Federal Ministry
of Education
and Research

Winning ideas.

Achievement Report of the Federal Ministry of Education and Research: Halfway through the 15th Legislative Period

Published by
Bundesministerium für Bildung und Forschung /
Federal Ministry of Education and Research (BMBF)
Publications and Website Division
11055 Berlin

Orders
In writing to the publisher
Postfach 30 02 35
53182 Bonn
Or by
Phone: +49 (0) 1805-262302
Fax: +49 (0) 1805-262303
(0.12 Euro/min.)
E-mail: books@bmbf.bund.de
Internet: http://www.bmbf.de

Layout
Heimbüchel PR, Köln/Berlin

Bonn, Berlin 2005

Printed on recycled paper

Federal Ministry
of Education
and Research

Winning ideas.

Achievement Report of the Federal Ministry of Education and Research: Halfway through the 15th Legislative Period

Leadership through innovation. This is the course this Federal Government has chosen. Successful efforts are being retained, necessary reforms are being tackled and suitable priorities are being set. Education and research now have top priority. Education generates employment, and research safeguards progress. This is the approach we need in order to be internationally competitive. It's also the approach we need in order to ensure that the next generation enjoys growth, prosperity, a stable public sector, national security and equal opportunity.

Germany's people are its most valuable resource. The skills, knowledge and commitment of our people are our real economic capital. One thing is clear: We can have innovation and progress only if our people are well-educated. We are doing everything to raise our overall educational standards – for our population as a whole and for our elites. We are working to mobilise all available talent – we cannot afford to waste anyone's gifts. This is especially true in light of our threatening shortage of specially skilled employees.

Success through education and research. With its Investment Programme for the Future of Education (Investitionsprogramm Zukunft Bildung), the Federal Government has launched the largest school programme the nation has ever seen. Our top universities are going to attract top minds from throughout the world, thereby making Germany an intellectual centre in the heart of Europe. Junior professorships are providing new options for our young scientists and scholars. Our Pact for Research and Innovation is harnessing the real potential of our research sector. And we are not hesitating to try unusual solutions and approaches where that seems appropriate. In particular, we are supporting technologies, processes and services that open up new growth areas. We are promoting efforts that create jobs and enhance our quality of life. In our own "Silicon Valley" in the Dresden area, for example, we've created some 20,000 new jobs. The environmental protection sector now employs 1.5 million people in Germany.

When we look back on the goals we set for ourselves in 2000, we find every reason to be satisfied. We have accomplished a great deal. Now – mid-way through the legislative period – we can list and outline the successes we have achieved with **winning ideas.**

Edelgard Bulmahn, Federal Minister of Education and Research

Contents

Strong in education and research – internationally successful through innovation

Germany needs a highly effective, innovative research and education system. Research produces ideas for new products, along with concepts for enhanced processes and innovative services. Education is the key to the employment market, the basis for producing adequate numbers of skilled people and, thus, the foundation for top-quality research.

With its Agenda 2010, the Federal Government has initiated an indispensable, trailblazing reform process – also with the aim of creating latitude for investments in our future. In 2005, the BMBF's funds for education and research will show an increase of some 36.5% over their 1998 level. As a result, we are nearing the following aim set by European heads of state: by 2010, investing three percent of our gross domestic product in research and development and becoming the world's leading knowledge-based region.

In 2002, the Federal Government established five central goals for education and research:

1. **Promoting and challenging talent – achieving equal opportunity.**

2. **Modernising education and research structures – promoting quality for international competition.**

3. **Promoting technologies for new markets – creating jobs with a future.**

4. **Research for people and the environment – shaping a future truly worth living.**

5. **Strengthening centres of growth – moving eastern Germany ahead through education, research and innovation.**

In the past two years, we have worked toward these goals by modernising relevant structures and frameworks and charting a course for success in research and innovation. Our success is clear. The Dresden area's "Silicon Valley" of the east has created 20,000 new jobs – 10,000 directly and 10,000 indirectly. Other success stories are still in the process of being written – for example, nation-wide introduction of all-day schools. And other reform projects – such as our top-class universities and the Pact for Research and Innovation – are awaiting systematic implementation. As a result, Germany is becoming strong in education and research, and it is achieving success through innovation. With our efforts, we are protecting our long-term prosperity and employment outlook.

Promoting and challenging talent – achieving equal opportunity

Knowledge is more than simply power. It enhances opportunities in the employment market. It provides orientation in a world that is steadily growing more complex. These are the reasons why we want knowledge to be shared on a broad basis.

1. All-day schools: Early encouragement awakens talent

In 2002, we set ourselves the aim of promoting the earliest possible individual guidance and encouragement in children's education.

Why?

The PISA study, providing an international comparison of pupils' capabilities, found that Germany ranks considerably below the OECD average. The result: Our children are not as good as they should be in reading, writing and math. This is especially true of children of immigrants.

In no other country does social background play such a strong role in deciding educational success. When it comes to obtaining a higher-education access qualification, the chances of children from socially disadvantaged families are much lower – by a factor of four – than those of other families.

We screen and select children much too early. The 2004 IGLU study of reading in primary school found that nearly half of all pupils receive the wrong school-track recommendations when they complete fourth grade.

In the 2002/2003 school year, only 9.6% of all pupils were able to attend all-day school. And yet the great majority of all Germans are in favour of introducing all-day schools on a large scale. A lack of child care is one of the reasons for Germany's especially low birth rate.

Here's what we've been doing!

Promoting all talents early and individually. The Federal Government was quick to respond to the PISA study's findings, and it launched the largest school programme the nation has ever seen. Through 2007, the Federal Government will provide a total of €4 billion for establishment and expansion of all-day schools. In the 2004/2005 school year, a total of some 3,000 pupils, throughout all of Germany's Länder, will profit from the relevant funding. Schools that wish to become all-day schools are being given support and advice for their plans. The BMBF's supporting programme is helping local players to learn from successful examples of new all-day schools, to exchange relevant information and to form regional networks. What is more, the BMBF is supporting research aimed at showing how expansion of all-day schools and development of suitable concepts can best succeed. All-day schools provide time for more: time for individualised support, time for social learning.

Better in reading, writing and math. In SINUS, the BMBF and the Länder have created a programme designed to make science and mathematics instruction more efficient. At present, SINUS is being implemented at 730 schools, in 13 different Länder. In 2005, the programme's second wave will reach several thousand schools. To spark pupils' interest in the natural sciences, the programmes *Physics in Context* and *Chemistry in Context* are being launched. To help pupils improve in reading, the BMBF and the Länder have established an "action framework" in "reading culture". And particular attention is being given to children and young people from immigrant families. In September, a special programme of the Bund-Länder Commission for Educational Planning and Research Promotion (BLK) will start that is aimed at the central obstacle such children face in school and the workplace: reading and writing German.

Promoting talent. To this end, each year the BMBF holds major competitions such as the "Jugend forscht" youth science project contest and the "Bundeswettbewerb Fremdsprachen", a national competition in foreign-language skills. In the 2003/2004 school year, a total of 250,000 pupils entered such competitions oriented to academic achievement. In 2004, Germany hosted the Chemistry Olympics, which attracted 500 competitors, from 61 different countries. At the BMBF's initiative, an unprecedented study of talent promotion throughout Europe is now underway.

