
Steering and Quality Control

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Since visible management, quality control and accountability are important issues in the everyday life of today's universities, the means and tools for promoting and providing these elements are discussed.

VISIBLE MANAGEMENT

In any university it is important that the management and the central executives are visible inwardly towards the university as well as outwardly towards the surrounding society and business partners of the university. It is essential that every individual knows who to go to when questions arise about policies and procedures. Also, everyone needs to know that their input is considered valuable if and when they go to the President, the Vice Chancellor or the Rector, and that they will receive an answer, whether it is a *yes*, *no* or even *maybe*. Some of the questions obviously need to be channelled to other people and places in the institution, but the essential element is that if a person insists on talking to central executives, it must be possible, and an answer or reaction must come out of it.

Visible management means that the President and his or her advisers should be outspoken in matters that are essential to the institution and they should be precise in formulating thoughts about the future and the priorities. Visible management also means that one has to be aware of public discussions and to participate in them in a pro-active way. This means that discussions and problems that arise should never be overlooked or silenced, if only because political actions and newspaper stories are beyond the control of the management of institutions and thus it is better to make an early attack than a late defence.

A President of a university should be visible to the organisation in the way that he or she visits the various departments and institutes in the organisation on a regular basis. According to my own experience a direct visit once every second year is an appropriate interval. Meetings of this type provide an opportunity for discussion with the management at the various administrative levels on how to attack the future of

the institution and the departments.

Just the mere fact that the President and part of the central administration announce a visit to a department brings most departments to think about how they want to present their activities and, in the light of the planning they are doing, how eventually to reorganise some of their activities. For the central administration a visit with departments is an important opportunity to announce new initiatives and to ask how departments are trying to arrange their activities in accordance with the policies and strategies of the institution.

Visibility of the central executives has to go in parallel with visibility of the institution as a unity. At many universities it is a fact that the stationary of departments looks like today's mail. This, I think, illustrates a weak central organisation and management and should not be tolerated. Departments should obviously have a certain freedom, but they should not be permitted to downgrade the name and seal or logo of the institution, and it is therefore imperative that one seeks to define a certain frame or format that departments have to accept for stationary, overheads, reports, etc. It is not an easy task to do a thing like this if it does not exist, and it may also be an exercise of some costs, but it is worth the effort. Although one might not, in the initial phase, believe that it actually helps to create a better mutual feeling for the institution and a common interest in promoting an institution's activities, it does nevertheless get everybody to be more like musketeers with the motto *one for all and all for one*.

It should finally be mentioned in this introduction that visibility towards the outside world is very important and especially important for engineering schools. Graduates of such institutions come to be employed with local companies and thus one has to show the

national industry what a given institution stands for and certainly also that it listens to the needs and wishes of the national industry. I am not saying that institutions should blindly do all that industry wishes, but it is important to listen to their thoughts and criticism and to use it in a constructive way so that relevant criticism leads to adjustments and improvements.

What one should never do is to close oneself behind high walls and declare that we at the university are those who know best and that industry better believe it. Such an ivory tower attitude is probably the most dangerous that one can imagine. Local industry does have influence on local government. This means that heavy criticism from industry against engineering institutions can lead to political pressures and cuts in funding because government may believe that their money is not being spent in the right way and that the individual institution is not accountable in a trustworthy manner. More on this later in the paper.

FOCUS ON QUALITY

Quality has in many aspects become a central issue in the last three to five years. Many governments have decided that quality and development of quality are essential to the whole educational system and thus also at the university educational level.

Quality is obviously a difficult subject to deal with in that quality parameters are not easily defined and certainly also not easily measured. At an early stage in the quality development process one would often hear statements such as *quality is difficult to define but you know it when you see it*, or *quality costs and the more money you get the more quality you are able to deliver*. The whole concept is obviously more complex than illustrated by such simple statements. The problem that most institutions face nowadays is that funding agencies and governments want value for money, ie if you want more money they want more value. Sometimes you even get into the situation where your minister or ministry want more value for less money, and thus focus on quality and quality aspects get to be an essential discussion.

It is essential that educational institutions try to define for themselves what quality is and how they would respond to governmental demands about this issue. Often governments handle the political focus on quality through creation of evaluation units and/or various incentives built into the financing procedure of institutions so that quality aspects are accounted for. This may be in the form of peer review or through bibliographic investigations. Under all circumstances budgeting procedures that are coming up as a result of easy access to advanced computer systems and

programs will make quality aspects and parameters both imperative and accessible to governments even when they are considering financing basic research at educational institutions.

This is one of the reasons, but certainly not the only one, why we in education have to focus on quality. It makes us accountable to various politicians, but it certainly also gives us an instrument for handling daily life at our institutions. It also gives us a good reason for acting as mentioned in the first section of this paper, ie having a visible management who, amongst other things, are focusing on quality.

FOCUS ON INTERNATIONALISATION

As international co-operation becomes increasingly global in outlook and in operation there will be a continuing growth and need for well-trained graduates from universities and engineering institutions who are able to co-operate closely with their international counterparts. Thus, the goal for educational institutions must be to create well-trained graduates and postgraduates equipped with the necessary foreign language ability, cross-cultural skills and professional experience to function in the multinational/multicultural business environment of the 21st century.

