Science Policy

Making Universities Cope with Science Today

Universities are the basic building blocks of the science system in most industrialized nations. Nearly all scientists have been educated in universities, and in many countries universities form the largest sector within the national research system. The integration of higher education and scientific research into one academic institution determines the hybrid character of the university. In the past, numerous studies have focused on different aspects of this most influential type of institution in the academic world. Each year some 200 new articles on universities get published in international top journals as covered by the Science Citation Index or Social Sciences Citation Index.

As science itself is undergoing rapid and far-reaching changes (UNESCO 2000), especially during the last two decades, these changes have a strong impact upon the universities. After a period of dramatic quantitative expansion until the mid-1970s, budget restrictions in many nations limited the growth curves and led to a *steady state* (Ziman 1994) in the 1980s and 1990s. Now there is no more additional funding to realize new developments; any new initiative has to be paid through internal cutbacks.

Whether or not the terms 'mode 1' vs. 'mode 2' characterize discrete forms of knowledge production and, what is more, whether or not 'mode 2' will eventually replace 'mode 1,' that is, the former thus charactizes a historical change in the science system (cf. Gibbons et al. 1994, and pp. 13–14, 130 in this volume) – this may be debated controversely (Weingart 1997). It is obvious, however, that universities will undergo severe structural and organizational transitions throughout the next decades. As Wilhelm Krull points out on the following pages, a number of critical issues are affecting the future development of the universities: there will be less state but more private funding; due to the possibilities of the world wide web and multimedia technology there is a significant trend towards virtual colleges; traditional disciplinary specialization will decrease while inter- and transdisciplinarity will increase; funding will be linked closely to assessments of performance, and indicators for 'outputs' of research and teaching will get more and more attention (Weingart 1996); in the era of globalized markets internationalization will be of growing importance.

Universities will have to change themselves into learning organizations; academic 'self-mystification' will be reduced while controlling and management procedures will be introduced on all levels to enhance the productivity of the organization and its members.

With Germany as an example, Krull explains the most important dimensions of change – in fact, the challenges – for universities today; his observations, however, are of relevance far beyond the German case.

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German Universities on the Threshold of the Twenty-First Century[1, 2]

Wilhelm Krull

Major changes in the calendar such as new millennia are also an occasion for looking back and taking stock, engaging in a critical or fond inspection of what has been achieved so far, but, above all – as a glance at the world in 1900 or even in 1000 would show us –, an occasion for speculations and visions, for promising utopian scenarios as well as prophecies of catastrophe and doom. Things are no different at the threshold to the 21st century or the third millennium.

Nothing ages so rapidly as long-term predictions, and I take to heart Peter Medawar's comment that everybody cultivates expectations regarding the future but only fools allow themselves to make predictions. Therefore, I fear that I shall have to disappoint all those who finally wanted to know which catastrophes await us and what German universities will look like in 50 or even 100 years time (should they still exist). Whatever, there has been no shortage of predictions of gloom and negative trends in the German higher education policy debates of recent years.

As far as German universities are concerned, critical reports and visions of doom were on the agenda long before the appearance of the current millennium. Diagnoses on their state of health have also long been bad. Even 10 years ago, Jürgen Mittelstraß, a philosopher at Constance, coined the metaphor of the "university as patient." He considered this patient to be suffering from "being overcrowded and underfinanced," to be struck down, and that neither science nor politics would seem capable of developing convincing proposals for treatment, let alone providing effective help: "The patient's coma has long since spread to the physicians as well" (Mittelstraß 1993: 27, translated).

Even a quick glance at the headlines on university policy in recent months reveals little change, at least in the public perception of the situation. Not only the unfortunate discussion on "lazybones professors," but also headlines such as "Stupidity: Higher education policy doesn't know what to do," "A desert in cultural policy?" "Universities: The major revival has failed to materialize," "German universities: Not good enough for Nobel prizes?" or "Musty gowns: Profes-

sors should be paid according to their productivity" have further damaged the image of German universities. This has been particularly encouraging to those powers that have long considered that the critically ill patient needs drastic surgery, to some extent, to be put under the knife, and thus ensure a return to health through intervention and external regulation. Particularly critical observers, most of whom prefer a shipping metaphor, are already seeing the approaching death of many universities: The ship is sinking, the "university for the masses" tanker is foundering, but what then? This is as far as the view of the pessimists goes!

