DUT individually and, at the institutional level, the Executive Board take the quality assessment reports with the recommendations of the review committees seriously. These reports have certainly been taken into account not only in the improvement of the educational programmes, but also, among others, in the development of a system of internal quality assessment and control for the education programmes of DUT. The development and implementation of such a system is very complex, because the universities must operate within the fixed boundaries of the Higher Education and Scientific Research Act. During this process changes in the curricula, in study structures, in decision-making and gradually also in study and teaching culture can be noticed. The decision of DUT to stimulate the appointment of the Curriculum Directors is a clear example of such a change in the organisation of education at DUT, and will therefore be described in a little more detail than the other features of the system for internal quality control at DUT.

4.1. The system for quality control of DUT

The DUT's system of quality assessment and control in education is focused on three 'areas': quality of the educational programmes; quality of the educational process and quality of the education organisation. In the following the main features are described.

The last two years, the quality of the content of DUT-education programmes has been stimulated by the lengthening of most of the Dutch engineering programmes from four to five years. As a result of the combined joint effort of industry, business and the technical universities in 1995 the study duration of the engineering studies was lengthened with one year on basis of two arguments. First of all, it was argued that the study duration of four years proved to be too short to incorporate all aspects for a good education of the “ingénieur”. Due to the concentrated programme too much emphasis was given to purely technical and fundamental aspects of an engineering study, and too little attention to the development of designing skills and social insights. Secondly, it was argued that the competitive position of the Dutch “ingénieur” was impeded by the fact that the engineering studies took officially four years, while in neighbouring countries engineering studies are at least five years. The fact that in reality the duration of the Dutch engineering programmes was five years, was not enough to overcome this situation.

DUT used the change in study duration as an opportunity to restructure and improve its study programmes and to add extra courses on topics, like sustainable development, ethics and economics and extra courses on the development of practical and designing skills. The changes in the content and structure of the study programmes were not only based on the requirements, set by the employers of the freshly-graduated “ingénieurs” and by the government, but also on the recommendations of the review committees for quality assessment. For example, additional courses on developing practical and designing skills were added to the programmes of Architecture and Civil Engineering as a result of the quality assessment report of February 1994 on these two study programmes.⁴

The aim of the activities for the improvement of the quality of the educational process is to ensure that a study programme is well-structured and is designed in such a way that a student is able to graduate in five years. With regard to the old 4-year programmes national and international peers, such as ABET, agreed that the 4-year programmes existed only on paper and that the working reality was that they were 5-year programmes, which, because of formal requirements, were administered as fictitious 4-year programmes.⁵ This opinion was also voiced by most VSNU review committees. DUT wants to ensure that the story does not repeat itself and that the formal 5-year programmes do not become in reality 6-year programmes, due to additional courses and practical work. So, the faculties are asked by the Executive Board to develop procedures and arrangements to stimulate the progress of the students, through, for example, the availability of good study-counsellors, and to pay special attention to the structure and design of their programmes. For that purpose evaluation systems are being set up by most faculties at the moment. These evaluation systems are instruments to gather information on the content of the individual courses, the amount of time spent on one course or assignment, the exam results, etc. This information, which mostly is based on the feedback of students, gives an insight in the efficiency of the programme and on the bottle-necks in the programme. At the institutional level a Curriculum Evaluation System is being introduced and in 1995 a system of Course Evaluation was set up. With these systems the feedback of the students on the quality of their courses and the educational programmes as a whole is systematically gathered and evaluated.

Those evaluation systems are but instruments and can only contribute to the improvement of the quality of the education of the study programmes if the management of the faculty and university actually use the systematically gathered information. As was said by the review committee for Applied Mining and Petroleum Engineering in 1992, the findings of internal and external quality assessments should have consequences, that is to say, when necessary, teachers or students should be required by the Faculty Board to alter their working methods, attitude, etc.⁶ Realising the importance of the matter the Executive Board set up an advisory committee for internal quality management of

education in April 1994. This committee concluded that the content of the study programmes and the organisation of the education process should be better matched and that employees with educational positions/tasks should be offered better career perspectives. The central question in this matter is how to distribute clearly and effectively the respective responsibilities concerning quality control and quality assessment within DUT educational system. The committee recommended to appoint a so-called Curriculum Director at every faculty, who should be responsible for the organisation of the first three years of the study programmes, and to structure discussions of professors on the tuning of content of their courses and the programme as a whole. DUT has almost finished the implementation of the recommendations of the advisory committee for internal quality management: most faculties have appointed a Curriculum Director and have scheduled the structured discussions of their professors and at the institutional level a better system for career planning for its teaching staff is being developed.