An international aspect in the educational programme can be a study period abroad in another culture, in another language, etc. It can be either a semester at a foreign university or a practical training period in a company abroad. The important point is that the study period abroad should be fully incorporated in a student's curriculum at home, meaning full academic recognition, and that the study period abroad replaces a comparable period of study at the home university even if the contents of the agreed study programme may differ. Full academic recognition for study periods abroad is a *conditio sine qua non* for student mobility in internationalised universities.

One thing is to arrange for students to go abroad, another is the internationalisation process for the students staying at home. By internationalising the curricula at the campus all students will feel an international flavour during their study time. This can be done by incorporating international subjects in the courses, by using international textbooks, by using research results in classes, by offering programmes to attract foreign guest students, by using foreign guest professors in the classes, and if English is not the mother tongue of the country, by teaching a number of both undergraduate and graduate courses in English.

Such actions are imperative to attract foreign students, but will also help in internationalising the national students at the campus in the way that they en-

counter both lectures given in another language than their mother tongue and foreign students on the campus and in the classrooms.

So, from an institutional point of view, it is important to think about the internationalisation process in developing a strategic plan for the university. One has to think about international competitiveness and how the individual institution is going to be visible both towards co-operation partners and foreign students.

It is important that the management of universities support the internationalisation process by contacting and co-operating with management at other institutions. It is certainly also important that Presidents, Vice Chancellors and Rectors sign co-operation agreements between their institutions through which both staff and students can be exchanged in such a way that certain essential expenditures are waived.

It is important however for central administrators to remember that someone has to perform the actions required by signed co-operation agreements. We need to be restrictive towards signing contracts unless someone on the faculty is willing to take over the job of defining more precisely how the specific international co-operation should take effect. Said in another way, Presidents, Vice Chancellors and Rectors may travel all over the World and sign all the agreements they can think about, but, if there is no one in their organisations to put life into these agreements, they are not worth the paper they are written on. Thus, central administrators should carefully consider what type of agreements they embark on and have their international officers and faculty behind them when the specific conditions for international co-operation are being outlined and ratified.

One more thing is important when internationalisation is considered, namely that the process is continuous and thus demands an effective co-operation between different units at a university and with a steady follow-up, evaluating performances and results and reconsidering actions to be taken.

As a conclusion, I think it should be stated that engineering education programmes need to suit the students' need and interest, and that international experience should be part of the curriculum, where it is both an asset and a necessity. When technical universities are taking actions in order to internationalise their curricula through opening up possibilities for students to gain international experiences during their studies, they need to be very accurate in their definition of how to internationalise the campus. An action plan needs to be worked out stating which actions are to be taken and how many resources the institution wants to set aside for them. Internationalisation of engineering education institutions and studies are far too im-

portant to be something that is done without co-ordination and as a part-time job. Even though internationalisation costs, technical universities cannot really afford not to do it as their graduates are going to compete on a global market.

MAKING PRIORITIES

It is true today that no institution can cover all the activities within its traditional area. In former times, technical universities, and the Technical University of Denmark (DTU) is in this respect certainly not an exception, were expected to cover all traditional areas in such a way that research could be done and new knowledge imported into the country through the staff and knowledge-base of the institution.

This is not true any more. And there are at least two major reasons for this development. One is that diversity has become the name of the game and the real growing point for new knowledge, ie where you experience the quantum jumps in technology are often between traditional areas. If it is your institution's ambition to cover all relevant subjects, you will either have to increase your staff beyond what is practically feasible or you will have the situation where the many areas that you are trying to cover are below critical mass. In this case, everyone will be sitting in his or her own office working in their own niche of knowledge without having fruitful contact with other persons in the department or institution.

It could be argued that with the Internet and the easy electronic communication that is available nowadays this is not a problem, since it is as easy to communicate with the person next door as it is with someone on the other side of the world. All that is true, but in R&D and in the fostering of new ideas it is essential that one has the opportunity to discuss ideas and sort out those that are valid from those that are just plain stupid through daily personal contacts. The fact is that it is not possible to know what is what without playing *ping pong* with close colleagues, using one's physically close colleagues as sparring partners.

The second reason for focusing an institution's activities is costs. In technical areas nowadays, both staff and equipment, and maybe especially the latter, are exorbitantly costly, which means that it is necessary to group around certain types of instruments that can be acquired either through the means of the university or through the means of private or public foundations.

In technical universities we no longer produce a lot of our instruments as was the way 30 to 50 years ago. Today it is necessary to buy instruments in order to stay competitive, which, from a purely economical point of view, demands choices about which subjects an

institutions wishes to teach and research.

It is thus imperative that the management at technical universities gives thought to the areas that should be selected as focal areas. It is simply necessary that management sits down and thinks about how to formulate the strategy for the university and how to select the areas in which the institution wants to be internationally competitive. The process is obviously painful in that it requires making priorities, and that means both positive and negative priorities. It is necessary to select areas in which you want the working groups to function and to cut those areas that are below critical mass and do not deliver research and education at an internationally competitive level. As I have observed, the process is painful in that there are some areas that it is necessary to cut and there are also departments or centres that need to be reconfigured by moving people around.