Optimistic observers of the situation and policymakers, in contrast, point out that the current state of German universities is, to a major extent, the outcome of the administered university world of the 1970s and 1980s, in other words, of a period in which the many self-appointed healers of the patient university had almost driven it to its death. They argue that belief in the self-healing powers of the universities should not be abandoned. They do not deny that it will be very difficult to create the preconditions for an effective growth of self-healing powers in light of the continuing diverse ties to politics and the accompanying lack of clarity in the allocation of responsibility. However, this will be essential if the universities are to act as self-determined institutions. Granting autonomy simultaneously implies a clear assignment of responsibilities.

The Volkswagen Foundation is one of those – along with other private supporters of higher education and research – that have not abandoned the hope that universities will have the power to heal themselves. This is apparent already in the title of their program 'Efficiency Through Autonomy.' It is supporting a total of 10 universities with more than 23 million German Marks. Of course, this support does not mean that the Foundation has shut its eyes to the problems and risks associated with such a path toward greater action scope and greater autonomy. I shall deal with this below (cf. the sections on "New Goals and Tasks" and "Problems and Perspectives"). However, I shall first sketch my assessment of the current situation of universities and the challenges facing them, because I think that this will clarify not only the difficulties but also the needs for change.

The conditions for successful university activity are changing decisively in line with the rapid change in the international division of

labor from hands, tools, and machines to brains, computers, and laboratories. For a number of years, the transformation from the traditional industrial to an information or knowledge society has not just been evoked in politician's speeches. In a world of 'global sourcing,' scientific knowledge – it is maintained widely – becomes increasingly more crucial in working out concrete problem solutions. At the same time, many advanced countries are revealing an unmistakable trend toward allocating less rather than more public funds to those institutions whose central function lies precisely in the training of future generations of researchers.

I shall now concentrate on five particularly marked changes that may be summarized under the following headings:

- Less state, more private sector.
- Less university attendance, more virtual college.
- Less specialization, more inter- and transdisciplinarity.
- Less input orientation, more assessment of performance.
- Less bilaterality, more globalization.

Less State, More Private Sector

The data on university funding are sufficiently well known. Even when conditions differ from federal state to federal state, there is an unmistakable trend toward declining or, at best, stagnating budgets. What is particularly conspicuous here – in a European comparison as well – is the dramatic cuts in spending per student since the mid-1970s (by almost 50 percent). At the beginning of the 1990s, a student cost the German public budget DM 6,318 per annum. The Netherlands were spending DM 9,540 per student; Great Britain, DM 12,177. The much promised 'contingency of planning' proves to be a mere certainty of advance warning on how much less money will be available over the next 3 to 4 years.

As a result, German higher education and research policymakers have recently also started considering the need for a new 'public-private partnership.' Alongside improving the fit between publicly funded and private sector research, this particularly means a need for new funding models in order to maintain the efficiency of the training and research domains funded traditionally by the public sector. Simultaneously, this places completely new demands on management.

It seems as if we are inexorably following a trend here that has become increasingly dominant in English-speaking countries since the beginning of the 1980s. There are now a number of initiatives and concrete plans in which the interface between public and private areas of responsibility has been shifted far into the field of commerce, and this does not just apply to college building, the provision of high-power computers, and so forth, but also in the joint establishment and funding of research institutions. The demand that more attention should be paid to foundation and innovation management in research and teaching and also to use the university as a training ground for entrepreneurs has gained – and this is a welcome trend – far more acceptance than in the 1980s (cf. Krull 1999: 6–9).

At the same time, we cannot overlook the fact that we are still finding it difficult to advance effectively along the path toward privatization. Here, I only wish to recall the seemingly endless debate on introducing student fees, in which rhetorical bouts were carried out with almost religious zeal, but no final breakthrough could be achieved. At present, I also doubt whether more can be achieved on the path toward founding private colleges. There is now a welcome variety of more than 10 private initiatives, and there is also talk about offering approximately 2,000 new student places. However, if we subtract the 1,200 places planned for the new International University of Bremen, it soon becomes apparent that most plans are not for universities but, at best, 'mini-versities' or even simple, one-course colleges (mostly business schools). Despite this criticism, I am, nonetheless, convinced that the current private initiatives to set up universities are a necessary beginning, and, in the years to come, we shall witness a much more dynamic development toward partial privatizations of previously publicly funded institutions and more large-scale foundations of colleges offering a wider range of subjects. First steps toward such partial privatizations can already be observed in some technological universities, for example, at Karlsruhe and Hamburg-Harburg, and no longer just for research but specifically for the international 'marketing' of their courses as well.

