



Federal Ministry
of Education
and Research

Strengthening Germany's role in the global knowledge society

Strategy of the Federal Government for the Internationalization of
Science and Research

presented in February 2008

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0. Preface

Scientific progress and technological innovation have contributed significantly to globalization, which has come to affect almost all areas of modern life.

The Strategy for the Internationalization of Science and Research, which was passed by the Cabinet on 20 February 2008, is yet another important step towards developing solutions to the challenges posed by globalization. After all, more than 90 percent of all global knowledge is generated outside Germany. We want to use this knowledge potential for the benefit of German research. At the same time, we are willing to take on more international responsibility and contribute more of our knowledge to international collaborations in order to develop joint strategies and technologies that will help us meet global challenges, such as climate change and energy efficiency. By engaging in a structured dialogue about research policy issues, particularly with emerging countries, we want to make an effective contribution to the development of joint initiatives.

That is why German researchers need to be given the opportunity to collaborate more closely with the best scientists from all over the world. Our training of young researchers needs to become more international as well. After all, experience has shown that the earlier international relations are established, the more productive the ensuing scientific collaborations are. In cooperation with research establishments and higher education institutions, companies have to build up centres of excellence that act as magnets for students, scientists and companies from all over the world.

With the Internationalization Strategy, Germany is living up to its role as a driver of European strategy development in research and innovation policy. Germany must make a contribution to ensuring that Europe develops into a modern, internationally competitive research area.



Dr. Annette Schavan, MdB

Federal Minister of Education and Research

1. Summary

(i) The Federal Government's Strategy for the Internationalization of Science and Research will lead to the identification of the best available knowledge, optimum structures and the most suitable processes by means of continuous international comparison and will thus promote their use for science and research in Germany. It will serve both as a guide and as a basis for the cooperation of stakeholders in the German science and innovation system, and it will support the work and mission of the German science, research and intermediary organizations in an international environment by improving coordination and increasing exchanges of information, thus promoting their goals and intended impact and exploiting hitherto unused synergy potential. ¹

(ii) The Strategy for the Internationalization of Science and Research provides the Federal Government's answers to the challenges of global competition confronting our science and innovation system. The Strategy pursues four main goals:

1. **Strengthening research cooperation with global leaders:** German researchers must in future cooperate even more closely with the most innovative researchers and with internationally leading research groups. At the same time, Germany must become first choice for the best researchers and students from all over the world.
2. **International exploitation of innovation potentials:** German companies must secure a good place in the world's leading and newly emerging high-tech markets and win the world's most creative R&D centres as partners. In this way, we will increase Germany's attractiveness as an environment for innovation, particularly for R&D-intensive companies.
3. **Intensifying the cooperation with developing countries in education, research and development on a long-term basis:** Scientific and technological cooperation and development cooperation will be better coordinated in future so that modern higher education, research and innovation systems can be set up or strengthened in African, Latin American and Asian developing countries and the conditions for closer science cooperation with newly established scientific and economic centres can be improved. This also constitutes an important contribution towards the economic, social and cultural development of these countries and forms part of international efforts to reduce poverty and solve other global problems.

¹ Departmental research with its special tasks is not fully covered by this Strategy.

4. **Assuming international responsibility and mastering global challenges:** Germany will use its research and innovation potential to contribute to the solution of global challenges in the areas of climate, resources, health, security and migration. In this way, Germany will be able to substantiate not only its science policy goals but also its foreign policy and development objectives.

Achieving these goals requires a focus on internationally oriented research policy measures:

(iii) The training of young researchers must be given an increasingly international profile in order to enhance the international, and particularly European, mobility of German researchers. International research projects and excellent, internationally available German research infrastructures should serve to give German researchers access to research infrastructures, large facilities and collaborations in other countries as well.

(iv) Funding programmes with a national, regional or international focus should be better coordinated and strategically aligned in cases where they can be complementary. The general conditions for international R&D investments in Germany and the knowledge transfer between public research establishments, institutions of higher education and business enterprises must be optimized. German investments abroad must achieve the greatest possible benefit for Germany.

(v) The instruments of development cooperation and those of scientific and technological cooperation will be strategically aligned and supplemented where this is possible under the priorities agreed with the partner countries. Strengthening higher education and research structures contributes to the development of local solutions to global problems, avoids elite migration from developing countries, helps developing countries catch up with the global knowledge society and enables cooperation with German researchers on a partnership basis in the interest of both sides.

(vi) The Federal Government uses its influence in international bodies to develop and implement an "international research agenda" which addresses global challenges such as climate change, solving the resources problems, dealing with security threats, and combating global infectious diseases. In addition, we will continue to intensify international cooperation in the humanities and social sciences in order to support the globalization process in a constructive way and manage its impact on society.