Understanding thought. The lead vision *Understanding thought (Das Denken verstehen;* cf. p. 34) has been undergoing implementation since August 2003. This fall, the BMBF will establish four centres for computer-aided neurosciences in which scientists from a range of different fields, including biology, medicine, physics, mathematics and computer science, will work together in studying how the human brain processes enormous amounts of information. The results will be applied toward development of new teaching and learning strategies, as well as toward treatment of brain-function disorders, such as dementia. Another aim of the support is to produce results that can be applied to technical systems such as robots.

Creating gentle transitions. The first day of school (for which German schoolchildren each get a big cornucopia of sweets) and the first day of gainful employment are important events in any person's life. To ease children's transitions from kindergarten to primary school, the BMBF plans to join with the Länder in testing curricula in kindergartens and in searching for ways to enhance cooperation between kindergartens and primary schools. The programme *School-Industry-Working Life (Schule-Wirtschaft-Arbeitsleben)* is aimed at transitions between the classroom and the workplace. To date, some 32,000 pupils and some 2,400 companies have taken part in it.

2. Setting standards: recognising strengths and weaknesses

In 2002, we set ourselves the goal of making Germany one of the top five countries, in education, within 10 years.

Why?

Germany lacks systematic quality assurance oriented to all educational areas, including kindergarten, primary school, vocational training, higher education and the workplace. We have not been measuring our schools' performance and systematically keeping track of what skills they impart. And yet countries that did well in the PISA study were early in establishing educational standards, educational research and educational reporting programmes.

Here's what we've been doing!

Introducing nation-wide educational standards. The Federal Government initiated a relevant study that received a great deal of international attention: *On the development of national educational standards*. The Länder are now using this study as a basis for developing educational standards, and the overall effort is introducing a major change in Germany's school system. Under the old system, curricular plans described what children were required to learn. Now, such plans will outline what both schools and pupils are required to accomplish.

Reporting on education. In March 2004, the Federal Government and the Länder agreed to report regularly and jointly on education in all its phases, from kindergarten to continuing vocational training. The resulting national reports on education, of which the first will appear in November 2005, will highlight the strengths and weaknesses of our education system.

Asking the right questions. We still know too little about the transitions between school, training and the workplace. How, and under what conditions, can people acquire necessary skills they failed to acquire the "first time around"? The Federal Government is providing effective, lasting support for empirical education research by improving the relevant framework and by promoting young scientists.

3. Giving all young people the opportunity to train for an occupation

In 2002, we set ourselves the goal of giving all young people the opportunity to obtain vocational training.

Why?

Completed vocational training enhances a person's employment opportunities and ability to participate in society as a whole. People without any vocational training face much higher risks of unemployment. As of the end of July 2004, the number of reported in-company training places was 25,000 lower than it was in the previous year. This situation is going to worsen in the coming years, when the labour market will be flooded with large numbers of young people.

At the same time, the experts are also predicting that by 2015, up to 3.5 million skilled workers will be lacking among people between the ages of 30 and 45. Unless we act now, we will not be able to counter this emerging shortage of qualified, skilled people.

Here's what we've been doing!

Setting a good example. In 2004, the Federal Government will offer 20% more young people than in the past an opportunity to undergo training in the federal administration. The BMBF itself has increased its number of training places by nearly 24% since 2002, and it marked an increase of some 7% in this area this year.

Taking industry at its word. The current situation shows that appeals are not enough. For this reason, the parties in the governing coalition have introduced legislation to protect vocational training, the Draft Law on Securing Vocational Training (*Berufsausbildungssicherungsgesetz*). The result: A pact on training. Industry has made a voluntary commitment, lasting for three years, to create a total of 90,000 training places and to enable 75,000 young people to complete work placements. Now it must keep its word.

An aggressive campaign for training. With annual campaigns and tours for training, the Federal Minister of Education and Research and the Federal Minister of Economics and Labour fight for each and every training place. The main focuses of the 2004 training campaign are sectors with enormous potential for growth, such as nanotechnology and biotechnology.

Using money efficiently. This year, the BMBF has increased funding for the STARegio programme, which improves regional training structures, from €4 to 6 million. The overall budget through 2007 is being increased by 50%, to €37 million. In light of the success achieved by 183 *"Training place developers for eastern Germany" (Ausbildungsplatzentwickler Ost)*, and of the difficult situation in western Germany's training sector, this year the BMBF is providing support for up to 60 training place developers for western Germany. In Germany's new Länder, the training place developers have been generating an average of 17,000 new training places per year.

Taking new approaches. To provide added incentive to offer training, in 2003 the Federal Government suspended the Instructor Aptitude Ordinance (*Ausbildereignungsverord-*

nung) for five years and lowered the minimum wage for trainees to €325. The BMBF supports the KfW's *"Training sponsorship commitments" (Patenschaften für Ausbildung*) programme, via which companies sponsor additional training places. Over the past ten years, the number of foreign owners of companies in Germany has nearly doubled. The BMBF has responded to this trend by joining with the Association of German Chambers of Industry and Commerce (DIHK) to establish an agency for co-ordinating training in foreign-owned companies. To date, this agency has already created 4,500 training places.

Awakening all talents. To ensure that disadvantaged young people also receive training opportunities, the BMBF is supporting the programme *Promoting skills – vocational qualification for young people with special support needs (Kompetenzen fördern – Berufliche Qualifizierung für Jugendliche mit besonderem Förderbedarf*). With EU support, this effort will provide some €60 million by 2006.

4. Skills with a future

In 2002, we set ourselves the aim of making our vocational training system more modern and capable and enhancing ease of transfer and movement between its various areas.

Why?

Requirements pertaining to skilled employees have changed profoundly. They have grown as a result of increasing globalisation and changes in industrial and societal structures. New occupations have emerged for which no training ordinances have yet been established. The process of modernising occupations has often taken too long. The Vocational Training Act (*Berufsbildungsgesetz*) has hardly been changed over the past 30 years.

Not all persons meet requirements for training right away or find in-company training places after they finish their schooling. And we need to consider new approaches for reducing the unemployment rate among persons between the ages of 15 and 24, which was nearly 10% in 2002.

Here's what we've been doing!

Creating better opportunities. The BMBF has tackled the most extensive reform of the Vocational Training Act to date. Vocational training is becoming more modern and international and is offering greater ease of transfer between its various areas. Young people who fail to find training places, and thus learn occupations not in companies but in inter-firm training centres, will be able to take Chamber examinations. This will ensure that 60,000 affected people do not have to take needless repeat examinations. The BMBF is accelerating the pace of modernisation. Proposals for modernised and new occupations that open up new training opportunities and provide good employment perspectives will be implemented within one year, even in cases in which the social partners (employers' and employees' representatives) are unable to reach a relevant consensus. What is more, trainees can work toward their qualifications internationally. Better credit is now being provided for work carried out abroad toward vocational qualifications: Soon, German trainees will be able to spend up to 25% of their training periods abroad. To date, some 40,000 young people have spent part of their training periods outside of Germany, with support from national or European programmes.

Modern occupations in a modern country. Since 1998, some 160 occupations requiring formal training have been either introduced or adapted to the requirements of a changed, globalised economy. Of these occupations, nearly 60 have been introduced or adapted in this legislative period. Over half of all young people with training places are learning one of the new occupations.

One, two or three years. The Federal Government has expanded the range of qualification programmes with varying durations, in order to take better account of different types of talents. New two-year training programmes have been introduced that are especially suited for young people with poorer initial opportunities. A new twist has also been added – a guaranteed continuation: The two-year training programmes can be credited toward three-year

programmes. And young people who fail to find a training place can spend a year acquiring an entry-level qualification. Companies who offer such opportunities receive monthly subsidies of €300 from the Federal Government. Such preparatory periods can be credited as part of a formal training period, and the relevant qualification components are formally defined by law.