Less University Attendance, More Virtual College

Everybody is talking about the knowledge or information society. The data highways seem to be becoming the traffic routes of the future. Thanks to the Internet and e-mail, information is becoming available in increasingly larger amounts and, simultaneously, at an increasingly faster speed. However, it is not just the changes in the transport of information and data affecting all areas of society that are worthy of interest here, but also (or perhaps, above all) changes in the scientific methods and questions that the 'digital revolution' has made possible. The spectrum associated with the 'informatization of knowledge' that is perhaps also leading to a new 'order of knowledge' extends from the mapping of the human genome, across the application of methods of nonlinear dynamics in the natural and engineering sciences, up to historical social research with mass data, to name only three examples. One particular challenge facing universities is that the production, processing, and distribution of new information occur almost simultaneously. Lectures and papers by outstanding professors at Harvard or Stanford, for example, become just as accessible for students at German universities as the lectures of their own German professors. An ever more perfect information network that permanently confronts our scientific understanding with what we already know or should have known is increasingly creating the impression that the information networks have developed more quickly than the research they were designed to serve.

At the same time, more and more virtual colleges are being set up and are moving into the education market with interactive courses. Although the largest Internet college in the USA, the University of Phoenix, has no real campus, it already has more than 200,000 students or subscribers (it is hard to know how to categorize them exactly). Up to now, Germany has followed this trend only hesitantly, and mostly in the technological college domain. However, Bavaria's plan to set up a state-wide Internet college will probably soon be followed by other states. This simultaneously raises the question of what repercussions these electronic, interactive courses will have on studies at a solid university building.

Less Specialization, More Inter- and Transdisciplinarity

For a long time, the organization into subject fields was the pride and joy of German universities. This was justified, because in many subjects – not least the 'classic natural sciences' such as physics, chemistry, and biology – their researchers were among the best in the world. Interdisciplinary research was already proposed repeatedly in the 1960s and 1970s and almost sounds old-fashioned today. However, for some time now, it has been experiencing a renaissance under new labels, because in many areas (not just in environmental research in which it has been apparent for a long time) the emerging problems can be solved only through cooperation between outstanding researchers from various disciplines.

Leading international science researchers like Michael Gibbons, Camille Limoges, and Helga Nowotny et al. have tried to describe these decisive changes in a book entitled 'The New Production of Knowledge' (Gibbons / Limoges / Nowotny 1994). They have proposed a heuristic discrimination between the traditional 'Mode 1' (disciplinary, primarily innerscientific context, homogeneous research questions, etc.) and 'Mode 2.' Mode 2 is defined particularly by the following elements: (a) The social and economic context is of great importance for a wide-ranging, mostly transdisciplinary research. (b) New research questions often originate outside of the science sector. (c) A common basis for the ability to communicate scientifically first has to be established between the experts involved, new methods have to be worked out together, and, frequently, standards can be defined only at the end of a project. (d) The relation to applied science and practice is often in the foreground. The final concern is to link together the previously all too often separated domains of theoretical knowledge, applied knowledge, and practical knowledge in new ways. In their new book, Helga Nowotny, Peter Scott, and Michael Gibbons also ask how the increasing demand for 'socially robust knowledge' can be met in the future (cf. Nowotny / Scott / Gibbons 2001).

Less Input Orientation, More Assessment of Performance

Up until well into the 1980s, science policy was almost exclusively input-oriented (and not just in Germany). The focus was on increasing the number of student places (without doubt, a necessity since the

number of enrollments had doubled). From the very outset, the increase in the numbers of first-year students, which was also motivated by labor market policy, was accompanied by an almost complete neglect of the number of graduates and the other activities of the university. Since the quantitative expansion of the education and research system has come to a halt, and, in this 'steady state' situation, new training courses and research institutions can be attained only through discontinuing old or outmoded workfields and closing departments, faculties, or institutes, the search for 'objective evaluation standards' has been stepped up throughout the world.