(vii) The Internationalization Strategy includes the coordinated presence of German science abroad, the provision of information for German industry and science about activities abroad relating to science and innovation strategy, and a targeted promotion of higher education, research and innovation in Germany.

(viii) A strategy for Europe and the strategies for specific countries will be oriented to the goals of this Internationalization Strategy. The Strategy's benefit for Germany will be evaluated at regular intervals of

three to five years by an independent panel of German and international experts commissioned by the Federal Ministry of Education and Research.

2. National interests and global challenges

Never before have there been so many international networks. Scientific progress and technological innovations have contributed substantially to the globalization process, which covers almost all spheres of life today. The drivers of globalization, particularly the new information and communication technologies, have an impact on research activities, that is, on the generation, dissemination and application of new knowledge and findings.

Traditional boundaries between academic disciplines are opening up. Often new findings are generated at the interfaces between established disciplines. International networks of research collaborations and global strategic alliances are emerging, particularly in the natural and engineering sciences, in addition to bilateral and trilateral international cooperation. The big challenges facing humanity require an international effort by science: National science systems do not have sufficient capacities and financial resources for shouldering the investments which are needed for large-scale research facilities and projects.

Work-sharing between public and private stakeholders in research and development is changing in this process. Multinational companies give their R&D activities an international focus. The internationalization of production capacities is now followed by the internationalization of development and research capacities. Countries are fiercely competing with each other as potential hosts of research centres. Companies are building links with research institutes and universities at their production, research and development sites in order to find more specific solutions to problems they face in the development of new products, processes and services and to translate the researchers' new ideas into marketable products more quickly.

Students and researchers today are also more mobile than ever before. They are looking for the best working groups in their fields, and institutions around the world are seeking to attract them. Higher education institutions and research establishments are faced with new institutional challenges: Input-oriented management is no longer an adequate means for dealing with this dynamic international development and meeting the need for international networking. Output-oriented forms of management are becoming increasingly important. When designing foresight processes, setting priorities and evaluating results, we must therefore take adequate account of the freedom and scope which continues to be the basis of creative research. We are aware of the importance of cutting-edge research and will provide training for the young staff needed in research and in knowledge-intensive occupational fields.

Innovative science and the translation of its findings into new technologies are the key to prosperity in modern knowledge-based societies. Public and particularly private investments in R&D are the major basis for the generation of knowledge, for progress in productivity and for economic growth.

However, large parts of the world are not sufficiently involved in international innovation processes and cannot benefit from the dynamism of science. The establishment of functioning education systems and research structures in developing countries is a major prerequisite for these countries' participation in international progress and for their sustainable development. This is a field where countries that are economically and scientifically advanced share responsibility with the less developed countries.

Climate change, future energy supply, the fight against global poverty and infectious diseases as well as security and migration are challenges which can only be addressed in a joint global effort. The Federal Government has defined its contribution to realizing the international development goals of the Millennium Declaration in its Action Programme 2015. National efforts to address these topics also enhance a country's acceptance and strengthen its position in other fields of international politics.

Particularly the natural and engineering sciences, but also the cultural sciences and the humanities play a special role in the solution of these international problems. The political community will only be able to continue to shape this process, if science describes and explains the trends, causes and effects of globalization.

Germany is a central driver of European political, economic and scientific cooperation in the enlarged EU of 27 Member States. The realignment of the Lisbon Strategy by the Heads of State and Government of the European Union stressed the key importance which education and research have for the Community's long-term competitiveness. The EU therefore supports scientific cooperation and the networking of science and industry.

The national structures and (science) cultures will continue to be a major factor in research even in a more strongly integrated European Union. These national structures and work processes have to be internationally compatible and competitive and therefore need to be designed accordingly. More than ever before, individual stakeholders are required to join forces. The Federal Government, the German Länder and the stakeholders in the civil society as well as industry and science must cooperate to ensure that Germany can continue to play a proper role at international level.

The Federal Government's Strategy for Internationalizing Science and Research is therefore also a guide for further activities of the participating Ministries and aims to increase the interdepartmental coherence of

the individual measures they are implementing on their own responsibility. At the same time, the Strategy invites a dialogue with the Länder and local authorities and with all stakeholders in the science and innovation system. An international dimension is not a value in itself. By continuously comparing ourselves with other countries to identify the best knowledge, optimum structures and most appropriate processes and by using them for German science and innovation, we want to strengthen Germany's role in the global knowledge society and respond to our grown international responsibility.

3. Investments, collaborations, mobility

3.1 The changed global science landscape: New partners and competitors for Germany and Europe

Past efforts of science and industry, supported by the public sector, have made Germany a leading location for higher education and research with an international reputation. Within the Federal Government, the international collaboration of the Federal Ministry of Education and Research and the foreign science policy of the Federal Foreign Office have contributed substantially to the internationalization of institutions of higher education and research establishments. But we cannot rest on our laurels in the face of new global challenges and an increasingly fierce international competition for the “best brains”.