There will obviously be major discussions and complaints about such procedures in most institutions when they are implemented, but I guess it is true, as one consultant once said to me, *making strategies and making priorities needs to hurt somewhere. If it does not hurt and if no one is complaining then you are doing the wrong thing*. Clearly not everyone should complain in a process like this. The majority of staff ought to be in agreement with what is going on and should applaud when well functioning research groups and educational programmes are put together. I think that the real essence of what I am trying to say in this section is: make priorities, listen to the discussions, be sure that you have some supporters in the system and that some of the more visible and active professors in your system support you, then act. I am of the conviction that you can hardly loose in promoting a process like the one I have described above.

TOP-DOWN OR BOTTOM-UP

It is always a difficult question to decide how to proceed in setting up strategic work, whether it is to be top-down or bottom-up. To a certain extent it is necessary to listen to the grassroots and the general opinions in the institution, and that means that at least part of the process has to be bottom-up.

There are also considerations to make in relationship to how the management at a given institution is appointed. If the Rector/President, as is the situation in Scandinavian countries, comes from within the university, then there is a certain guarantee of knowledge of what the central questions are at the institution. This is in contrast to the situation in North America, where the President generally is hired from outside the university. In the latter situation it is nec-

essary for the university leader to undertake an investigation to determine what is available in the institution and what the general opinions are before starting a major strategic process.

Obviously, one may also make use of consultants during the starting phase in order to define both the structure of the process and to cover some of the work connected to the analysis of what is available and what to build on for the future of the institution.

There is, in my opinion, no question about the fact that in strategic work at a university one needs to use the bottom-up process in the beginning in order to line up the various groups and the achievements of the past.

Once the existing areas have been described, analysed and put in perspective, it is often a great help to perform a so-called SWOT analysis (Strengths, Weaknesses, Opportunities, Threats). With this analysis at hand, and that can either be done by consultants or by people in the central administration of the university, one is ready for the second part: the top-down process, namely the setting of priorities and the making of choices. So, as is hopefully obvious from the above, when we are talking in terms of top-down or bottom-up processes these are, in my opinion, not an either-or, but a both-and.

What is important, however, is the order in which the two procedures are applied and that the process started in a both-and setting is announced to the university before it is started. Otherwise those who are involved in the bottom-up process and in the description of areas which may afterwards be eliminated, changed or moved will feel strongly cheated when the top-down part suddenly sweeps over the institution.

Thus the procedure should be an announcement that the *top* has decided to undertake a strategic planning process and, based on that, to make choices in order to strengthen the international competitiveness of the university. With that announced, the descriptive phase as a bottom-up process is started and the work may be done in such a way that there is a common paradigm for the way in which areas should be described so that the SWOT analysis is facilitated. After this it might be a good idea to start a general discussion at the institution about the preliminary results of the descriptions and the SWOT analysis so that possible errors may be corrected and possible complaints and frustrations may emerge.

Hereafter, it is up to the management to perform the second phase, ie the top-down process. The top-down process consists namely of writing a proposal for the future strategy of the institution and the consequences in the form of priorities, both positive and negative, configurations of departments, transfer of

personnel, and defining which areas are to close.

It must be evident to everybody that this latter part necessarily has to be a top-down process for the simple reason that no one wants to shut down or change dramatically areas in which he or she is occupied and has spent quite a number of years working in research and education, and with students.

QUALITY MANAGEMENT

Once the strategy and priorities are made, it is important to think about how to manage and develop the quality aspects of the activities in the institution. Whatever the number of students, and whatever the budget, we must never forget that the products we deliver should be of quality. Quality is a word that has been constantly repeated both in governmental connections and in relation to university activities, and it is necessary to handle quality in such a way that it can be both defined and measured. It is certainly not enough to say that one recognises quality when one sees it, and it is certainly also insufficient to claim that quality costs money and that the more money one gets, the more quality one can deliver. Quality obviously costs money, but it does not necessarily follow that quality comes from a lot of money.

Quality aspects need consideration, they lead to prioritising and they require definition of success criteria. This is really what the whole process is about: focusing on quality, discussing quality, setting priorities according to quality parameters and finally evaluating the results.

Research

Much thought and discussion have been invested in defining such criteria. Taking again my own institution as an example, we have been discussing what our definitions of quality and the measurement parameters ought to be both in research and in education.

Our research activities are evaluated according to a scheme with five success criteria that are expanded into thirteen quantitative measurement parameters when quality and achievements of research groups are to be evaluated:

- Research results have to be published in international journals and some of the results may also give rise to claim of patents:
 - Number of publications in refereed international journals.
 - Number of publications presented at refereed conferences and printed in refereed proceedings.

- Research groups must have extended exchange and relationships with other research groups nationally as well as internationally and this should be reflected through various types of co-operative projects and invitations to act as guest lecturers and visiting professors:
 - Number of EU contracts.
 - Number of PhD and post-doc exchanges.
 - Other exchanges.
- Projects at universities should, as spin-off, give rise to new products, new production methods and new companies:
 - Number and extent of co-operation agreements with companies.
 - Number of industrial PhD fellow projects.
 - Other indicators for co-operation with companies.
- A university should be able to attract a considerable amount of external resources within its strategic focal areas:
 - Volume of external resources.
- A university should be able to attract and retain a suitable amount of motivated and well-qualified students, males as well as females:
 - Number of graduates from a specific group within a certain period, eg the last three years.
 - Number of PhDs graduated from a specific research group within a certain period, eg the last three years.
 - Number of PhD students associated with the group.
 - Number of post-docs and research assistants associated with the group.

