Perspectives of Universities in Germany

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The authors provide a short survey of the latest developments and the current structure of higher education in Germany. They point out the tasks of German universities and give some ideas about their future.

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1 Framework Conditions for Higher Education Institutions in Germany

Global competition is characterizing the economic development, the development in research and technology and, as a consequence, the development in higher education institutions, especially universities. In order to define the perspectives of universities in the 21st century it is necessary to look on to the surrounding of the institutional development of universities.

1.1 Economic Development

- Stock markets react to economic and political events, world-wide within hours.

- Global-player companies are moving their plants according to suitable surroundings concerning location, labour force, financial and fiscal conditions.

- Research and development in globally acting companies are also located according to the best surroundings like location, cooperation with the universities and research institutes, human potential for research and development, salaries of the labour force and legal conditions for new technologies.

1.2 Scientific Developments

In the so-called new fields like computer science, microelectronics, biotechnology, material sciences and neuroscience the distance between research and development on the one hand and production on the other hand is becoming shorter and shorter. The life cycles of products, especially in the field of computing, exceed the human abilities of adaptation to new generations of computers for instance, and at least sometimes also the financial potential of small and medium-sized enterprises. The distribution of research and development in global-player companies is a world-wide one. This has become possible according to the development of information and communication technologies which enable world-wide companies' communication within seconds. Thus, research, development and production are working within world-wide networks. The fact that three major Germany-based international companies concentrated the majority of their software production in Bangalore/India within the last three years demonstrates in one focus the consequences of globalization in this field.

1.3 Demographic Changes

The numbers of first-year students in engineering and natural sciences, especially physics and chemistry, in German higher education institutions have decreased since the beginning of the nineties to 1995/96 down to 40 percent. The decrease is due to at least two developments: the economic and labour market development and the demographic development. The yearly birth rate in the former German Democratic Republic (GDR) in East Germany amounted to around 300,000 between 1950 and 1963 and then decreased down to around 180,000 in the mid seventies (1973/1975). After an increase up to 245,000 in 1980 the development between 1987 with 216,000 and the mid nineties with around 80,000 births shows a tremendous decrease down to 40 percent. In West Germany the numbers increased from around 800,000 between 1950 and 1953 up to 1.06 million in 1964 followed by a sharp decrease between 1965 and 1978 down to 576,500. Until 1990 the numbers raised up to around 727,000 births (enclosure). The consequence of these developments in one sentence: Germany has or is an ageing society.

1.4 Development of Public Budgets in Germany

Since the beginning of the nineties a huge annual transfer of public funding from the Western to the Eastern part of Germany has been taking place. After the unification of the former two states in Germany on October 3, 1990, the unified Germany has to cope with the consequences of around 40 years of a centrally planned and managed economy and society in the former German Democratic Republic. It is aim and task of the state to raise at least the public infrastructure of the six East-German Federal States to a level comparable with West Germany. The transfer with an annual amount of around 150 billion DM is one, but by far not the only reason for the development of deficits in public budgets in Germany. Problems in public budgets directly influence the development of higher education institutions in Germany due to the fact that around 80 percent of all German higher education institutions are state-founded, state-owned, state-organized and state-financed institutions. In these institutions around 98 percent of all students in Germany are enrolled. In the around 20 percent private higher education institutions, roughly half of them run by the churches, partly with public subsidies, only two percent of students and three percent of first-year students in Germany are enrolled.

1.5 Sustainable Development

In his book "Preparing the 21st Century", Yale Professor Paul Kennedy already underlined the problems and risks of our natural surroundings, our environment before this became a topic of broad political discussion in highly industrialized countries. For the survival of humankind societies have to develop a different culture of using nature and environment as resources for industry in order to reach a sustainable development. The consequences of industrialization for the living of the next generations are obvious in Germany and all over Europe. Therefore it is not only necessary to develop new kinds of industry to cope with consequences of traditional industries, but also to develop new kinds of behaviour in using natural resources. The problems of air pollution and climate changes are only two dramatic examples for the importance of sustainable development.