Education without barriers. The BMBF has committed itself to making it easier for people to move from the workplace into higher education. An education system's real effectiveness can be seen in its transition points. In 2003, we issued a relevant declaration in co-operation with the German Rectors' Conference (HRK) and the Conference of Länder Ministers of Education and Cultural Affairs (KMK). Together, we recommend that universities award credit for qualifications earned in occupationally related continuing education. We now plan to take action on this recommendation. The advantage is obvious: Persons who wish to move from the workplace into college, to obtain additional qualifications, will no longer have to undergo individualised review. Instead, they will profit from standardised procedures that provide direct access to higher education studies.

5. Making higher education possible: The same opportunities, today and tomorrow

In 2002, we set ourselves the goal of increasing new enrolments in higher education.

Why?

Throughout the OECD, an average of 47% of each (year) age group go on to higher education. Since 1998, the relevant figure in Germany has increased by eight percentage points, to 36%. In the long term, this level will still not suffice to meet the needs of a highly technological industrialised nation. What is more, too many young people in Germany – 27% of all those who begin university studies – fail to complete their studies. One of the reasons: Many young people, after completing their schooling, take too little time to familiarise themselves with their chosen field of study.

Here's what we've been doing!

Provide support where it is needed. The Federal Government has reformed the Federal Training Assistance Act (BAföG) and palpably enhanced incentives for enrolling in higher education. New enrolments in higher education were up by 62,000 in 2003 over their level in 2000. From 2002 to 2003, the number of students receiving support grew to a total of 326,000. Over two-thirds of all those receiving assistance under the Federal Training Assistance Act (BAföG) reported that they would not have been able to begin their studies without such financial assistance. In addition, the BMBF introduced an electronic BAföG calculator, in the 2002/2003 winter semester, that any person can use to quickly and easily calculate how much support he or she is likely to receive – and then complete the relevant application online.

Giving students education loans instead of taking their savings. We have introduced education loans. Flexibly and user-friendly, they provide funding to meet short-term needs. To date, a total of 36,600 such loans, totalling some €185 million, have been awarded. And the demand is growing. 50% more loan agreements were concluded in 2003 than in the previous year. This positive trend has continued this year.

Letting the universities decide. The Federal Government has strongly supported nationally standardised regulations that in future will allow universities to select more of their students themselves. Soon, they will be able to select most of their students in admission-restricted subject areas such as medicine, psychology and biology. While 20% of study places are reserved for those persons who do best in each year's Abitur university entrance qualification examinations, 60% of study places will be left up to the universities' own discretion.

6. Equal opportunity on all levels and floors

In 2002, we set ourselves the goal of ensuring that women enjoy equal opportunity in science and industry.

Why?

Too few girls and young women choose occupations that offer attractive opportunities for upward mobility. Females account for only one-fourth of all those who learn and study IT and media occupations. Only 20% of all new students in engineering sciences are women.

While women outperform the average in the qualifications they earn, they are underrepresented in managerial positions. It simply makes no economic sense to let their potential go to waste.

While 12% of all men go into business for themselves, only 6% of all women start their own companies.

Here's what we've been doing!

Tapping the potential in our women. The new "junior" professorships are increasing the percentages of women in higher education teaching. Women now hold one out of every three junior professorships. By contrast, women account for only 13% of all professorships – although this figure is up from 9.5% in 1998. Since women account for fully 36% of all persons who earn doctorates, the current relatively low percentage of female professors cannot be accepted as the last word. This is why the BMBF continues to fund programmes aimed directly at supporting tomorrow's female leaders and managers.

Top in research and teaching. The BMBF has introduced an absolutely unprecedented women's career counselling programme. The *"Springboard to Advancement" (Anstoß zum Aufstieg*) programme coaches women who seek managerial positions in science and research, and it is now grooming a total of 1,000 female scientists for (junior) professorships. In addition, each year the BMBF invests over €15 million in *Equal opportunity for women in research and teaching (Chancengleichheit für Frauen in Forschung und Lehre*), a Federal-Länder programme aimed at helping women prepare for doctorates or professorships. The centre of excellence for women in science (CEWS), founded in 2000, also provides information and services.

Power for pioneering women. This year marked the launch of the nation-wide *Agency for women's start-ups (Gründerinnenagentur*), for which the BMBF is providing €1.2 million in support. A total of over 850 women have turned to the agency for advice in its first three quarters (of a year) of operation.

Awakening interest. The BMBF invests a great deal of time and money in awakening girls' interest in science and technology. The "Girls' Day" programme, for example, in which over 108,000 girls took part in 2004, is aimed at awakening girls' interest in new and emerging occupations. In addition, the BMBF is providing €3.1 million in support, through 2005, for the *Centre of excellence for women in the information society and in technology (Kompetenzzentrum für Frauen in Informationsgesellschaft und Technologie)*. And from 1999 to the end of 2003, a total of 150,000 women received training in Internet use in the framework of the initiative *Women going online (Frauen ans Netz)*.

7. Learning – all your life

In 2002, we set ourselves the aim of making the ideal of "lifelong learning" a realistic option for all people.

Why?

In 2010, 80% of the entire workforce will hold qualifications that are more than ten years old – at a time when 80% of all technologies will be less than ten years old. And the intervals at which knowledge becomes obsolete are constantly growing shorter.

People should not stop learning simply because they have completed their schooling, training or studies, since learning is the key to acquiring qualifications – and, thus, to making the best of individual life and work opportunities. Lifelong learning is a strategy for strengthening cohesion in our society and reducing isolation and exclusion.

Here's what we've been doing!

Financing lifelong learning. A *Commission of experts on financing lifelong learning*, an independent commission appointed by the Federal Government, presented its report in July 2004. Now, the Federal Government will review the commission's proposals, which include ideas such as educational savings programmes (*Bildungssparen*) modelled after the well-known home-construction savings programmes (*Bausparen*). The Federal Government is already promoting individual learning via the Federal Training Assistance Act (BAföG), the Upgrading Training Assistance Act (= *Meister-BAföG, Aufstiegsfortbildungsförderungsgesetz*) and the services set forth in the codes of social law. And new income-tax laws have been in force since last summer under which taxpayers may declare up to €4,000 in vocational training expenditures each year as deductible special expenditures.

Promoting skilled employees. In 2002, we extended the Upgrading Training Assistance Act, and since then the number of persons receiving relevant support has more than doubled. Available support has been increased especially for families, single parents and start-up entrepreneurs. As a result of the increases, since 2002 the number of women undertaking continuing education, earning a master-craftsman qualification or going into business for themselves – and receiving support under the Upgrading Training Assistance Act – has grown by 57%. Last year, the BMBF supported some 122,000 participants in continuing education and awarded support amounting to €388 million. Furthermore, last year the Federal Government introduced education vouchers (*Bildungsgutscheine*) for continuing vocational training and, as of 1 July 2004, issued an ordinance on certification of such training (*Anerkennungs- und Zulassungsverordnung*).

Lifelong learning. The Federal Government and the Länder are pursuing a joint strategy for lifelong learning. Germany plans to participate in a study, comparable to the PISA study, that assesses skills of adults. In 72 "*Learning Regions*", located throughout the country, the BMBF has set up networks that facilitate lifelong learning – in both national and European educational contexts. Already, ten regions are co-operating with European neighbouring regions, and 12 "learning regions" are taking part in the EU's "R3L" lifelong learning initiative.