Germany and the European Union have set themselves the goal of investing 3% of the gross domestic product into research and development by 2010. Even with changed economic conditions in an enlarged Union, Germany will keep to the 3% target while pursuing the objective of budget consolidation. At the same time, Germany will consistently contribute to increasing the R&D intensity of the European Union. The R&D expenditure of the 27 EU Member States as a percentage of global R&D expenditure decreased from 27% to 25% over the past ten years. We will only be able to compete internationally with an increasing number of competitors if we keep to the 3% target.

China, India and South Korea as well as other former developing and emerging countries are becoming new partners and competitors in addition to the USA and Japan. R&D expenditure is massively increasing in these three countries, which contributes to an economic recovery in the longer term.

3.2 Young academics, international mobility and international cooperation

The training of young researchers is a European, and particularly a German strength. For example, more young people (roughly 16 million in 2005) are enrolled in higher education in the EU Member States than in the USA (13,6 million). Approximately 90,000 doctoral study programmes are completed in the EU Member States every year; in the USA, the annual number of doctorates awarded is a mere 52,600 (China: 24,000).

Germany is among the world's five leading countries where 80% of all internationally mobile university students choose to spend a period of study. Germany is the third most attractive place of study in the world after the USA and Great Britain. In 2006, 9.5% of all students in Germany were non-nationals who had

acquired their university entrance qualifications outside Germany. A global increase in the number of internationally mobile students from 1.8 million to 7.2 million has been forecast for the period 2000 to 2025.

By international comparison, however, the percentage of foreign doctoral students in Germany is below average. Germany takes only 15th place compared with the other OECD countries. We want to make research in Germany more attractive for this target group as well.

In order to prevent a permanent brain drain from developing countries, we aim to pursue an approach which promotes close and lasting cooperation in the interest of both parties involved (brain circulation).

On the other hand, we must also prevent a brain drain from Germany as German doctoral students are increasingly looking for study options abroad. German graduates are the largest group among all international doctoral students in Great Britain. The situation is similar in the USA. Almost half of all German doctoral graduates from US universities plan to stay in the USA.

Roughly 5,000 German researchers are working at US universities alone. An estimated 20,000 are employed at research establishments in the USA. On the other hand, approximately 20,000 international researchers, mainly from European and Asian countries, conduct research in Germany every year with the support of German science organizations. And Germany draws even larger numbers of researchers within the framework of further cooperation projects.

In recent years, German science organizations and research establishments have opened up their young researcher and project funding programmes to the international community. Particularly non-university research institutions are today trying to appoint internationally renowned researchers to top positions.

Germany is well networked when it comes to large research facilities and participates in large-scale international projects. At the same time, Germany hosts a number of large facilities which are used by international researchers. The European Strategy Forum on Research Infrastructures (ESFRI) was initiated at European level in 2002. The Forum aims to identify new research infrastructures which are of European interest and will be needed in the next 10 to 20 years to keep and consolidate Europe's leading position in international research. In October 2006, a European Roadmap for Research Infrastructures was published. It will be updated at regular intervals.

3.3 New competition for research excellence

International competition for talents and investments is increasing: The increase of R&D personnel in China as shown by OECD statistics alone exceeded the total number of researchers working in Germany between 1997 and 2004. The Chinese Academy of Sciences is attracting Chinese nationals working abroad at American and European research centres by promising them high salaries and offering the latest laboratory equipment. An equally dynamic development can be seen in India, which is already among the top ten research countries in the world with its R&D expenditure of approximately US\$21 billion. Even though a major brain drain from Germany and Europe to these regions is not to be expected in the medium term, this development is nevertheless putting the strong position and attractiveness of European research centres into perspective.

3.4 Germany as a target region for R&D investments

Globally active companies base their decisions about locations and investments on the availability of direct access to lead markets, efficient infrastructures, excellent universities and research institutions and qualified staff. Germany is an attractive location for investments. Foreign companies invest roughly €11 billion annually in R&D in Germany, which is about the amount provided by German companies for R&D abroad. But current trends show that large companies are increasingly shifting their R&D investment activities to locations abroad, mainly to South East Asia.

International comparative studies show that, over the past ten years, Germany fell behind in central areas of the education system and with regard to the volume of public funding for science, research and development and that in comparison to other countries fewer Germans become self-employed – particularly in the cutting-edge technologies. Venture capital in Germany is not as easily accessible as in the USA. The High-Tech Start-up Fund established by the Federal Government in 2005 was a first step towards improving the situation. Under the Federal Government's impulse programme, Germany is providing a total of roughly €15 billion for the cutting-edge technologies and technology-spanning programmes defined in the High-Tech Strategy and has thus been clearly reversing the trend. This has created a considerable dynamic in industry. This positive trend will continue as additional funding of almost €6.5 billion is being provided for research and development until the end of the legislative period.