Demographic changes, the development of public budgets and sustainable development - these are at least three major tasks and responsibilities for the young generation not only, but especially, in Germany. They concern universities and higher education institutions as well.

2 Development of Higher Education Institutions in Germany

2.1 Quantitative Development

Germany has an overall population of 82 million inhabitants. Around one third of an age group is studying in higher education institutions: A total of 1.8 million students in higher education institutions and around 280,000 first-year students in 1996. According to a prognosis of the Federal States' Ministers responsible for higher education, the number of first-year students will increase by a minimum of 25 percent within the next ten years. This prognosis is based on the development of student numbers in secondary schools (enclosure).

As the political and economic system in the former GDR was a centrally planned one, the development of first-year student numbers in higher education institutions was stabilized at a level of around 32,000 per year or 13 to 15 percent of an age group since the early seventies till the end of the GDR in 1990. Starting then, major changes have occurred according to the development in West Germany. Within the next five to eight years the percentage of an age group entering higher education institutions will be at a similar level of around one third all over Germany.

The quantitative development of the West German higher education system during the last 20 years has been characterized by expansion of student numbers but only

comparably small increases in the figures concerning scientific staff and study places in higher education institutions.

The numbers of first year students expanded from 159,000 in 1977 to 218,000 in 1997 and the total numbers of students from 913,000 to 1,600,000 whereas within the same period the figures of scientific staff positions increased from 63,000 to 69,000 and the number of study places from 726,000 to 866,000. But the number of final examinations rose from 120,000 to 211,000 between 1977 and 1996.

Looking at the percentages of the development in West Germany during the last two decades: there was an increase of 38 percent in the number of first-year students, of 35 percent in the total number of students, of 10 percent in the number of scientific staff positions, of 19 percent in the number of study places and of 75 percent in the number of final examinations. The financing of higher education institutions including students' grants and loans as part of the gross domestic product declined from 1.32 percent in 1975 down to 0.83 percent in 1995, this is a decline of 38 percent. The investment per student per year increased in nominal figures from 11,000 DM in 1980 to 11,900 DM in 1995. In real figures - with the inflation rate deducted - this means a cutback of around one third.

These figures demonstrate that higher education institutions in Germany solved their tasks with growing effectiveness and efficiency.

2.2 Institutional Diversification

The institutional development of Germany's higher education system is characterized by institutional differentiation and diversification especially betweeen universities and *Fachhochschulen* (Universities of Applied Sciences).

In 1997, first year student and total student numbers were distributed among the different types of institutions as follows:

Institution	First year students	Students
Universities	182.300	1.356.800
Colleges of Music/Arts	3.900	29.800
Fachhochschulen	71.500	399.300
Colleges of Public Administration (only for in-service training of civil servants)	9.800	38.200

Universites are defined as research-oriented institutions of higher education realizing - according to Wilhelm von Humboldt - the unity of research and teaching. They are those institutions of higher education which - as a system - enclose all fields of knowledge and science.

Fachhochschulen are comparable with the former Polytechnics in the United Kingdom. According to a recommendation of the *Hochschulrektorenkonferenz* (German Rector's Conference) being acknowledged by the *Kultusministerkonferenz* (Conference of State Ministers of Higher Education) this denotation is to be translated into English as "Universities of Applied Sciences". They are practice- and teaching-oriented institutions awarding academic degrees after 3.5- to 4-year courses leading to the *Diplom* which is comparable to a Bachelor honours of UK or a Bachelor with thesis of US universities. *Fachhochschulen* concentrate in three main sectors: around two thirds of all engineers in Germany, around half of all graduates in business administration and economics and around 80 percent of all graduates in social sciences and social work are graduates of *Fachhochschulen.*

The new framework law for higher education entitles universities and *Fachhochschulen* to introduce new courses leading to the Bachelor's and Master's degrees. An accreditation of these courses by an independent accreditation agency is being prepared in a common working group of the *Kultusministerkonferenz* and the *Hochschulrektorenkonferenz*. To avoid misunderstandings it is worthwhile to mention that the Bachelor's degreee will always be a Bachelor with thesis.