These parameters can be used when activities are evaluated, but it is important that the departments and the faculty know that the parameters and the evaluation have an importance when resources are being (re)allocated to the various units in the university. It is also very important, for accountability with funding agencies and ministries, to be able to describe the evaluation parameters that are being used in the institution; to ensure that the organisation is not running off track but is operating in such a way that it is working towards a common goal; and that the processes are evaluated and kept on track.

We will now turn to the curriculum and the education. It is equally important that quality parameters and expectations are well defined, expressed and used when it comes to developing this aspect of university life.

Education

In working with quality parameters for the education process one finds oneself with a much bigger dilemma than when talking about research.

This has to do with the fact that quality in education is much more difficult to measure directly in form of output and results than is the case with research activities of the university. As an example, we have worked at DTU with the definition of expectations in relationship to education. Our first result was an overall mission statement formulated as follows:

A certain education possesses quality when the participating students find it relevant, developing, engaging and interesting, and when the graduates have achieved such knowledge and skills that they, on the basis of their education, are able to make a living for themselves in their professional careers.

It is obvious that a statement like this is very general and does not contain guidance for deans, teachers and students in deciding which kind of actual teaching is of good quality. Thus one needs to work somewhat more, and that has at DTU led to the formulation of thirteen expectations for quality teaching and quality education.

Before going into the thirteen specific points, I should like to make some more general comments about the situation of universities of today. The university nature has changed dramatically over the last 10-20 years from that of institutions of elitist education to mass education organisations with a responsibility towards a steadily growing part of the population.

Universities in various parts of the world may have reached different stages in their development, but beyond doubt it will hit us all in the not too far distant future. In the traditional elitist university the responsibility for academic advancement lies solely with the student. The professors define the frame and content of the curriculum and the students may participate in the lectures or classroom teaching as they wish. The only thing that is important is to pass exams and if that does not happen the problem lies with the students themselves.

With the recruitment of students we see that the role of universities has changed a lot, and thus the educational process comes much more into focus. It is now the problem of the university and the individual teacher if students are not able to obtain graduation; at least that is true for a sizeable part of the students.

At this stage it should be mentioned that, since many universities are nowadays financed by a model where money for the educational process is more or less pro-

portional to the number of exams passed (taxi meter systems), there are economical incentives for the university to establish a process for improving the educational process and the teaching.

This is the background on which one should see and understand the necessity for quality development of the curriculum and the various evaluation procedures that function at many universities independently of which part of the world we are talking about.

I will now return to the Technical University of Denmark and our deliberations on the thirteen expectations of quality education and teaching. Even though this is directly from one individual university, I am of the opinion that our considerations contain so much generality that they can be of value for others to study as a preparation for similar procedures.

One more general remark is necessary before going into the details and that is that a modern, mass education university has to be aware of its two main duties and consider them of equal importance, ie research and teaching. This means that when hiring staff one cannot, as was often done earlier, only focus on research capabilities. One must also look at the teaching and communication abilities of the staff member, and not only should you look at it in the hiring process, one should also use it in the quality development process and when defining incitements for excellent teaching at the university.

And now I come to the thirteen individual points with comments.

General expectations

1. The institution should be aware of its own situation and duties. It should maintain a close dialogue with its partners and show readiness to develop and act according to defined missions and/or strategies.

Tools:

- External members of university senate, boards or any other executive committee.
- External advisory committees in action towards departments, institutes, centres, etc.
- The executive management of the university stays in contact and dialogue with staff and students and gives detailed information about decisions taken.
- Internal debates at all levels concerning the institution's role and situation.
- Internships as part of the curriculum and co-operation with companies and other research institutions.
- Alumni questionnaires.

- Close contact should be kept with the underlying schooling system.
- External evaluations initiated by the institution itself or through other agencies or partners.
- Establishing routines with annual teaching reports (equivalent to annual research reports from departments).
- Participation in the public debate on university life and education.
- Contact and organised dialogue with external examiners.

2. The course content lies at an internationally competitive level.

Tools:

- Teaching is done by staff with research expertise within the teaching area.
- Co-operation agreements exist with foreign universities about exchange of students, staff and credit points/hours.
- Visiting professors.
- A certain fraction of the courses at the institution is offered in a common international language (English, French, Spanish, German).
- Teaching is evaluated regularly.
- At examinations mainly external examiners are used.

3. The curriculum develops competent, capable, mature and motivated students and graduates.

Tools:

- In the curriculum, projects are offered and the students are required to use their creativity and integrate knowledge from several areas/subjects.
- A variety of teaching techniques and examination forms are used in such a way that it fits with the content of the various subjects.
- Teaching, co-operation and exchange are arranged with other universities, nationally as well as internationally.
- The purpose and background of research and teaching activities at the institution are made visible and understandable for potential students from the underlying schooling system.
- The curriculum and the teaching methods support students' initiatives to penetrate a subject and to develop their own opinion about it.

4. Good teaching is recognised and rewarded, and pedagogical experiences and skills are considered of value in the process of recruiting new faculty members.

Tools:

- Hiring or search committees are advised about how to weigh pedagogical aspects during the identification process of new staff members.
- Establishment of a permanent pedagogical advisory committee at the university.
- Courses and seminars on pedagogic and didactic subjects are offered regularly to the staff at the university, and staff are urged to participate in such activities.
- Good teaching is (as good research) recognised and rewarded in several ways, including salary increases.