Quality of continuing education. English in Malta, mediation in Munich, IT in Itzehoe – there are many different opportunities to learn something new. Both general and vocational continuing education must meet certain minimum requirements, however. For this reason, the Federal Government has requested the Stiftung Warentest consumer advocacy organisation to develop tests for continuing education programmes – after the model of the Technical Safety Standard Authority (TÜV) certifications found on a range of products.

Modernising education and research structures – promoting quality for international competition

To be internationally competitive, Germany needs programmes with international reputations, qualifications that readily lend themselves to international comparison and a strong European and international orientation.

1. Top-class universities with international reputations

In 2002, we set ourselves the aim of making our universities and research institutions internationally known centres of education and research.

Why?

In addition to a solid base of universities offering high-quality programmes for large numbers of students, Germany also needs elite universities with world-wide reputations that can attract students and leading academics and scientists from around the world. German universities need to acquire international reputations that compare with those of top universities such as ETH Zurich or Oxford University.

When qualifications are internationally comparable, students can more easily transfer to German universities. Conversely, German students will have less incentive to gain international experience if they know their home universities will not recognise the work they do abroad.

Here's what we've been doing!

Top-class universities can attract top minds. In January 2004, the Federal Government announced it would begin supporting top-class universities. A total of €1.9 billion, over a five-year period, is being provided for development of graduate schools, clusters of excellence and selected top-class universities; three-quarters of this funding are being provided by the Federal Government. Funding for relevant competition has been budgeted. Support is to begin in 2006, and competition for "top-class university" status is to begin in the coming year. Commencement of the competition now depends solely on the Länder.

Moving the Bologna process ahead. At a September 2003 meeting in Berlin, education ministers from 40 different countries adopted key resolutions aimed at creating a unified European higher education region by 2010. By 2005, each participating country is called on to create structures for a two-stage bachelor's/master's degree system, and for internal and external quality assurance at universities, and each is expected to introduce a system for evaluating achievement under an EU-wide point system. Germany has taken a major step for-

ward in this area. In the 2004/2005 winter semester, German universities are already offering over 2,560 bachelor's/master's degree programmes, many of them in English.

Measuring performance. The Federal Government has commissioned the Science Council to develop standards for rankings. Rankings provide orientation for potential students from both within Germany and abroad. The Science Council will present its recommendations in November 2004.

Supporting practically oriented research. In 2003, the BMBF focussed the *FH*^{3} programme (applied research at universities of applied sciences, in co-operation with industry) on technologies for new markets and on modernised education and research structures. Relevant demand has greatly increased as a result. A total of over 1,400 co-operation partners applied for funding totalling €130 million and mobilised some €40 million funding of their own.

2. More research for the money

In 2002, we set ourselves the aim of making our education and research system more modern and capable and more flexible in terms of ease of transfer between its various areas.

Why?

Research in Germany needs to become more efficient. Seen in an international light, Germany's research institutions still engage in too little competition among themselves. The country's complex research sector needs to develop a tighter system of networks. Co-operation between university and non-university research institutions is one way of meeting this need.

Support for young scientists needs to be further improved – also with the aim of protecting Germany's international competitiveness. The Federal Government is aiming to double the number of junior research groups in research institutions by 2010.

Here's what we've been doing!

Pact for research and innovation. The Federal Government has offered major non-university research organisations a pact for research and innovation. The pact offers them a reliable planning basis and annual 3% funding increases through 2010, working out to some €100 million in additional funding per year. In return, we expect universities to carry out additional measures to increase their efficiency and performance. More competition within and among organisations will promote a focus on excellence. Young scientists and academics – including outstanding women scientists and researchers – need to be given better support. We need a forward-looking strategy for developing new research areas. We also need to have the courage to pursue even risky, unconventional research approaches. And non-university research institutions, universities and industry need to co-operate more intensively. We have already made progress in these areas. For example, 77% of the Fraunhofer-Gesellschaft's directors have been appointed in co-operation with universities, and the corresponding figure for the Helmholtz Association will soon reach 88%.

Improving quality. The BMBF has been supporting the idea of making regular evaluations a basic instrument in quality assurance in research institutions. This fall, following an evaluation of the country's major research organisations, a review of specific ministerial research tasks will begin, at the request of the Federal Government.

Modern salary scales in science and research. The Federal Government has taken decisive steps for modernisation of salary scales and employment terms at universities and research institutions. In the last legislative period, it laid the foundation for a merit-oriented professorial salary system. In addition, the Federal Government has negotiated with the re-levant partners regarding collective-bargaining laws suited to the special needs of the science sector. Although the Länder have withdrawn from these negotiations, the BMBF still con-siders reform in this area to be long overdue.

Funding large-scale scientific equipment. In keeping with recommendations of the Science Council, the Federal Government has decided to introduce a new generation of large-scale

scientific equipment in Germany: The HALO research aircraft; the HLD high (magnetic) field laboratory in Rossendorf (near Dresden); the X-FEL free electron laser at the DESY facility in Hamburg; the conversion/upgrade for DESY's PETRA ring accelerator, which will produce one of the world's most advanced synchrotron-radiation sources (making DESY, including X-FEL, an international centre of excellence for interdisciplinary research); and expansion of the GSI in Darmstadt.

3. Young researchers: independent and successful

In 2002, we set ourselves the aim of enabling our young scientists to be internationally competitive.

Why?

Germany needs top-quality people in all areas. Talented young scientists must be prepared, via efficient support and early independence, for later leadership in science, industry, culture and society. This process includes promoting our own talented people, providing incentives for top German scientists to return from abroad and making Germany attractive for top foreign scientists.

Here's what we've been doing!

Junior professorships as springboards. The Federal Government has introduced "junior professorships". They give scientists and academics the opportunity to conduct independent research and teaching beginning in their early 30s, rather than having to wait until they are 40. The ruling handed down by the Federal Constitutional Court in July 2004 does not call junior professorships as such into question. The Federal Government is thus planning to introduce relevant new legislation in the near future that will provide a reliable legal basis, also in the area of laws governing time limitation (*Befristungsrecht*). The BMBF is making €180 million available in this area, enough to support about 3,000 junior professorships. Ten of Germany's 16 Länder have already included the "junior professorship" in their state law. A total of 14% of the junior professors appointed to date have come from abroad – and many are German returnees.

Structuring the path to a doctoral degree. Each year, we invest well over €46 million in structured education for doctoral candidates, in various programmes of the BMBF and the German Research Foundation (DFG). Most of these programmes have an international orientation. They enhance the attractiveness and competitiveness of doctorates earned in Germany. For example, the 26 international Research Training Groups that the BMBF supports, via the DFG, are programmes that, in each case, enable a group from a German university to join with a partner group abroad in earning doctoral degrees. In addition, 29 International Max Planck Research Schools have been initiated, with the support of the BMBF.

Attracting top young researchers. The BMBF has introduced the largest prizes for young scientists that Germany has ever seen. The Wolfgang Paul and Sophia Kovalevskaya prizes attract top foreign scientists to Germany. A total of 300 young scientists are now active in working groups led by 43 foreign winners of these prizes. In all likelihood, over one-third of the Paul-Prize recipients, and two-thirds of the Kovalevskaya-Prize recipients, will remain in Germany for the long term.