The right to award a doctor's degree is - in Germany - exclusive to universities in spite of the fact that many doctoral theses are prepared in research institutions like Max Planck and Fraunhofer Institutes and not in universities.

3 The Role of Modern Universities

How do universities - the term university used in a broad sense, including universities, *Fachhochschulen* and colleges of music and fine arts - react to the challenges in economy and society? The institutional and quantitative development of the last 25 years is not covered by the traditional definition of a university as an institution combining research and teaching.

The generation of knowledge and science is a dynamic process. Therefore the tasks of a modern university are not to be seen as a definite set, but have to cover various fields.

The main challenges of the future are to ensure quality in spite of narrow public budgets, which include narrow budgets of higher education institutions in a state-owned, state-organized, state-run and state-financed higher education system, to realize more efficiency in dealing with the taxpayer's money, to contribute to the development of knowledge and science in world-wide competition and cooperation in all fields including humanities and social sciences.

3.1 Teaching and Study

Around 85 percent of all students of German higher education institutions, who represent one third of an age group, are interested in solid, science-based education and training for the labour market. Around 10 to 15 percent are interested in research as a profession.

Universities have to meet the requirements of the young generation concerning profession-oriented training. They have to answer as well to the demands of students interested in knowledge and science as such. Therefore universities have to offer courses leading to diversified degrees - profession-oriented and knowledge-oriented - in a university system characterized by institutional diversification. The globalization of economy and science requires the introduction of courses leading to B.A.- or M.A.-degrees, those being the world's leading currencies of academic degrees.

3.2 Research and Development

Universities are the major places for knowledge production in the broad sense of all disciplines. They are part of the cultural heritage. Looking at some quantitative indicators universities in Germany represent around one fifth of the overall expenses for research and development. This is slightly more than all publicly funded private, non-profit research institutions outside the universities. Universities as a system include all fields of knowledge and science and so enable their members to use the institutional framework for trans- and interdisciplinary cooperation. Research and development in universities covers the whole range of knowledge production from so-called pure or basic or curiosity-driven research to applied research or solving of practical problems of business enterprises.

3.3 Education and Training of Young Researchers

One of the major tasks in the future will be education and training of young researchers because universities produce the next generation of researchers and academics in all fields. As new fields of knowledge arise and expand at the borderlines of traditional scientific disciplines, universities have to organize education and training of young academics in a way that combines a strong disciplinary basis with interdisciplinary work. This is the reason why - based on recommendations of the *Wissenschaftsrat* (Science Council) - the *Deutsche Forschungsgemeinschaft* (German Research Society) is financing slightly more than 300 *Graduiertenkollegs* (graduate schools) in German universities. In these institutionalized graduate schools, which are established under the responsibility of the university as an institution, not only under the responsibility of an individual department, and which include academics of research institutes outside the universities, formal doctoral studies are combined with the traditional individual work of preparing a doctoral thesis. The President of the Max Planck Society, Mr. Hubert Markl, asked the Max Planck Institutes on the occasion of the 50th anniversary of the society in February 1998 to get more committed in the field of education and training of young scientists and to assist universities in fulfilling this task by cooperation especially in - as he called it - international graduate schools. Universities as well as the *Deutsche Forschungsgemeinschaft* are interested in opening *Graduiertenkollegs* to international cooperation. Science and knowledge as well as training of young academics develop in international cooperation and competition. In March 1996, the Confederation of European Union Rectors' Conferences recommended to establish European Graduate Schools in universities and to finance those centers of excellence within the framework programme on research and technological development of the European Union.