5. Buildings, facilities and administrative procedures are arranged to support quality development of teaching and to ensure a good study environment for students.

Tools:

- Modern or modernised classrooms.
- Modern or modernised equipment and/or instruments.
- Easy access to computer facilities, WWW and the Internet.
- Rooms, cafes and other types of leisure facilities available to students.
- Effective and flexible study administrations.
- Easily accessible information on important and relevant issues for both staff and students.
- Student counselling and advice available in necessary volume.

Specific expectations in relation to how teaching is planned and done

6. Teachers perform, participate and evaluate the learning process in a balanced dialogue with respect for each other and the students.

Tools:

- Open dialogue between teachers and students in the classroom and on an individual basis.
- Teaching questionnaires and evaluations.
- Statistics on classroom and laboratory activities, participation and examination results.

7. Teaching evaluations are followed up by the department and are used in the organised quality development process.

Tools:

- Discussion of evaluation results at the department and in the department teaching committee.
- Evaluations are considered open to such an extent that discussions about them in the department are meaningful.
- Standing discussions between departments and central study boards about the quality of teaching and possible improvements thereof.

8. Planning and further development of the various courses at a department are a common job and of common interest.

Tools:

- Colleagues advise each other about performance in the classroom.
- Pedagogics, teaching methods and forms and various teaching experiences are discussed in the teaching committee of the department.
- There are several staff members who can teach the same course and thus substitute for each other and/or co-operate.
- Staff members' qualifications and experiences with different forms of teaching are considered when the teaching duties of the department are distributed among staff members.

9. The teachers are interested and engaged in their subject and its presentation.

Tools:

- Participation in conferences, further education, etc on pedagogic and didactic subjects.
- Participation in pedagogic networking.
- Production of textbooks and other educational material.
- Resources for participation in conferences etc on pedagogic and didactic subjects should be available on equal terms with resources for participation in scientific conferences and meetings.
- Pedagogic and didactic research and developing projects.

10. The individual courses are planned and described in such a way that the prerequisites are known, relevant and necessary, and, furthermore, so that they establish a relevant platform for following courses in the curriculum.

Tools:

- Contact between teachers.
- Contact between departments.
- Dialogue with central study board or similar executive committee, body or person.

11. Teaching methods and examination forms are chosen according to course goals and content.

Tools:

- Course evaluations by students.
- Follow-ups on evaluation results.
- Identification of course success rates and follow-up if too low.

12. Exams shall test both subject understanding and subject capabilities.

Tools:

- Examination problems shall test both understanding and capabilities.
- More oral examinations.
- Teachers shall participate in discussions and developing projects on the subject.

13. Textbook and other teaching material are worked out thoroughly and are easily understood.

Tools:

- The students' course evaluation forms contain questions on the subject, and criticism is followed up.
- The subjects are brought to discussion between colleagues at the department/institute.

GRASS ROOTS

One thing that is very important for the management of an institution is always to stay in contact with the various groups at the university, ie the faculty, the technical and administrative staff and the students. These groups are in one or the other way the constituency, independently of whether the management is elected from within the institution as is the tradition in the northern part of Europe or hired from outside as in the United States, Australia and many other places. There simply has to be some system by which pieces of information from the grass roots are fed into the executive boards, committees and persons at the institution.

The university governing acts in some countries ensure some contact in the way that the various groups are represented in the university senate. The number of representatives of the various groups and the balance between them can obviously be of importance in the final decisive procedure. However, the most im-

portant part in relationship to the governing of the institutions is that opinions are heard and taken into account when the final proposals for strategies and principles are formulated and passed through the university senate. This is what I would call the necessary conditions for running a university in the right manner. There is something more to it and that is the possibility of knowing what really is going on in the institution. As Rector or President, it is vital to know what the faculty, the technical and administrative staff and the students think and feel about subjects that are high on the university agenda.

Students

Let me start with the students. Some consider them to be customers of the university since they come to *buy* education, but I do not subscribe to that view. I prefer to see them as partners since they are adults and thus they bear responsibility as both taxpayers and voters.

In some countries students pay tuition fees, in others they do not, but it still does not make them more or less customers at the institution. They simply have to be considered as partners, and this will make them put greater effort into carrying responsibility towards themselves, their parents and society.

There are different traditions in various countries to what extent students are organised in unions, but a well-organised student union is certainly an asset in terms of keeping in contact with what students feel, think and want.

I think it is necessary that the management at a given institution has regular contact with representatives of the student union or the student body and that the Rector or the President is open for the individual student to ask questions about things that have been handled to their dissatisfaction. Such an attitude will promote consideration and concern among the administrative staff members who are handling the students' affairs, knowing that in the end the students might go to the President or the Rector and complain if they are not treated with fairness and thoughtfulness.

To my mind, students' opinions are important in the that they sometimes see things in a less conservative way than the institution itself, and, for sure, students want as effective and enlightening a study period for themselves and their study-mates as possible.

In the Danish university governing system, students vote in the executive study board, and this obviously gives them much decisive power on questions related directly to the various study components. Again, one can discuss how representation should be and how the balance should be set up, but, beyond doubt, I be-

lieve that students should participate at the executive level in the planning and delivering of the curriculum.

Faculty

It is obvious that the faculty should have a great deal to say about what should happen in the institution because they are the ones who carry the burden, both in education and research. They are also the ones who are going to raise a fair amount of the resources that are used in running the institution. These resources come in the form of money from research councils, research programmes, international committees, helping organisations, private companies, etc.