Excellence in funding programmes. The BMBF is increasingly using its funding programmes as a vehicle for qualifying young scientists. For young biotechnology researchers, it has introduced the *BioFuture* prize, worth an average of €1.5 million. Winners of this prize, who may not be older than 39, are en-

abled to conduct research of their own choosing, with their own research groups. To date, a total of 20 recipients of this prize have received appointments at renowned national and international universities. In addition, BioFuture has produced 11 companies; these have hired a total of over 250 highly qualified persons and have mobilised more than €80 million in private capital. Similar programmes are in place in the nanotechnology and optical technologies sectors.

4. Exchanges with the world: boundless knowledge

In 2002, we set ourselves the aim of making our universities more attractive in an international context.

Why?

To succeed in a globalised world, we must be able to attract and keep top people in the long term. By remaining in Germany, foreign graduates of German universities could significantly strengthen the country's academic workforce – thereby enhancing universities' and research institutions' innovation resources.

Top students profit greatly from study abroad. Today, too few Germans gather international experience during their studies or working life. The BMBF's aims in this area, to be achieved by 2008, call for foreign student enrolments to grow to 10% of our student bodies, and for 20% of all German students to spend at least one semester studying abroad.

Here's what we've been doing!

Looking beyond our borders. We have improved working conditions for researchers and provided attractive relevant offerings – especially for young scientists. The new Immigration Act, initiated by the Federal Government, provides reliable perspectives for internationally leading scientists and researchers. This effort has reversed the trend in this area. Now, 85% of all recipients of grants of the German Research Association (DFG) return to Germany. Many foreign scientists express a desire to continue working in Germany after their initial stay is over. In the 2002/2003 winter semester, the *"Brain Gain instead of a Brain Drain"* initiative increased the numbers of foreign students by 10%; in the current semester, over 163,000 foreigners are studying in Germany. This figure is 51% higher than the comparable figure for the 1998/1999 winter semester.

Gaining experience abroad. The Federal Government has made Germany a leader in internationalisation. Beginning in their 2nd semester, students can now study abroad without financial assistance from their parents – they can take the support available to them under the new Federal Training Assistance Act with them throughout the EU. Under the EU's Socrates programme, some 18,500 Germans per year are now transferring to other European countries for studies. In addition, at the beginning of the legislative period, the BMBF introduced the "GoEast" initiative, aimed at establishing a balance in exchanges with eastern and south-eastern European countries.

Advertising Germany as a centre for knowledge. Working in co-operation with the German Academic Exchange Service (DAAD), the BMBF promotes the establishment and expansion of networks of young German scientists abroad, with the aim of sparking interest in returning to Germany. At the same time, the BMBF has launched the programme "*Export of German study programmes" (Export deutscher Studienangebote)*. This has led to the development of 29 projects, ten of them in Asian countries. On 5 October 2003, the German University in Cairo – an institution also charged with promoting exchange with the Islamic world – opened its doors. In 2004 alone, the BMBF provided funding totalling €14 million for the Kovalevskaya prize (cf. p. 20), for professional marketing of universities and for German study programmes abroad. Originally, these programmes were to run only until the end of 2003, but their great success has prompted the BMBF to extend the relevant support.

5. Building on strengths: Europe as a centre of knowledge

In 2002, we set ourselves the aim of making the European research area a reality.

Why?

At their meeting in Lisbon in 2000, the heads of European Member States set themselves the aim of making Europe the world's most competitive and dynamic knowledge-based economic area by the year 2010. From 1991 to 2002, Germany increased its private and public R&D expenditures by 40%, while the 15 (at that time) European Member States increased their expenditures by 58%. Other countries invested even more, however: the U.S. increased its R&D expenditures by nearly 72% during the same period.

Here's what we've been doing!

Sharpening the profile of European research. For the EU's Sixth Framework Programme for Research and Technological Development (FP6), the Federal Government increased Germany's participation to 20%, up from a German participation level of 18.1% in FP5. With a budget totalling some €20 billion until 2006, FP6 is the world's largest research-funding programme. German universities, research institutes and companies are involved in over 80% of the programme's research projects, which are selected by international experts. Thanks to effective advising and good co-operation between players from science and industry during the preparatory phase, Germany's share of the research funding has grown to about €1 billion per year.

Reaching for the stars. The Federal Government has successfully promoted intensified co-operation between the European Space Agency (ESA) and the European Union. For example, in GALILEO, a key future-oriented project, it has attracted the industrial leadership and headquarters of GALILEO Industries to Germany. Another ESA-EU joint initiative is GMES – Global Monitoring of Environment and Security, a project for remote earth observation. Germany has secured a leading role in two of the new services being developed. The importance of new forms of co-operation with industry, in public-private partnerships, has been growing overall.

Magic hours for high technology. Support for civilian space programmes supports high technology. For example, a camera developed by the German Aerospace Center (DLR), with BMBF funding, played a key role in the outstanding result of the European Mars-Express mission: proof of the existence of water ice on Mars. In TerraSAR, Germany has launched the first civilian mission for space-based earth observation using radar. And with the "RapidEye" satellite system, the Federal Government has established a further national satellite project, on the basis of existing key competencies in Germany. RapidEye is to commence in 2007, with a total of five satellites. The new satellites, which are equipped with optical cameras, will have the unprecedented capability of being able to take pictures of any point on earth on a daily basis. The resulting images will be useful in a wide range of applications – for example, in documenting crop damage. In addition, national and international organisations will be able to use the satellite data to monitor compliance with environmental agreements or to co-ordinate humanitarian aid following disasters.

Promoting technologies for new markets – creating jobs with a future

New technologies provide opportunities. Our economic future depends on how decisively we recognise such opportunities and make use of them on the world market. Research policy plays a key role in sparking the relevant process – and in making Germany a leading location for innovation.

1. Promoting efforts that create jobs!

In 2002, we set ourselves the aim of encouraging innovation, by promoting capable, effective research.

Why?

Germany faces constantly increasing international competition. We need innovation and top-quality research, to provide the basis for growth and employment. Without innovation, we will lack secure jobs – which are the basis for sustained prosperity and social peace.

Here's what we've been doing!

Creating jobs with a future. The BMBF orients its support to technologies and processes that exert especially powerful economic leverage. It invests some €500 million annually on promoting technologies that create jobs with a secure future, that protect and build on technological leadership and that support companies – especially small and medium-sized enterprises (SMEs) – in developing new growth fields. In so doing, it places a clear emphasis on health-care research and on new technologies. In the 2005 budget, funds for project support have once again been increased over their level from the previous year. Since 1998, the BMBF has increased funding for project support by more than 30%.

Developing new growth fields. Since 1998, the BMBF has increased its funding for nanotechnology projects fourfold. In March, the initiative *"Nanotechnology conquers markets"* was launched. Roughly speaking, the U.S. and Europe each have approximately the same number of companies with an orientation to nanotechnology. Significantly, half of the relevant European companies are from Germany, which is the European leader in this area. Biotechnology is another support emphasis. With 350 biotechnology companies, Germany is also the European leader in this key area. This sector's workforce has nearly tripled since 1997, and its revenue has grown from €300 million to over €960 million.

Support growth drivers. Information and communications technologies (ICT) are still growth driver no. 1. The ICT sector now employs some 800,000 people, and it is generating new jobs both directly and indirectly. With its action programme *"Information Society Germany 2006"*, the Federal Government has paved

the way for Germany to build on its leadership in high technology.