The above-mentioned measures are complemented by a more managerial tool: management's contracts or "covenants". This implies that periodically the Executive Board makes several concrete and verifiable agreements with each faculty of the university. In these contracts the Executive Board ensures that the faculties, which are within the structure of the university more or less autonomous, pay sufficient and systematic attention to quality assessment of the organisation of their educational programmes. It is a chain of accountability: the faculties are accountable for the quality of their educational programmes while DUT is being held accountable by the Ministry of Education, Culture and Science. Furthermore, DUT has set up a special fund to stimulate innovation of the educational programmes.

4.2. The curriculum director

The Curriculum Director is an important step in the development of the system of quality control at DUT and therefore this function is described in more detail.

The most important task of the Curriculum Director is to monitor the coherence of the first three years of the study programme(s); coherence in structure and coherence in content. When necessary the Curriculum Director is authorised to intervene in the organisation of the study programme in order to remedy bottle-necks. He or she is the advisor to the Faculty Board on the permanent improvement of the quality of the curricula and educational organisation and is responsible for the implementation of these improvements. In order to give weight to the recommendations and decisions of the Curriculum Director, most faculties have chosen to appoint a specialist, either an authoritative professor or an authoritative educative specialist. The Curriculum Director should operate on the basis of his expertise in the field of the study and as a teacher; he is not primarily the 'manager' of the educational processes.

In order to strengthen his/her position within the faculty organisation the Curriculum Director is either a member of the Faculty Board or is directly operating under the Faculty Board. The later solution is preferable as it more clearly divides the responsibilities of the Curriculum Director (for the first three years of the programme) and those of the Faculty Board, which is in the end responsible for quality and organisation of the whole programme.

4.3 Future plans of DUT

DUT feels the need for a even more-permanent monitoring of the initiatives, which have been taken as a result of the recommendations of the advisory committee for internal quality control and for a more-systematic and anticipating dealing with processes concerning with the organisation and management of education. This need was expressed in a Quality Management Plan, which was on request formulated and presented to the Ministry of Education, Culture and Science in April 1996. In this plan DUT announced the setting up of a permanent Advisory Committee for the Quality of Education. This committee, which will start its activities as of January 1997, will be asked to guarantee the systematic control of initiatives for the improvement of education at DUT and to analyse the effects of these initiatives. The Committee will in a sense act as a internal review committee. As a result, it is expected, the faculties, and the university, will be better prepared for the external quality assessments.

4.4. Impact of national developments on the DUT system for quality control

The external quality assessments of VSNU have clearly had an impact on the educational programmes, processes, and in some respects on the organisation of education of DUT. Quality assessment and quality control have become an integral part of the thinking on education and research at DUT and a part of the strategy of DUT. At the programme level the assessments lead to changes in content and structure of the curricula and at the institutional level it has resulted in decisions leading to the development and implementation of an internal system of quality control. The existence of the VSNU system of quality assessment has improved the awareness of the importance of quality control and has thus stimulated the development of a more systematic approach towards internal quality assurance, in order to meet the requirements of the quality assessments of DUT's education and research programmes. The fact that the Inspectorate for Higher Education in The Netherlands has been increasingly asserting its role of monitoring the follow-up of the external quality assessments, has no doubt stimulated this development.