One may think that the opinions of the faculty would easily flow to the executive management, but that is certainly not always the case. Thus it is necessary to set up various means for getting as much information as possible. This can obviously be done in several ways, but, beyond doubt, a system in which Vice-Presidents or Vice-Rectors with a solid foundation in the faculty, to the extent that they are still teaching and doing research, is an essential tool in this connection.

The President or the Rector of an institution easily gets caught up in a number of committees and boards and will be doing a lot of travelling and international negotiating. Thus, it is important that he or she is allied with a group of people, both at the academic level and in the central administration, who are open-minded, good listeners and aware of how important it is that a representative from the executive level is always ready to discuss any question of importance to the faculty, and to participate in as many events and gatherings as possible. It is simply a must that someone from the executive level always accepts invitations to participate in various meetings and events. It is probably not necessary to mention that receptions of all kinds are one of the best tools for unveiling possible likes and dislikes and also to take care of a lot of problems in an unofficial and uncomplicated manner.

Technical and administrative staff

Let me finally mention the technical and administrative staff, which is of utmost importance to an institution and which tends, sometimes, to be overlooked by upper management. There is also a lot of information to be gathered from this group of employees. It is certainly important that the various unions and/or interest groups at the institution have an opportunity to speak with the executives on a regular basis. In this way, problems may be brought to the surface in such a way that the needs and wishes of the technical and administrative staff are also brought into the discussion of

how to use the resources at the institution in the most effective and constructive manner.

In using the personnel resources in the proper fashion and as effectively as possible, it is important to consider how the various duties are distributed among the employees. Be sure that the faculty does not use its time on something that could be done by the technical staff, in many cases even more efficiently. Part of this is also to reconsider which services are the most pertinent to the institution. For a technical university it is obvious that over the last thirty years a number of mechanical shops have either been or ought to be closed down and the manpower transformed to duties within data treatment. Similarly, this is also true when we are talking about secretarial assistance: the number of typing jobs for secretaries in the departments is certainly diminishing as personal computers are introduced, but this should not just lead to the decision that you simply and without reflection cut the number of secretaries in the department. There are a lot of other duties that might be taken over by them if proper further education or course offerings are provided.

The executive staff must perform considerations such as these during the planning process of the institution, a process that can only be smooth and with the staff confident in what goes on if there is open and frank dialogue with representatives of the various groups in the institution.

CO-OPERATION PARTNERS

For a technical university it is very important to stay in contact with the surrounding society, especially with the national industry that, to a great extent, employs its graduates. The process of staying in contact with the important industries in a country is not a simple one for a university because it may be faced with a lot of criticism in connection with both the type of research that is being done at the university and with the qualification level of the graduates. To avoid non-constructive criticism it is important to use industrial contacts in a lot of different aspects. One example is external representatives, ie industrial representatives in the university senate or in the university board. Obviously, external representatives should not be a majority in the university board or senate, but the mere fact that they are present and participate in the discussions helps in a lot of situations. Furthermore, contact between the two groups, industry and academia, is important from the point of view that these two groups operate with conditions in two very different worlds. The academies live with State rules and various political inputs, and must pursue projects of a long-

term nature, whereas industry obviously has to make profits and operates on a more short term basis. Different conditions like these lead to various types of tensions and these can only be solved by finding various ways in which the two communities can stay in contact with each other and keep a dialogue going.

As well as membership of the university senate or the university board, other possibilities for contact are to work with scientific councils, counselling boards, various types of panels and accreditation units in which representatives from the national industry are to be found. As seen from the above examples, contact between technical universities on one side and industry on the other side can be handled in many ways. It is probably less important which method is used, but it is definitely important that contact is established and kept alive. Otherwise the university might find itself isolated and with politicians and executives from industry dictating how they want engineering education to be altered.

The signals from industry concerning governing systems and educational processes can be of a somewhat unclear and diffuse nature. Mostly the messages relate to the idea that industry wants graduates with knowledge of basic disciplines in mathematics, physics, chemistry, thermodynamics, material science, etc, whereas some of the *soft* competencies, such as knowledge of economics, management, knowledge of consumers' attitude, professional ethics, etc, are not necessarily very high on their priority list for the subjects that should be taught at technical universities.

It is of course important to listen to industry, and it is also important that some of their wishful thinking is introduced into the curriculum. However, if industry wants to decide and maybe even finance activities in order to influence a university curriculum, it is vital to remember that a technical university must never be the pilot plant for a given industry. If that is happening, the broadness in the educational spectrum is threatened and the time perspective in the activities becomes shorter and maybe even too short. Such action may threaten the life of a university as a knowledge producer and institution with a long-term perspective in teaching and research.

One should always remember that graduating students take a number of years. We must, as educational planners, think ahead and ensure that the students, when they graduate three, five or eight years from enrolment, possess capabilities for the job market at that time and not for the job market of today.

This puts important constraints on what an institution can allow in its co-operation with industry. However, to listen to them, to have a dialogue with them

and to let some of their opinions influence the university's planning are essential.

STRATEGIC ALLIANCES

Industry

It is very important for a technical university to have a close contact with national and international industry, but close ties to domestic production companies are of the utmost importance because they are customers of the technical universities in that they employ graduates. Furthermore, during their study periods a fair proportion of the students will need to do internships in domestic production companies. Mutual understanding and trust are essential in this connection.