Promoting new industrial sectors. BMBF support in nano-electronics has helped strengthen Germany's electronics sector, especially in the area of chip production and specialised supply, and to make it a force driving innovation in other sectors, including the automotive and machine-tool sectors, medical technology, communications and security technology. The BMBF provided start-up funding for what is now Europe's largest electronics centre, a complex in the Dresden/Freiberg area. In that area, support for 300 mm technology has been directly responsible for creating about 10,000 jobs and indirectly responsible for some 10,000 additional jobs. A total of 400 jobs have been created in the AMTC Advanced Mask Technology Center, a joint venture involving AMD, Infineon and Du Pont Photomasks that supplies research-intensive, competition-critical preproducts for Dresden's new chip factories. The BMBF has chosen the right technology to support: AMD is now planning to invest €1.5 billion in Dresden and create 2,500 additional jobs there, while Infineon is creating 1,000 jobs in a factory employing 300 mm technology. And the next steps have already been introduced. At the end of August 2004, the chip companies Infineon and AMD, and the Fraunhofer-Gesellschaft, signed a Memorandum of Understanding on a new nano-electronics research centre in Dresden. The Federal Government and the state (Land) will provide €80 million annually in support for the new facility. The involved industrial partners are planning research projects worth some €170 million over the next five years.

Building on technology leadership. Thanks to support for laser technology – which we were still having to import in the 1980s – laser-manufacturing companies' revenue has grown tenfold, to €1 billion per year. Today, we produce 40% of all lasers used world-wide for processing of materials. Germany is also a world-market leader in plasma technology, along with the U.S. and Japan. As a result of the BMBF's research support in this area, this sector's workforce has tripled or even quadrupled. Today, half a million people – representing 6–7% of the entire manufacturing workforce – work with plasma technology in Germany.

Using interfaces. Innovations are often produced at the interfaces between different technologies. In order to reinforce synergies between nanotechnology and biotechnology, the BMBF is supporting 40 research projects in nano-biotechnology. All in all, through 2006 we plan to provide up to €50 million in funding for nano-biotechnology, in which Germany now has an internationally leading position. The sector has produced a number of promising results, such as nanoparticles that combat cancer disorders and nanosystems that wash blood.

2. Generate big success by promoting small companies

In 2002, we set ourselves the aim of strengthening small and medium-sized enterprises (SMEs) in their role as innovation accelerators.

Why?

Each year, some 200,000 small and medium-sized companies introduce new products and production processes on the market. A total of 35,000 of these companies carry out R&D on an ongoing basis. Over 70% of all new jobs (subject to normal social insurance obligations) are created by newly founded companies with fewer than 50 employees, and up to 74% of all employees work in companies with fewer than 500 employees.

Here's what we've been doing!

Aiming efforts directly at SMEs. Last year, the BMBF provided support for nearly 1,900 small and medium-sized enterprises (SMEs). That figure is some 14.3% higher than the comparable figure for 2001. In a range of programmes – for example, in biotechnology and production research – SMEs receive the lion's share of available support. The Federal Government has made a special effort to ensure that SMEs, in particular, participate in the EU's Sixth Framework Programme for Research and Technological Development (FP6). German companies now account for one out of every five SMEs now participating in SME-specific measures in FP6. The corresponding figure in 1998 was only 14%.

Fast money is good money. Fast, simple application procedures are welcomed especially by smaller companies. This is why the BMBF created *Profi*, a centralised database. Profi is a platform for provision and efficient exchange of current daily information.

Large networks of small companies. SMEs are especially strongly represented in the competence networks supported by the BMBF – especially in such networks oriented to new technologies. For example, 66% of the members of OptecNet, oriented to optical technologies, are SMEs. From 1998 to 2003, SMEs involved in cutting-edge-research networks received access, as a result of their network involvement, to research funding totalling some €1.7 billion.

Master plan for SMEs. In 2002, the BMBF successfully introduced the *Innovative SMEs (Mittelstand innovativ)* initiative, aimed at making it easier for SMEs to participate in funding programmes. That initiative was then followed by the *High-tech Master plan*, which improves the overall framework for SMEs – for example, by facilitating their access to venture capital. The Federal Government is also strengthening young companies via the ERP/EIF umbrella fund for mobilisation of venture capital. What is more, the BMBF is providing up to €100 million for young biotechnology companies in the BioChancePLUS programme. Such funding provides direct assistance during companies' development phases. The range of available assistance is rounded out by a programme for advising SMEs on support opportunities. Since the beginning of the legislative period, this programme has individually advised some 8,000 SMEs and new entrepreneurs regarding research and innovation funding available from the Federal Government, the Länder and the EU.

3. From idea to product

In 2002, we set ourselves the aim of making better use of the potential inherent in knowledge and technology transfer.

Why?

Over 36,000 companies regularly carry out research and development in Germany, but fewer than 9% of all innovators report having developed new products and production processes, in recent years, on the basis of recent scientific findings. This shows: considerable potential resources in the area of knowledge and technology transfer are not being used.

Here's what we've been doing!

Idea – patent – product. The BMBF has established a professional, complete-coverage infrastructure for fast, smooth patent commercialisation. Currently, some 21 patent and commercialisation agencies support about 210 different universities and research institutions, thereby reaching about 100,000 scientists. As of the end of 2003, the BMBF invested €38.5 million in the commercialisation campaign. For the second phase, to last until 2006, it is providing some €28 million.

Transfer of knowledge. Frequently, non-university research institutions and universities co-operate intensively in commercialising joint inventions. The Helmholtz Association has established two commercialisation agencies, one of which markets research findings for the life-sciences sector. At the beginning of this year, the Helmholtz Association launched an initiative aimed at encouraging spin-off companies. The Fraunhofer-Gesellschaft is in the process of optimising its own patent commercialisation efforts. As part of this work, it has founded the Fraunhofer Venture Group, which is aimed especially at the area of spin-offs. In "Garching Innovation", the Max Planck Society has a professional, successful organisation for marketing knowledge generated by Max Planck institutes.

Nets for big fish. We have enhanced networking among players in key technologies. These efforts, for example, have led to the creation of a range of different scientific networks (for example, via the National Genome Research network) and regional networks (for example, via Bio-Regio/Bio-Profile competitions) in the area of biotechnology. In model regions such as Heidelberg and Munich, every publicly invested euro mobilises at least ten euros from the private sector.

4. Today's idea is tomorrow's company

In 2002, we set ourselves the aim of encouraging more innovative start-ups.

Why?

By founding companies, people create jobs and, via creativity and new products, generate innovation for industry. This is especially true for spin-offs from the scientific sector, the numbers of which need to be further increased.

Solid, precise, reliable – those are the "German virtues" everyone talks about. So far, the "German virtues" do not include the courage to try something new, to accept failure and to try again. In the U.S., a bankruptcy with a first company is viewed as a badge of experience – and of the maturity and readiness to try again with a second company. In Germany, such an initial bankruptcy is viewed mainly as a sign of poor credit-worthiness. We are lacking in "second-chance" culture.

Here's what we've been doing!

A culture of entrepreneurial independence. With its *EXIST* and *EXIST-SEED* programmes, the BMBF has produced two success stories in the area of start-ups. In a total of 27 *EXIST* regions, students, graduates and university staff receive encouragement and advice with regard to starting their own companies. *EXIST-SEED* gives would-be entrepreneurs room to manoeuvre – for an entire year. In March, partners in the "partners for innovation" initiative agreed to extend this one-year preparation period to all of Germany. Through 2010, the Federal Government is providing €50 million in funding to this end. All in all, some 500 new companies have emerged from *EXIST* and *EXIST-SEED* since the beginning of this legislative period.