3.4 Continuing Academic Education

Due to the globalization and the fast development, the acceleration of knowledge production in research and development, studies for a first degree are only the basis for lifelong learning or continuing academic education. Universities and higher education institutions have - as part of their service to the society - the task to improve the abilities of graduates of higher education institutions or qualified professionals by continuing education. There are some recent examples for cooperation between large companies and *Fachhochschulen* but also universities in order to train and retrain people from the labour market. Universities have to realize that because of this task the number of non-traditional students will increase. Universities have to offer specific programmes to those students who ask not only for a variety of courses and programmes in order to specialize or to be informed on the latest developments in narrow scientific fields but also for broad information and training combining various scientific fields due to the fact that problems do not arise according to the borders of traditional scientific disciplines.

3.5 Services to the Society

Traditional German universities offer their services to the society in all university hospitals being not only institutions of research and study but places of health care and the treatment of patients. The development in all fields of knowledge and science having become the main factor of innovation and production besides capital investment and workforce strengthens the role of universities as partners of industry and society. This concerns especially the field of transfer of knowledge and technology in the broadest sense.

Universities have to play their role as centers of innovation in their individual region in cooperation with research institutes outside universities and industry. Especially in the so-called new technologies like biotechnology, material sciences, microelectronics and computer science but as well in humanities and social sciences dealing with the main questions in changing societies, which are influenced by the globalization not only of economy, but also of information and culture, by tensions between global influences and regional cultural identity, it is obvious that universities serve the society in a very specific way. Their role in society is changing from being treasures of knowledge to becoming leading actors of innovation and change.

4 The Future of the Universities

A science-based society requires more and more high-qualified graduates prepared to solve problems by using scientific methods. In times of globalization of knowledge

and science, economy and society, universities as institutions are part of the cultural heritage of a country. They develop, expand and transfer knowledge. They have to be engaged not only in narrow, specialized fields, but in a broad sense including humanities and social sciences in order to avoid the announced "clash of civilizations" *(Huntington 1993)* and to cope with challenges of the society and the young generation described above.

Universities as scientific institutions have to ensure a frame for individual academics to enable them to fulfill their academic tasks as far as possible. If the development of knowledge and science is described as the expectation of the unexpected, universities have to serve for adequate conditions for thinking and working of academics and students as scientific work is done by individuals and teams.

Regarding this, universities are acting in a tension between freedom and responsibility of the individual academic on the one hand and institutional autonomy in a state-owned, state-run and state-financed system of higher education and research, where the freedom of science (in a broad sense) and fine arts is guaranteed in the constitution (Article 5 Paragraph 3 of the German *Grundgesetz*), on the other hand.

Defining the tasks of universities as teaching and study, research and development, education and training of young academics, continuing academic education and services to the society, the future of universities will be determined by three major developments:

4.1 Individuality and Cooperation

The development of universities will be determined by more individuality. Universities have to diversify and to develop specific individual profiles due to the fact that developments in different disciplines and the costs of research and development as well as of education and training will lead to a necessity of concentration. Regarding these tendencies, no university will be able to cover all fields of research and teaching at an internationally competitive level. Therefore competition between universities as institutions will become more intensive as a competition for the best academics, the best students, academic reputation, public and private funds.

Universities are not only responsible for their own development according to their institutional individualism but as a system in a given country - in Germany or even Europe, looking at the development of the European Union - also for the overall development of knowledge and science and the chances of the young generation requesting education and teaching. Hence universities have to cooperate, especially in specific regions, in order to optimize the range of courses for students and the cooperation in the other fields of university tasks as defined above. Therefore the

system of individual institutions of higher education will move towards networks of universities or university-systems within and across the borders of German federal states.

4.2 Specialization and Interdisciplinarity

Concentration on strengths in research and teaching and the development of individual profiles of universities require specialization on the one hand and interdisciplinarity on the other hand. 'Specialization will be inevitable' was one of the famous sentences of Max Weber already at the beginning of this century. Due to the new developments, the new fields of research and development arising on the borderlines of or between traditional disciplines in all fields of knowledge and science - from biology and brain research to cultural and social sciences - cooperation betweeen disciplines will more and more influence the development of research and study.