Numerous countries can offer a wide range of experiences with different structures, procedures, and institutional forms for evaluating university teaching and research. Terms such as evaluation, quality assessment, and productivity-related fund allocation are on everyone's lips. Of course, previous experiences have also shown the importance of a balance between quantitative and qualitative methods and how urgently an effective framework for the external quality evaluation of research and teaching needs to be established. If evaluations have no consequences – either intentionally or not – and, as a result, no structural changes and relocations of resources can be made, they soon lose their credibility and degenerate into frivolity (cf. Krull 1998: 151). In Germany at present, the reverse would seem to be true, with, in many cases, a fear of any kind of evaluation. It is repeatedly astonishing to see what reservations are raised – and, in particular, how – with regard to any assessment of performance.

In the future, too, the function of the university will remain the same, namely, to acquire, impart, and generate knowledge (as well as the technologies that may be necessary for this). However, the following aspects will become increasingly important for their efficiency: the underlying ideal along with all its attendant goals and visions, the culture of teaching and learning, the organizational structures and control mechanisms, and, not least, the available financial and staff resources.

Recent studies (including those of the American science researchers Rogers J. and Ellen Jane Hollingsworth 2000: 215–244) nonetheless confirm impressively that the decisive breakthroughs that receive Nobel prizes and comparable awards tend to occur at medium-sized universities with a broad spectrum of interacting disciplines, a minimum of hierarchies, and a high degree of horizontal communication

offering a multitude of opportunities of interacting with the fields of practice. They also have a strategically focused college management with effective procedures of quality assurance that assign a particularly high status in every sense to research achievements. In the United States, this applies, for example, to Rockefeller University (where last year's Noble prize winner Günter Blobel is to be found) and the University of California at San Francisco to a much higher extent than, for example, to the University of California at Berkeley.

Less Bilaterality, More Globalization

"Internationality belongs to the essence of science." This is the first sentence of the Science Council's recommendation for the internationalization of scientific relations (Wissenschaftsrat Köln 1992: 5). This particularly means the, so to speak, constitutive international character that cannot be held back for any length of time by historically given or politically ordained borders. However, in the context of a world-wide market, not just for research- and technology-intensive products, global networking, and multinational companies, the international dimension of science gains a new importance. As worthy as it may have been in individual cases for German universities to have supplied themselves well with partnerships and cooperation agreements, this can scarcely distract from the fact that new efforts are required (and have actually been implemented at many universities) if they are to hold their own in the international competition between colleges. These include, among others, basic improvements in study conditions in numerous faculties, particularly in overcoming the lack of communication between the natural and engineering sciences, and recognizing internationally comparable qualifications. Through designing study courses in modules up to a first university qualification and setting up 'international graduate schools' together with leading international universities in other countries, German universities have gained completely new opportunities to demonstrate their efficiency and recapture some of their earlier reputation. By the way, the participation of Rice University at Bremen or Purdue University at Hanover is essentially due to the fact that it enables not only students but also teaching staff at both universities to gain additional international experience and, hence, intercultural competence.

Efficiency Through Autonomy

As already mentioned above, with its program 'Efficiency Through Autonomy,' the Volkswagen Foundation is supporting 10 universities to the tune of more than 23 million DM. The universities are the Free University of Berlin, the Humboldt University at Berlin, the University of Bremen, the Technological University of Clausthal, the University of Dortmund, the University of Göttingen, the University of Hamburg, the University of Heidelberg, the University of Kassel, and the University of Mannheim. These institutions differ greatly in terms of age, size, structure, and framing conditions. It is particularly pleasing to see that, thanks to the Humboldt University, the program does not just include universities from former West Germany.

The central goal of the Volkswagen Foundation program is to improve the efficiency and effectiveness of universities by strengthening their autonomy. Hence, the concern is not with university reform in a general and comprehensive sense, but to start off in a very concrete way, namely, with the university management and decision-making structures, and target these for specific reforms. As a funding institution, the Volkswagen Foundation usually contributes to strengthening research structures. In this case, it is concentrating particularly on promoting the organizational and administrative preconditions for successful research and teaching. The idea is to support universities in their efforts to examine and improve their structures, procedures, and processes on various levels; to reorganize areas of competence and responsibility and allocate them more meaningfully; to try out corresponding new rules and then implement them effectively. However, this should not be an end in itself. Merely focusing on technocratic and administrative measures would not go far enough. The final concern is for universities to develop structures and procedures that create the preconditions for carrying out their genuine tasks as well as possible with a minimum of administration and friction loss, namely, science in the form of research, teaching, training, and knowledge transfer.