It is important that company executives are asked to give their advice in relation to planning the curriculum at the university. It is obviously impossible to follow all the advice that is given, but it is important to listen actively.

If technical universities are not in contact with domestic industry, if there is no dialogue between them, or if they are not following any of the advice that is given by industrial representatives, this may signal to politicians and newspapers that the quality of the product that the technical universities are delivering is low and that the level of qualification in the companies cannot be maintained by employing graduates from the national technical universities or colleges.

This can lead to serious problems as young people are very sensitive to signals about where they might get a job and where they might not. Denmark is a good example in this connection. During the eighties, DTU was forced by a very energetic minister of education to expand the intake of students considerably. The process led to a situation where almost everyone seeking entrance was accepted with the consequence that even students with a relatively low secondary school level performance started in engineering schools. The weakest students obviously had difficulties following the courses and achieving the necessary performance in the classrooms and laboratories, and a lot of effort was used by the university to keep them in the system because the Danish educational financing system is based on the number of students passing exams.

Over some years this led to a weakening of the curriculum and also a lowering of the examination standards in some of the basic engineering courses and disciplines. Soon after graduates from this system started to leave DTU a lot of complaints about the quality of young engineers were communicated

both directly to the university and through the newspapers. This had an immediate and unpleasant effect in the manner in which the number of students seeking education as engineers decreased dramatically over a period of four to five years.

DTU has taken note of the consequences of this development and has now defined a minimum entrance level given as a minimum grade average from the secondary school leaving certificate. At the same time we have also rearranged our curriculum so that certain basic engineering disciplines are ensured in everybody's teaching programme. These actions have helped immediately in that companies have become confident with the process and are signalling opportunities for good employment prospects for engineers coming out of DTU, with the result that the intake is now increasing again due to the much better image for the institution.

But it is not only with respect to the educational process and the image relating to this that it is important to have a close contact with local industry. It is also important in terms of R&D that technical universities have as close a connection with national industry as possible because this provides the possibility for resources to float into various programmes at the institution. Perhaps even more importantly, it gives professors at the institution the possibility of knowing what is at the cutting edge in national industry. This information can obviously be used both in research and teaching and it also provides industry with the possibility to use universities in their appropriate capacity, that is as knowledge reservoirs.

Alumni

Another important contact is with the alumni of the institution. There are many levels to this, but first and foremost it is important to learn from alumni how they fared when they got into industry, whether the competencies that they were provided with were useful in their professional lives.

This type of information is obviously most important in the years immediately following graduation. It is, however, also the time when graduates move around a lot before settling down at a specific company in a specific city and country. Thus it is necessary for a university to put some effort in to following its alumni around the world. At DTU we have found that it is worth the effort in that the information we receive is useful and essential and can make the difference when modernising the educational plan and curriculum.

As the alumni gets older, the direct relation between the education they had and the actual curriculum obviously becomes weaker. These former graduates may

also be reaching the executive level and are thus becoming more generalists than specialists.

However, even at that level the alumni can be of major importance, first and foremost as ambassadors for the academic institution, but also as possible sources of finance for the tools and necessities the university requires to remain as competitive as possible. But this does not come by itself; it is necessary to work for it. It is necessary to stay in contact with the alumni and to tell them regularly, either at meetings or through a university newspaper or annual report, what the status is, and what the university's wishes and priorities are, should the resources be available.

Others

Other co-operation partners are parliamentarians, ministers and civil servants in ministries. Certainly, in a country like Denmark, where both the education process and a big part of R&D are financed through the State budget, it is important that the parliament, various public accounting units and the civil servants of the ministry under which the university are placed in the state hierarchy, are informed that the taxpayers' money is well spent.

If you are not accountable, you are likely to end up with a number of problems and certainly also with a cut in resources, maybe even the unpleasant situation that somebody else decides to take over and control your activities.

It is therefore important to maintain a well-developed network with ministries, parliamentarians and ministers, which can be more or less difficult to establish depending on the state size and culture. It is, however, essential to work with the matter and to do it in such a way that the minister who is reported to not only feels, but also expresses, confidence in what goes on at the academic institution. All this is no easy task. It requires a considerable degree of communication with the ministry and the minister, but it also requires the university to be active and visible in society and the newspapers.

It is also a good idea to establish close and well functioning contacts with the local authorities, ie the local mayor, civil servants at the town hall, and the politicians in the city council. They might help in any planning processes, but they may certainly also help in convincing politicians at the national level of what they need to do in order to help and support the university.

I think it is important for an institution to be visible in the local community so that people are aware of its presence and are confident with it. It will all help in providing a respectful image, which is of immense im-

portance in all of the institution's activities, both in getting resources for R&D and certainly also in attracting qualified students to follow your study programmes.

When it comes to the bottom line, it is essential for the university that newspapers, politicians, employees and students state more or less with one voice that what the university does is of quality and provides students and staff with excellent competence and competitiveness. This is not something that comes by itself; it requires hard work to get there and might even take years. Further, once this is achieved, it is necessary to work with it and to nurse it in order to keep it. A bad reputation is relatively easy to acquire, but it takes an immense amount of work to get rid of it, even if it was acquired through unfair and unreasonable arguments and conclusions.