But not only the existence of external systems of quality assessment has influenced the development of the DUT system of quality control and the decision-making on quality assurance at DUT. The mission of DUT to be one of the leading technical universities in Europe has been a major factor, as such a position can only be gained and maintained through quality; quality of education, quality of research and quality of university management. Also external factors other than the external assessments, which should be seen in context of a more general shift in The Netherlands towards quality control in higher education, influenced the process and thinking at DUT. The most important factors are:

1. As has been implicit in this paper, an important factor has been the changing of the length of the engineering programmes due to government regulations. In 1982, the programme was reduced from five to four years. Seven years later, in 1995, the 5-year program was re-introduced again for the majority of the engineering programs in The Netherlands. In this context not only the duration of the engineering studies but also the quality of the engineering programmes were discussed by the industry, government and universities. These discussions were held parallel to the quality assessments of the engineering study programmes. As has been described in this paper the changes in the duration of the studies provided DUT with the (extra) opportunity to restructure and improve its study programmes.

2. The intake of students, that is not fixed per programme, has shown a substantial variation over the years. Due to demographic developments the number of potential students has been decreasing over the past years, which stimulated the universities to evaluate their programmes and organisation.
3. Recently the Ministry of Education, Culture and Science has set apart a special budget for higher education, which will be distributed over specific projects to improve the quality of education. This budget was a response to the student demands for better higher education at a time when the costs for studying were increasing. A Quality Management Plan, as mentioned on page 10, in which the existing quality system is analysed and recommendations for improvement of this system are made, then became a prerequisite for being eligible for a share of the budget.

5. Conclusions

Both the national and the international system for quality assessment have had their impact on the educational programmes of DUT and on the decision making on quality control.

As until now ABET has only accredited the DUT study programme of Aerospace Engineering, conclusions regarding the impact of this international assessment system can only be drawn from this experiment. The ABET accreditation procedure has indeed influenced the changes in the study programme and the decisions on the future of the Faculty of Aerospace Engineering. However, its impact is limited to this faculty, due to the experimental status of the accreditation. Given the ambition of DUT to have all its educational programmes internationally accredited, it can be expected that in the future DUT will be more structurally influenced by international assessments as it highly values those assessments. The declaration of 'substantial equivalency' by ABET is only the first step towards this goal. On the longer term the goal is to have all educational programmes also assessed by a European system of External Quality Assurance, which DUT helps to develop.

The national system of quality assessment has had without any doubt an impact on the methods of quality assessment at DUT and has influenced the decision-making process on quality assurance. In the absence of a systematic approach towards quality assurance, the decision-making at DUT regarding the quality of education, and later of research, was geared as of 1987 towards the procedures, requirements and consequences of the Dutch system of quality assessment. The development of an internal system of quality control started with the activities for the improvement of the contents of the study programmes and has recently resulted in initiatives for the improvement of the educational organisation, with, for example the appointment of the Curriculum Directors. As a Curriculum Director combines in his position both responsibilities and authorities regarding the improvement of quality of the study programmes, it is to be expected that his/her existence will influence the decision-making process at the faculties and at the institutional level on the matter of quality control.

In view of the other external factors mentioned in this paper, it would be interesting to examine the relative impact of the national and international systems of quality assessment on the study programmes and the decision making at DUT in more detail. Without any doubt the discussions on the duration of the engineering programmes have had their impact as well. It would also be interesting to examine the question of causality and salience of influencing factors more closely. Also the contributions by the different universities on the development of the national system of

quality assessment could be examined, as one can suppose that after being in operation for 10 years, the universities have had their impact on their quality system in return.

NOTES

1. VROEIJENSTEIJN, A.J., *Improvement and Accountability: Navigating between Scylla and Charybdis*, 1995, London, Jessica Kingsley Publishers, pp.4-5.
2. VSNU, *Quality Assessment of Education and Research, Aerospace Engineering*, November 1995, Utrecht.
3. ABET, *Statement to the Institution. Substantial Equivalency Evaluation of the Program in Aerospace Engineering at Delft University of Technology*, June 1995.
4. VSNU, *Onderwijsvisitatie Civiele Techniek, Bouwkunde en Geodesie*, February 1994, Utrecht, pp. 33 and 37.
5. ABET, *Dutch Engineering Programs in a European Context*, 1993, Hengelo, pp. 163.
6. VSNU, *Onderwijsvisitatie Aardwetenschappen*, June 1992, Utrecht, pp. 66.

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