To attain the goal of higher efficiency, it seems essential to follow the path toward more autonomy. Some implications of this are:

1. Responsibility should no longer be socialized diffusely but be made identifiable and attributable.

2. It must be ensured that responsibility is not without consequence for those bearing it.
3. Decision-making competencies and obligations must be allocated to those who can and must take responsibility for the consequences.
4. It is necessary to promote an awareness among members of the university that it is *their* university in which they are working.

Higher efficiency initially means that:

1. Resources are exploited and used better.
2. The available means are applied more effectively.
3. Procedures and processes are simplified and speeded up.
4. Communication and cooperation are intensified on the various levels and between the individual units.

The reform plans supported by the Volkswagen Foundation reveal a multitude of different concepts and approaches. This places them in line with the Foundation's goal of every university having to find the best possible solution to fit its own framing conditions (rather than making the often exaggerated claim in advance of developing models for a German university reform in general). I shall now sketch three reform approaches in more detail.

The approach at the *University of Bremen* aims toward a comprehensive reorganization in the sense of a universal contract and quality management. Under the heading "We are changing our university," some of the concerns are:

1. An achievement orientation based on agreements over goals and contracts.
2. Quality development in teaching and research for the extension and control of the faculties (drawing up contracts between the university administration and faculties).
3. Development of new forms of participation in decision making and autonomy (between the rector's office and the faculties as well as between faculty speaker, academic self-administration, and faculty administration in the faculties themselves).
4. Achievement- and obligation-oriented allocation of funds.
5. Teaching contracts between staff and students.

6. The establishment of a 'learning organization' (through, among others, 'staff-supervisor discussions').
7. Development of guiding principles and a management concept for the university (the university as an enterprise).
8. Development of a new contractual relationship between the university and the city state of Bremen.

Following principles of process-oriented and systemic organization development, the *University of Hamburg* is striving toward a design and control of its administration and self-government focusing on tasks and goals as well as an improvement of internal university communication. On the basis of an agreement over the goals and profile of the university, increases in efficiency and efficacy should be achieved through more effective links between planning, decision-making, and executive activities. Responsibilities for decision making and action are being delegated from the central administration to decentralized units while simultaneously strengthening the service concept. Alongside the topics "Setting goals and forming profiles" and "Team discussions," work is being carried out on the following sub-projects:

1. Developing and testing internal agreements on goals.
2. Strengthening the faculties.
3. Reorganizing central administration.
4. Developing a university report and controlling system.

The goal of the project at the *University of Heidelberg* is to improve the deployment of available resources throughout the university and to create a new awareness for costs and efficiency. The institutes are being assigned a global budget with a large degree of freedom in allocation (with corresponding accountability). The existing resource allocation accounting processes are being developed into new funding modes and supplemented by a business accounting system. This makes it possible to set up an internal services and resources market in the university. The university management will thus be enabled to pay more attention to long-term strategic objectives and the necessary structural decisions. This will be oriented toward cost and productivity data developed within the framework of an internal information and reporting system that will also be made available to the institutes.

New Goals and Tasks

In a paper on structural plans for the University of Constance, the need to strengthen priority setting and profile formation is expressed as follows:

> Nowadays, no university can function as an institutional expression of all branches of academic knowledge, especially when it comes to generating, processing, and conveying this knowledge. In this sense, there are no longer any complete universities in line with the ideal of the old university. This process is due not only to modern developments in academia but also to financial and organizational constraints, and it compels us to form more specialized profiles from the perspective of a limited, 'finite' universality that is now replacing the unlimited, 'infinite' universality claimed by the universities before. These have to be expressed not only from scientific but also from structural and organizational perspectives. As a result, the special character of the modern university of the future will be revealed less in its variety of disciplines but far more in its special profile and corresponding specializations (Strukturkommission Universität Konstanz 1998: 32).