4.3 Internationality and Regional Responsibility

The future of universities will be determined by internationality in all fields and tasks, requiring mobility of students and staff, including administrative staff. Science and knowledge are orientated to international competition and standards. Academics in a given field compete in creating new knowlewdge, in expanding the borders of the discipline, in setting up hypotheses and theories and in their verification or falsification. Results of research are published in world-wide known and quoted journals, a tendency being strengthened by science citation index, impact factors and the various types of measuring results and output of the scientific process. As a consequence which is fostered by the development of multimedia-comunication academics work together with partners allover the world, this cooperation being a solid basis for institutional cooperation.

On the other hand the rapid developments in the labour market, the changes in society and the complexity of problems to be solved in community require answers based on well-known scientific methods and results. The local and regional needs ask for assistance in higher education institutions looked at as think-tanks not only in order to generate knew knowlegde but to be helpful in the given community or region. This is most important in university systems which are defined as state higher education systems financed as part of public infrastructure with tax-payers' money. But universities of course have to solve regional problems not by provincial methods but with proposals according to the "state of the art" in the required disciplines.

5 Strategic Development Planning

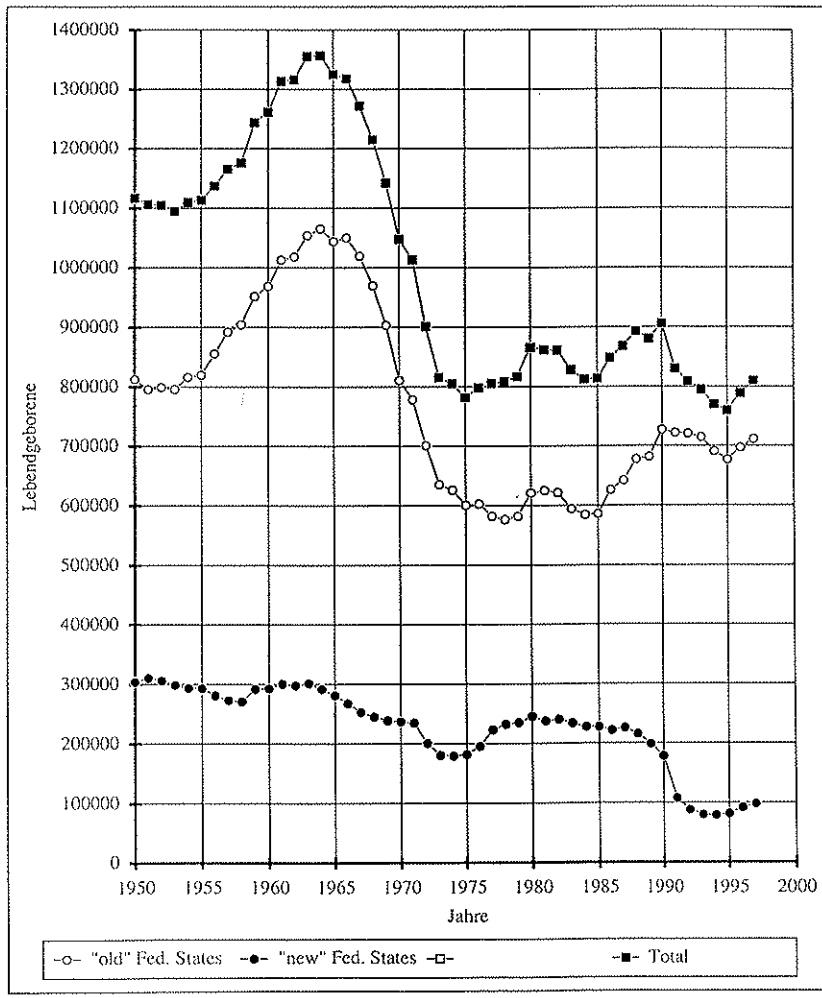
Universities are - as mentioned above - not only institutions of teaching and study but also institutions of research and development. Concerning the strategic development in research organization in universities it is necessary to look at three levels in research: the individual academic, the institute or the department and the university as an institution.