At DTU we have found that a good image and visibility are acquired first and foremost through the University's work, but also through press releases on happenings and activities at the institution. We have found that it is important to have people with a journalistic background working in the central administration, as they are able to use their network to get positive stories about DTU into the newspapers.

Colourful commercials, either in the newspapers or on television, have no effect in our experience, and may, in fact, have a negative effect as potential students and co-operation partners may believe that the institution has something to hide or some cheap product to sell.

Hence, it is a far better use of resources to get newspapers and journalists to interest themselves in the activities of, and stories about, the institution.

INTERNATIONALISATION

The world is becoming *smaller* and we are living in a global village with easy communication and connection with each other through transportation and certainly also through the Internet and WWW. This also means that we are all getting closer and more in contact with each other than ever before, and this means that a well functioning infrastructure and international co-operation are a major part of our everyday life.

This situation has to be built into the strategies and thoughts of an engineering education institution in as much as the graduates have to work and compete in an international market. It means that institutions have to have mission statements, and understand how they treat the international dimension and its organisation. Depending of course on the amount of resources available at an institution, the ambitions can be very different. Again, taking DTU as an example, it is our ambition that research in those areas that we have selected

as focal is to be internationally competitive. We expect that our faculty are invited and invite co-operation partners for sabbatical visiting professorships and that they become keynote speakers at international conferences.

With respect to students, a strategy has been formulated that by the year 2000 at least 50% of our students should have study periods abroad that earn credit points towards their Danish diploma. At the same time, we expect a similar number of foreign students to participate in the educational programmes at the DTU.

This obviously requires a number of tools and decisions at the institution, one of which must involve a consideration of how to handle credit points. The decision at DTU was to use ECTS (European Credit Transfer System). There are also semester packages that can be taught in English when foreign students are in a classroom, and this is obviously important in a country where the common language is other than English and only spoken by relatively few people (5 million) measured on a world scale.

Exchanging students obviously requires a lot of effort in setting up exchange agreements with other universities around the world, but this is part of the game, and it can be fruitful and satisfying in the development of contacts with many other institutions. It also supports considerations about how to underline the issues of internationalisation.

Let me finally state, both in context with the process of internationalisation and also as a general statement, that tools and procedures for quality control and evaluation are important aspects of what it is necessary to do in an academic institution. As I have tried to indicate, it is necessary to formulate a mission statement and strategies and to establish systems that allow an evaluation of the success of established goals and criteria.

Obviously a number of people in your institution will be dissatisfied with decisions not being in accordance with their wishes or hopes, but my main point is that there is no way to avoid this strategic process in today's world where the competition is strong and global. University presidents and rectors should press for quality issues and quality aspects because they are expected to do so by politicians, ministers, foundations, private companies, but first and foremost by the students and taxpayers.

ACCOUNTABILITY

This issue is one which has received much attention in the last two to five years and to which many institutions and universities have been exposed.

Accountability is an obligation to answer for the execution of one's assigned responsibilities. In simpler terms, accountability is reporting.

The basic ingredients of successful accountability relationships are as follows:

- Set measurable goals, and responsibilities.
- Plan what needs to be done to achieve these goals.
- Do the work and monitor progress.
- Report on results.
- Evaluate the results and provide feedback.

Improved accountability is a necessary step to allow governments and taxpayers to decide if they are getting value for money.

The existing accountability framework is undergoing significant change. In the past, governments tended to assign tasks rather than goals. Central agencies were used to enforce rules and control organisations. Effective accountability is replacing the need for bureaucratic control and this means that those managing public resources depend on sound information and not speculation. This information can take many forms, from the simple to the complex. The test of what is needed is what is useful to decision-makers.

Accountability is necessary when responsibility is assigned and authority delegated, it is simply the obligation to answer for the execution of one's assigned responsibility.

In various countries the subject takes various forms and there are rules that one has to respect in the process. Therefore the only aim of these few notes is to underline that accountability is an important issue that deserves much attention and that at the same time may deliver a quality lift; it also certainly means a big drag on the available personal resources in the institution. Simply said: when setting up various procedures within quality development and accountability, it should be ensured that the cost of providing quality increases and accountability to a certain level should not exceed the expected benefits.

BIOGRAPHY



Rector Hans-Peter Jensen received his MSc in chemistry from the University of Copenhagen and his doctorate degree from Chalmers University of Technology in Gothenburg, Sweden. He also holds an honorary doctorate from Shenandoah University in

Winchester, Virginia.

Through his entire professional career he has been affiliated with the Technical University of Denmark, but has spent several periods as a visiting professor at University of Oregon and at Chalmers University of Technology in Gothenburg, Sweden. His major scientific interest has been polarised light and its use within phase modulation spectroscopy. Since becoming Rector in 1986, he has been more involved in work with science and educational policies. In this connection, he is Chairman of the UNESCO International Committee on Engineering Education and a member of the Higher Education and Research Committee under the

Council of Europe. He was a member of the Danish Natural Science Research Council, and in connection with that a member of and chairman for Collaborative Research Grants Programme Panel under NATO Scientific Affairs Division. Hans Peter Jensen is furthermore Chairman of the Danish Rectors' Conference, the Nordic University Association, the Fulbright Commission in Denmark, and is serving on a number of national boards as a consequence of his rectorship. He has published more than 50 scientific papers in international journals and participates in the standing national and international debate on educational and research policies.