However, the profile formation demanded here requires each university to have a clear concept of its goals and tasks. It calls for intensive deliberations, tests, negotiations, and decisions over what should be the priorities – and all against the background of a reliable quality assessment of respective strengths and weaknesses as well as a prospectively based strategy. It is my belief that a structure and development planning designed in this way cannot be worked out in each institution by itself. It requires interaction with the external world and can finally function only if it is based on an extended concept of autonomy – in the sense of a responsibility of the scientific community at large and no longer just the individual university.

The development of a new concept has to be accompanied directly by a strengthening of inter- and transdisciplinary research and teaching. Nowadays, in terms of science policy, it is almost a truism to say that research within each area moves increasingly more frequently at the borders of the traditional subjects and disciplines, and that, outside of academia, it is expected to contribute to solving problems in, for example, the realms of energy, the environment, and health that cannot help but stray over the borders of subjects and disciplines.

One expression of the transdisciplinary orientations that are becoming effective wherever a solely disciplinary definition of problem states and problem solutions no longer works, is the new scientific centers emerging, or already working nowadays, like those at Harvard (Center for Imaging and Mesoscale Structures) and Stanford (Bio-X) in the United States, but also at the University of Munich (Center for Nanoscience). These centers are no longer organized along the traditional lines of physics, chemistry, and biology institutes, but from a problem-oriented perspective that, in these cases, follows the current trend in science. Transdisciplinarity proves to be a new and highly promising principle of research. Where it works, the old institutional structures pale in comparison (Mittelstraß 1999: 3).

To develop a specific, not just regional, but, above all, also international profile, it is essential for each university to reconfigure its previous efforts toward internationalization that were generally based on cooperation agreements. Alongside a universal application of international standards for the recognition and comparability of student credits and qualifications, not least in the ECTS (European Credit Transfer System), this includes the formation of a network for research and teaching that particularly emphasizes combinations of competencies that may be used to supplement the resources of one's own university. As long as attention is paid to the criterion of scientific excellence and, for example, internationality is not promoted for its own sake, such 'strategic alliances' and the resulting combinations of competencies are exceptionally suitable for giving the specific profile an additional productive focus.

The rapid advances in new information and communication technologies make new teaching and learning methods based on multimedial forms of imparting knowledge enormously important. As mentioned above, the 'digitalization of knowledge' implies that new knowledge is generated, processed, made available, and imparted almost simultaneously. This does not just mean an extension of the traditional correspondence course model. Nowadays, it is far more the case that each university has to ask itself how it intends to react to the major relaxation of the constraint of teaching and learning to one time and place ('learning anytime, anywhere'). Future courses can be carried out in a joint division-of-labor process by several faculties or several universities on both a national as well as international level. As mentioned above, the situation is similar for research: Here as well,

multimedial information and communication technologies have long played an important role and have led to the development of new forms of work and organization.

To the extent that the forms and paths by which new knowledge is created are developing from a relatively homogeneously structured, institutionally anchored process shaped by the discourse within the individual disciplines to a more open process shaped by a service character and a firmly applied reference, the demands on colleges and research institutions on the one hand and industry on the other are also changing. Both need to work together more intensively than before in training and research processes. This is why German higher education policymaking has recently been talking more about the need for a new public-private partnership. Alongside improved coordination between publicly and privately funded research, this particularly means the need for new funding models if the traditionally publicly funded research and training institutions are to retain their efficiency. German universities still find it difficult to cope with such an idea. They particularly fear a loss of independence in research and teaching. However, the need is to develop new forms of coexistence in the sense of a "purposeful scientific cooperation between two equally entitled partners with different abilities and goals" (Stock 1990: 10, translated). The goal of a public-private partnership is not a reciprocal transformation into the other but an optimal exploitation of the different competencies and strengths of both partners. The main concern is to improve knowledge networking through binding cooperation schemes, in-service training, and the like. This means that it is necessary to develop the ability not only to produce relevant knowledge but also to register this knowledge. Whether this will simultaneously lead to a 'denationalization' of tertiary education does not need to be discussed further here. However, it can be anticipated already that these new forms of coexistence will also lead to changes in the financial interfaces between the public and private sector.

The more strongly universities are controlled on the basis of contracts, thus through productivity agreements, the more important the quality evaluation of the entire performance spectrum of a university will become as well. Internal and external evaluation need to be coordinated better and developed further. Germany has a lot of catching up to do, particularly in evaluating teaching and university

services. Of course, the quality of appointments remains of decisive importance. However, even in this context, reforms based on new internal and external checks and balances would be desirable that could be oriented toward the practices developed at leading non-German universities.