Research is done by academics in international competition for reputation and of course for public funds or research funds from whatever source. When universities are asked to "do more with less money", they are asked for more efficiency and effectiveness inside the individual university. On the other hand external research funding is of growing importance. Institutional funding of universities (see above) has been declining for years. As a contrast, the annual budget of the *Deutsche Forschungsgemeinschaft* (DFG), being the largest provider of research funds for the universities, has been increasing by five per cent per year since the beginning of the 90s. The *Hochschulrektorenkonferenz* as Association of Universities and other Higher Education Institutions in Germany has fully supported the political decisions of the Federal and States' Governments to increase DFG's budget in spite of the decreasing budget development in universities. Competition for peer reviewed research funds improves the quality of research and education and training of young academics.

Diversification and concentration in research within and between universities due to the development of disciplines and the cost of research will lead to individual profiles of universities in research by setting priorities. Each university has to concentrate on certain fields. Without additional funds the consequence will be to set up posteriorities. This is a challenge for university management and institutional strategic planning for research. This includes more intensive cooperation between universities and research funding agencies, especially the *Deutsche Forschungsgemeinschaft*.

Live-born children in Germany as well as in "old" and "new" Federal States 1950 to 1997

Quelle: BMBF: Grund- und Strukturdaten /Stat. Bundesamt



Higher Education Institutions in Germany 1996

Quelle: BMBF: Grund- und Strukturdaten 1997/98

90 Universities, among them 7 private ones

6 Teacher Training Colleges (in BW)

16 Colleges of Theology, run by the churches

46 Colleges of Music /Fine Arts, among them 2 private ones

146 Fachhochschulen - Universities of Applied Sciences, among them 40 private ones

305 Higher Education Institutions

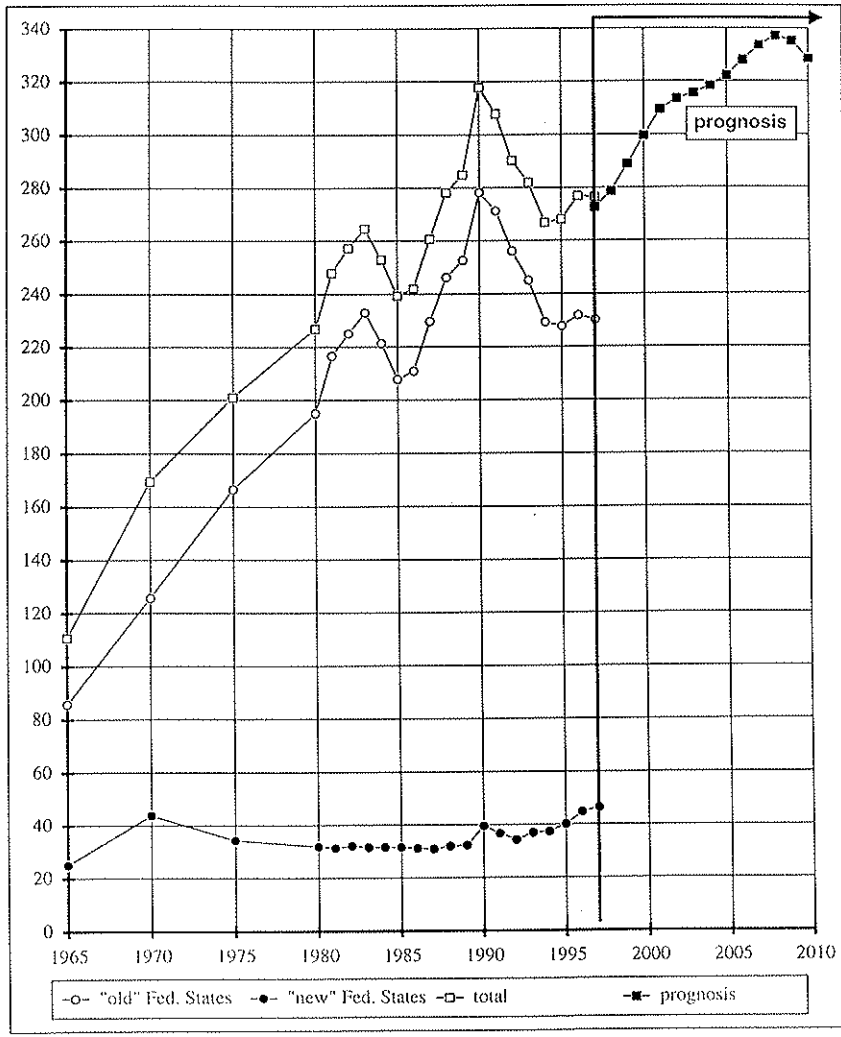
of which: 65 private HEI's, 39 of these run by the churches; in 1996: 7.700 first year students (=2,9 %); 39.100 students (= 2,1 %)