Supporting projects that benefit start-up entrepreneurs. In 2003, about 29% of the SMEs receiving support from the BMBF were no more than five years old. In its "X-Chance" programmes (Bio-ChancePLUS, NanoChance), the BMBF is now supporting young high-technology companies. The BMBF has commissioned the Helmholtz Association to develop a strategy for encouraging and promoting spin-off companies, and it plans to encourage all research organisations to introduce relevant initiatives of their own. From 1999 to 2003, Helmholtz Centres recorded a total of 109 spin-offs, while the Fraunhofer-Gesellschaft registered 164, the Max Planck Society listed 33 and Leibniz Association institutes recorded 48.

Born to be an entrepreneur? One certainly does not need any special "entrepreneur gene" in order to go into business for oneself. And it is possible to awaken interest in business ideas and spark joy in entrepreneurial approaches. This is insight on which the *Youth start-ups! (Jugend gründet!)* competition is based. This event, which was established in 2003, honoured its first prizewinners this year: four girls from the state of Schleswig-Holstein who are planning to sell plasma monitors. A total of nearly 2,200 pupils took part in the competition. At the end of the competition, some 70% of all participants stated that they could imagine going into business for themselves at some time in the future.

Reading, writing, founding companies. The BMBF has provided the impetus for 150 inventors' clubs and, as of fall 2004, is supporting the establishment of a relevant nationwide initiative, *Young people think to the future (Jugend denkt Zukunft)*. This project, an effort within the "partners for innovation" initiative, gives pupils an opportunity to develop ideas for new products or services and then discuss their ideas with sponsoring companies.

Research for people and the environment – shaping a future truly worth living

Research opens up ways of better understanding life's processes. Its findings can benefit both people and the environment. For example, it can combat disease and help keep the natural environment intact. Responsible use of research findings must be focussed on people.

1. Research for people

In 2002, we set ourselves the aim of making better use, for the benefit of human beings, of opportunities provided by modern biomedical research. We also set out to have research help improve the quality and efficiency of medical services.

Why?

In recent years, the life sciences have developed more dynamically than almost any other research area. Modern biology is a key technology that holds great promise for people, especially via enhancement of medical care. Experts predict that by 2010 half of all new medications will have their origins in biotechnology companies.

Demographic change, higher standards of living and greater lifetime expectancies are creating major challenges for our health-care system. We still lack structures for systematic research into the condition of our health-care and rehabilitation systems.

Here's what we've been doing!

New technologies solve existing problems. New procedures in regenerative medicine will help solve or circumvent key problems in transplantation, such as rejection reactions and shortages of donated organs. Tissue engineering is an important area of regenerative medicine. In the area of tissue engineering, the BMBF is promoting projects that could find ways to ease or fully repair organ and tissue damage – for example, for treatment of cartilage damage, nerve injuries and skin burns. Since 2001, the BMBF has provided over €23.5 million in support for research networks working in the area of tissue engineering. In addition, the BMBF has been supporting stem-cell research aimed at developing the regenerative potential of such cells in an ethically acceptable way.

Studying common diseases. In the last legislative period, we used €180 million in UMTS-related funds to establish a national genome-research network that is internationally unparalleled. This network is studying the causes of diseases that are particularly common in Germany – cancer and cardio-vascular/circulatory disorders, for example. This year, a second support phase, providing €135 million, is beginning. This funding is a highly worthwhile investment in the future: in the long term, health-care research will help us keep costs down in our health-care system.

Lifelong health and vitality through prevention. Since 2002, the BMBF has successfully been implementing a FUTUR-process lead vision with this title (cf. p. 34). The key is to determine whether prevention is truly effective and whether the relevant costs/benefits relationship is suitable. What is more, individual opportunities to remain healthy should no longer depend on social background.

Research for better care. We have focussed efforts directly on strengthening this research area. In co-operation with social security insurance authorities, relevant research structures have been established in the rehabilitation sciences. A "care research" funding priority has been launched in co-operation with leading associations of the statutory health insurance schemes. Over a six-year period, the BMBF has invested a total of €23 million in care and rehabilitation.

The right framework. On both the national and EU level, the Federal Government has successfully advanced positions that benefit society and the environment, that combine ethics with law and that open up possibilities for research. In July 2004, these efforts were highlighted in a first report on experience with the Stem Cell Act (*Stammzellengesetz*). Other relevant successes include the EU regulations on genetically modified foods and feeds, which establish obligations on labelling, and a Law on amendment of laws pertaining to genetic technology (*Gesetz zur Neuordnung des Gentechnikrechts*).

2. Acting for today and tomorrow

In 2002, we set ourselves the aim of using concepts for sustainable development to help keep the environment healthy and enhance our quality of life.

Why?

The earth's temperature is rising and resources are growing scarce. It is also likely that requirements for clean drinking water will become a source of political conflict. Storms, floods and great droughts cause damage that even international insurance companies can no longer cover. Innovative, resources-conserving technologies can help protect our natural bases for life. At the same time, they create jobs and give Germany a leading role in the world market.

Here's what we've been doing!

Research for tomorrow. In June, we presented the framework programme *Research for sustainability (Forschung für die Nachhaltigkeit)*, for which some €800 million will be made available in the next five years. The aim of the programme is to produce concepts and technologies that protect the environment in economical, socially compatible ways. With a 16% market share, Germany is already the second-largest exporter in the international environmental protection market. Some 1.5 million people now work in Germany's environmental protection sector. This figure, representing 3.8% of Germany's entire workforce, is larger than the workforces of the country's machine-tools, automotive and food sectors.

Protecting the climate. We have reoriented our climate research, to programmes that create innovation and jobs, and we are taking precautions to prepare for the consequences of extreme weather events. A new research vessel is now being built that, beginning in mid-2005, will provide a platform for research into interconnections between climate, ocean currents and geological phenomena. A new polar station in the Antarctic has been approved; our climate-computing resources are being expanded; and funding priorities are being placed on coastal zone management, coastal engineering and marine aquaculture.

Protecting our oceans. The BMBF supports technology to protect against oil spills. A total of €11 million has been invested in development of multi-phase pumps, which prevent oil from leaking during drilling on the sea floor. Over one-third of the world's oil and gas now come from offshore sites.

Building and housing in the 21st century. The BMBF is supporting the search for answers to demographic trends. A key aim in this connection is to prepare cities for smaller populations. There is also a need to establish new materials and processes in the construction industry. Since 1999, the BMBF has invested a total of €48 million in these priorities.

Sustainable mobility – certainly! One out of every seven jobs in Germany depends on automobiles, either directly or indirectly. To protect our leadership in this area, we need new technologies for safe, environmentally friendly and comfortable vehicles. To manage traffic bottlenecks, we need to shift increasing amounts of freight transports from roads to the rail network. To succeed in this effort, we need

advanced technologies and innovative operational concepts for the freight trains of tomorrow. The 2006 World Cup will bring many visitors to Germany, and the Federal Government is aiming to impress these visitors with new traffic concepts and initial successes in the traffic sector.

Promoting the next generation's awareness about sustainability. We support peace research aimed at lasting, effective conflict prevention. The German Foundation for Peace Research (*Deutsche Stiftung Friedensforschung*), which the BMBF founded in 2000, acting as the Federal Government's representative, promotes development of young people for both peace missions and science. The foundation's endowment has been increased by €2 million in the current fiscal year. Other activities are oriented to the insight that schoolchildren should learn about the meaning of sustainability in national and societal concepts and actions. For this reason, the BMBF provides direct support for relevant programmes of the Bund-Länder Commission for Educational Planning and Research Promotion (BLK), such as *"Learning about democracy" (Demokratie lernen)* and *"Education for sustainable development" (Bildung für eine nachhaltige Entwicklung)*.