Promoting science and research with public funds is justified by the crucial importance of producing new knowledge and passing it on to society, above all, the young generation. It is a particular task of the university to produce excellently qualified young persons who will be able to take over leading roles in academia, business, and society. With a view to future generations of university teachers, there is a need to enable early scientific independence so that creative potential and motivation can be exploited optimally. This requires a new personnel structure and also discontinuation of Germany's postdoctoral habilitation system. It should be replaced by demanding other proof of special scientific aptitude for university posts that goes beyond an excellent Ph. D. In my opinion, the quality assurance for high posts at universities and research institutions is not a job for the institute of origin but – with the involvement of external experts – for the institution with the post to fill.

At the present time, more than 60 percent of the postdoctoral graduates who transfer to English-speaking countries – predominantly the United States – do not return to Germany. This is something that needs to be thought about. From many personal conversations, I know that the lack of assistant professorships and posts for junior research group leaders is a particularly major handicap. At the Volkswagen Foundation, we have set up a special program for 'junior research groups at universities' in order to provide an opportunity for particularly highly qualified members of the next generation to run their own research groups. It remains to be hoped that the current Education Minister's openness to reform will be crowned by the successful introduction of a basically new personnel structure during the further course of the present parliamentary term.

Problems and Perspectives

A spirit of optimism can be found in many German universities. Dynamics of change have been set in motion that are also forcing previously more reticent universities into action. However, this does

not mean that the desired goals can be attained straightforwardly. I should like to sketch some of the major problems that I consider to be present in the various reform plans:

1. The tense relation between the top-down and bottom-up orientation in the development and implementation of new management and decision-making structures; the strategic versus participative approach in plans; the integrative function of the discussion on ideals and the associated goal of strengthening corporate identity ("We are changing our university"); the need for structural reform versus much-loved habits or committee traditions; questioning the legitimacy of reform plans outside traditional procedures and – losely linked to this – the necessary gaining of trust through intensive public relations work.
2. Potentials and limits of achievement-related allocation of funds as an instrument for controlling resources; tendencies to self-block reform plans through excessive adjustments to data and so forth; premature restrictions of the breadth of funds to be included and difficulties in obtaining acceptance for the new instrument; the problems of implementation: Differentiation of achievement and internal university integration seem to be hard to reconcile; the necessary complementary function of negotiated goals and corresponding forms of productivity-related allocation of funds.
3. The coordination of organization development and personnel development; not only technological and administrative abilities require further development; the willingness to take over responsibility for resources does not grow by itself; in individual institutions, the projects have to tackle staff problems – both in terms of fluctuations in team members as well as intended transfers into university management.
4. The decentralization of responsibility for resources and the accompanying administrative processes require rethinking the interface between central administration and faculty or institute administrations; the danger of extra work and over-organization is in no way banished.
5. The relation between the university and the state, between university administration and government ministries has yet to be clarified satisfactorily; many contracts and new models for productivity and obligation-related allocation of funds are a pretext for new modali-

ties of fine control that tend to encourage more rather than less state intervention.

Final Comment

Finally, I should like to reemphasize three points:

1. The 'tertiary teaching and research institution' of the university has to change itself – in a comprehensive sense – into a learning organization, to stimulate its staff repeatedly to enhance productivity, and convey a sense of membership to all.
2. The changes sketched at the beginning and the associated challenges have to be accepted. New concepts of strategic control and everyday management also have to be developed as well as new forms of imparting knowledge, curriculum organization, and research itself.
3. For a long time, the academic world was engaged in a sort of 'self-mystification' (cf., also, the labyrinth as a metaphor for scientific work). Although the goal is more success, 'self-enlightenment,' learning from mistakes, reorganization of procedures, and so forth are essential milestones along the way.

It should also be borne in mind that not all therapeutic steps will succeed, and that the patient will have to anticipate relapses. However, in all, I am confident that the outcome will be reform of the more efficient institutions, and that the end of the story will not be, to quote Francis Bacon, "Cure the disease and kill the patient."

Notes

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2 This contribution is based on a talk the author held at the University of Ulm and the University of Marburg, Medical Faculty, on occasion of the *Dies Academicus.*

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