additional:

30 Colleges of Public Administration

First-year students 1965 to 1997 and prognosis 1997 to 2010 in thousands (with 75 % of secondary school graduates entering higher education institutions)

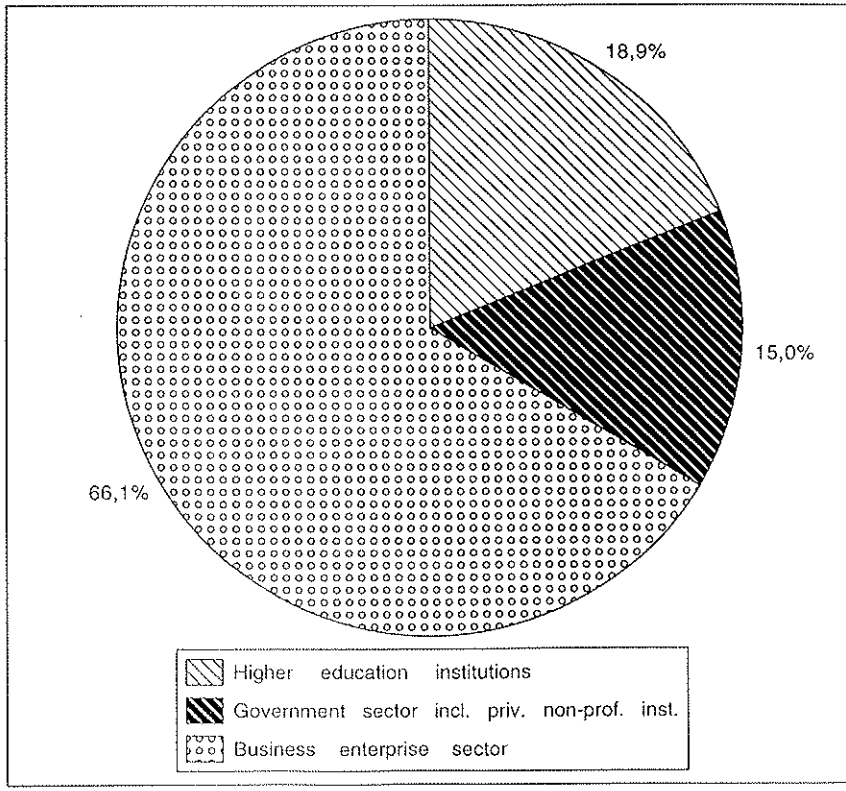
Quelle: Amtl. Statistik, eigene Erhebung,KMK



Gross expenditure on research and development by sectors of performance 1995 in Mio DM