3. Open discussion about science

In 2002, we set ourselves the aim of engaging in intensive dialog with society regarding science and research, as well as the opportunities and risks inherent in new developments.

Why?

We are developing into a knowledge society, a society whose members solve complex problems on a daily basis. The simple question "What do I want to eat today?" can lead to a decision for or against a specific technology. As this example shows, it is thus important to conduct a broad-based public discussion about research, and to promote society's awareness of science as a sector full of possibilities.

Here's what we've been doing!

Dialog is golden. The initiative *"Science in dialog" (Wissenschaft im Dialog)* offers interested members of the public a new look at research. It also approaches young people regarding careers in science, and it encourages scientists to communicate their research findings to an interested public. The *Year of Chemistry* 2003 was a great success. This year, the *Year of Technology* is providing a fascinating look at yet another sector. And Einstein Year 2005 will help enhance public awareness of the interconnected responsibilities of society and the science sector.

Thinking about tomorrow – today. The unique (in Germany) "*FUTUR*" process provides for dialog between science, industry and society. Its specific results include priorities for research policy, known as "*lead visions*". A total of six lead visions have been implemented to date, including "Minimally invasive surgery with innovative technology" (*"Schonendes Operieren mit innovativer Technik"*), "Understanding thought" ("*Das Denken verstehen*"; cf. p. 6) and "Lifelong health and vitality through prevention" ("*Ein Leben lang gesund und vital durch Prävention*"; cf. p. 31). Some €40 million per year have been allotted for these areas. In a FUTUR-framework event held in summer 2004, 700 students, trainees and pupils met for discussion with members of the Federal Government regarding future-related issues and for an opportunity to express their views concerning the world of tomorrow.

Analysing innovation and technology. We have expanded our efforts in the area of innovation and technology analysis (ITA), oriented to early study of the opportunities and risks of technological and scientific developments and to development of recommendations for the political sector. ITA provides orientation in a highly technological society and helps shape technology in keeping with the needs of people, society and the environment. A current ITA emphasis is on suitably supporting developments in the area of nanotechnology.

Strengthening centres of growth – moving eastern Germany ahead through education, research and innovation

A region's ability to innovate will centrally affect its economic and employment trends. Eastern Germany is already deep into the competition for the best minds and concepts; within just a few short years, a modern, highly capable education and research landscape has been created there. Nonetheless, eastern Germany still has shortcomings in development of innovation. In this light, the BMBF has developed a specific strategy for improving the framework for innovation in the new Länder.

1. Focus on the new Länder: operation "region"

The Federal Government has concentrated disproportionately high levels of funding on education and research in the new Länder. This year, a total of 20.8% more funds, in comparison to funding in 1998, are being provided in these areas. This funding represents nearly 18% of the BMBF's entire budget. Eastern Germany's share of project funding within the framework of the BMBF's funding programmes has also increased markedly. This year, over €400 million, or 42% more than in 1998, are being invested there. In addition, the BMBF is applying a special innovation strategy for the new Länder, providing for linking excellent research with entrepreneurial concepts and approaches. Since the beginning of this legislative period, these measures have been combined under one umbrella, the innovation initiative *"Entrepreneurial Regions" (Unternehmen Region)*. In 2004, the BMBF provided some €98 million in support for this initiative, while total funding of over €550 million is planned for the period 1999 to 2007. This funding level is double what was originally planned.

2. Thinking globally, acting regionally

In 2002, we set ourselves the aim of helping more regions develop competitive profiles in industry and science. Co-operation is stronger than competition.

Why?

The idea behind regional support is based on a simple insight: A region produces innovation when partners from different areas within it form innovation alliances, in order to enhance their region's value added and competitiveness.

Here's what we've been doing!

Regional profiles, world-wide profits. A total of €250 million is being made available, in the Innoregio programme, for strengthening co-operation between education and research institutions, industry and the administrative sector. The aim is for regions to develop and sharpen their own profiles. To date, a total of 670 relevant individual projects have been approved, and the most recent scientific evaluations show that the 23 *InnoRegios* are already boosting local economic development. For example, the *MAHREG* alliance, comprising 150 automotive-industry suppliers, created 5,000 new jobs in Saxony-Anhalt. Many of the products produced by *MAHREG* alliance partners are in demand world-wide – for example, certain partners produce radiator grills for Rolls-Royce luxury automobiles. And this alliance is not the only one producing for the world market. Three-quarters of all products emerging from *InnoRegios* are oriented to international markets.

Sowing for growth, and harvesting success. The main emphasis of *Innovative Regional Growth Cores* is on implementing business strategies in regions that have already developed sharp, clear profiles. Each growth core receives between €2 million and €5 million for a three-year period. In 2003, the two growth cores Soundline Erzgebirge and IKON were launched, while 2004 has seen the start of three new cores, ALCERU-HIGHTECH in Rudolstadt, BioResponse in Lipten/ Niederlausitz and ReactiveWetCoating in Bitterfeld-Wolfen. All in all, the BMBF has supported 12 growth cores to date.

Innovation forums. The BMBF is working to forge alliances of companies, scientific institutions and other regional organisations. "Innovation forums", which can be likened to specialised congresses, provide an opportunity for initial contacts and sharing of knowledge. The BMBF provides annual funding of €1 million for such forums.

3. Training rather than leaving

In 2002, we set ourselves the goal of giving all young people the opportunity to obtain vocational training.

Why?

Shortages of in-company training places are especially acute in the new Länder. Persons who find no vocational training opportunities in their local regions tend to move to areas that can offer them such opportunities. This trend produces a vicious circle: regions lose skilled employees and highly motivated young people, and their companies face shortages of qualified employees.

Here's what we've been doing!

In 2004, the Federal Government provided a total of €85 million for programmes in this area. With regard to the 2004 vocational training year, the Federal Government and the eastern German Länder agreed that plans calling for a reduction in the new "training place programme East 2004" should not be implemented. As a result, a total of 40% more training places are now available this year. In 2005, funding of €81 million will be provided in this area.

4. The sharp minds are heading east

In 2002, we set ourselves the aim of stopping the exodus of young specialised employees and of providing attractive development opportunities for talented young scientists.

Why?

The best young scientists, from both Germany and other countries, tend to move to places that offer top working conditions. Such places, innovative centres, tend to attract innovative small companies, start-ups and spin-offs. They create jobs and training places – and, thus, they create opportunities to end the vicious circle in which the search for training opportunities leads to exodus.

Here's what we've been doing!

Centres for innovation competence. Since 2002, the BMBF has supported the establishment of internationally competitive centres for top-quality research at eastern German universities and research institutions. In a first step in this area, the BMBF, in co-operation with the relevant Länder governments, selected 12 university research teams and institutions. With financial support from the BMBF, and with the help of professional consulting services, the teams then developed strategy concepts for their future innovation centres. Since March 2004, the BMBF has been financing implementation of six excellent centre concepts. Through 2009, these centres will receive some €50 million.

Promoting young scientists and researchers. From 1998/99 to 2002/03, student enrolments in the five new Länder have grown by 30%. From 1998 to 2004, the BMBF provided €1.8 billion for university construction in the new Länder. At the same time, the BMBF has been providing direct support for young scientists and researchers. For example, it is providing total funding of some €30 million, until 2007, for improvement of clinical research at medical departments in the new Länder.

Federal Ministry
of Education
and Research