Quelle: BMBF: BuFo1996, Tabelle II/3 © J. Lange

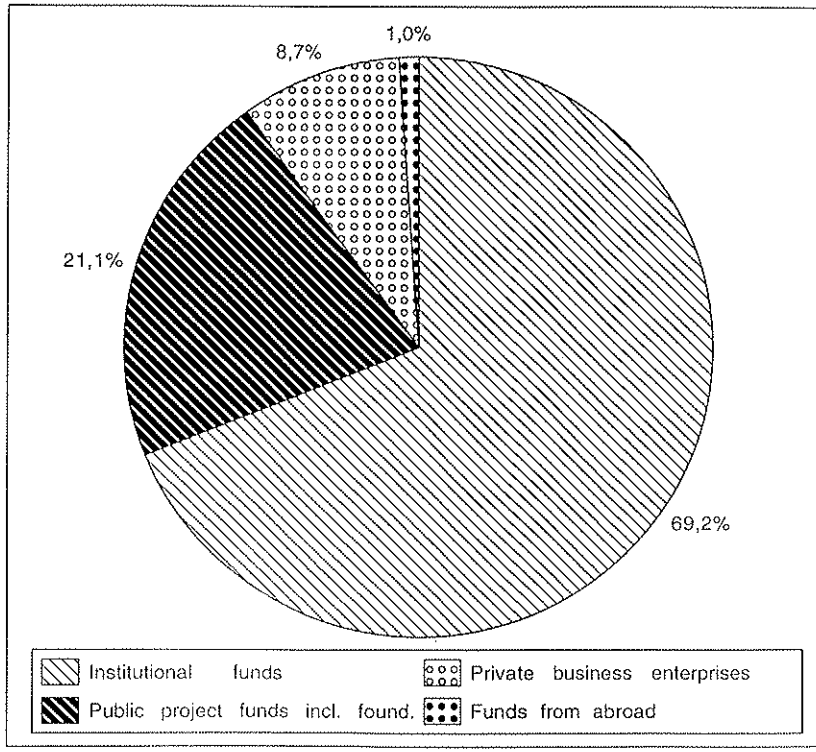
Higher education institutions	14900
Government sector incl. priv. non-prof. inst.	11800
Business enterprise sector	52120
Total	78820



Financing of Research and Development in German Higher Education Institutions 1995 according to Sources in Mio DM

Eigene Berechnungen nach: BMBF: BuFo 1996, Tabelle VII/3 © J. Lange

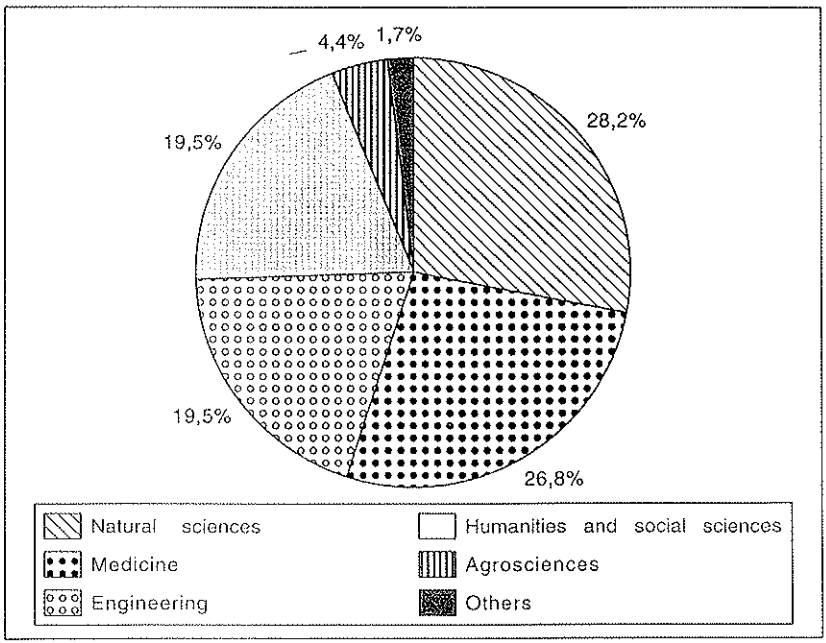
Institutional funds	10305
Public project funds incl. found.	3145
Private business enterprises	1300
Funds from abroad	150
Total	14900



Financing of Research and Development in German Higher Education Institutions 1995 according to scientific fields in Mio DM

Eigene Berechnungen nach: BMBF: BuFo 1996, Kap. II/8 © J. Lange

Natural sciences	4200
Medicine	4000
Engineering	2900
Humanities and social sciences	2900
Agrosciences	650
Others	250
Total	14900



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