3.5 Science cooperation with developing countries

While former developing and emerging countries such as South Korea, China and India are now also catching up in the scientific and technological area, numerous other countries are falling behind. 98% of the most cited scientific publications are generated in only 31 countries, and the eight leading countries already account for a share of 85%. Providing training and advanced training for researchers from developing countries and strengthening the scientific infrastructures in these countries contributes to their participation in scientific progress and helps achieve the Millennium Development Goals of the United Nations. The developing countries can thus participate as equal partners in the global knowledge society and in the solution of global problems.

In this process, Germany can build on the long-standing cooperative relations between institutions in science and research as well as on the study programmes which have been designed together with developing countries. A particular focus of these programmes is on regional and global challenges such as environmental technologies, water, climate, energy, agriculture and economic development. Scientific and technological cooperation with Germany broadens the range of research options in the interest of both sides, improves international networking and facilitates collaborations with companies in order to enhance the transfer of technology from research into practical application.

Development cooperation also improves the working and living conditions of researchers in developing countries, which prevents a permanent brain drain and increases researchers' motivation to return to their home country. Supporting the reintegration of top researchers via alumni networks, further training and equipment is particularly important.

3.6 Global challenges

Assuming global responsibility for addressing the problem of global change, securing the energy supply, reducing poverty and controlling pandemics is in the national interest and also strengthens Germany's and Europe's position in other matters of foreign policy, as the German EU and G8 Presidencies underlined in 2007. In the Declaration of the G8 Summit in Heiligendamm, the German Federal Government announced its willingness to assume responsibility for a long-term international research agenda in the scientific and technological area so that we will be able to respond more efficiently to future global challenges. In view of the increasing importance of many emerging economies, the G8 together with Brazil, China, India, Mexico and South Africa decided in Heiligendamm to initiate a dialogue on the central challenges of globalization.

The fields for action in science and research will include in particular the promotion and protection of innovations and the improvement of energy efficiency and technology cooperation.

3.7 The European dimension

Germany should also use international partnerships to successfully safeguard its interests and pursue its scientific goals in our globally networked world. Under its 7th Research Framework Programme (RFP), the European Union will provide a total of €54 billion in funding, more than it has ever spent before on research. As the most important business and research location, Germany accounts for roughly 28% of all research capacities in the European Research Area. German partners are involved in more than 80% of all EU cooperation projects. Germany receives approximately 20% of all the funds awarded in a competitive procedure. This roughly matches the German share in the EU budget. With a success rate of 24%, German applicants are, however, only average on a European scale. The EU has made it clear that it adheres to the principle of excellence by establishing the European Research Council (ERC). Scientific excellence is the sole criterion for selection in this context.

The Community instruments offer complementary options for the design of European and international research collaborations, for the coordination of national policies and programmes within Europe and with third countries, for the definition of framework conditions for European and international research collaborations as well as for the structural development and networking of science and innovation systems. Using the available instruments in a consistent and coordinated manner is a challenge which must be addressed. The European concept of R&D support with its two pillars, the EU Research Framework Programme on the one hand and the national funding programmes on the other hand, has proved a success and should be retained so that we can benefit from the specific strengths of both approaches.

Europe's further development into a European Research Area and the opening up of European research to the world are important factors in securing international competitiveness and thus for achieving the goal defined in Lisbon to make Europe the most competitive knowledge-based economy in the world. Germany plays an active role here and will build on the results of its EU Council Presidency to achieve major progress, particularly in the further development of the European Research Council, the establishment of the European Institute of Innovation and Technology (EIT), the use of the EU's regional business development programmes for supporting R&D, the management of intellectual property, and the development of a European strategy for cooperation with third countries.

4. Talents, collaborations, markets and global responsibility – the reorientation of measures for internationalizing science, research and development

The goals of this Strategy can only partly be achieved with measures conducted by individual players. The new quality of international challenges requires cooperation and coordination with partners within and outside Germany, and this is one of the central tasks of the Federal Ministry of Education and Research and the Federal Foreign Office among others. The political community will coordinate and focus political activities beyond departmental borders in order to increase Germany's strength in the global knowledge society. Science and research organizations, universities and companies conducting research also need to pursue these goals on their own initiative and responsibility. The Strategy formulated in this paper therefore also invites dialogue and cooperation.

4.1 Strengthening research cooperation with global leaders

Students and researchers who have gained experience in international research collaborations are more creative and productive in their research. Such experience furthermore increases their readiness to deal with other nations and cultures. We must therefore strengthen the international dimension of training for young researchers and support their international mobility without causing or increasing a brain drain from Germany. The Federal Government will support relevant internationalization strategies of universities and research establishments in cooperation with the Länder.

4.1.1 Internationalizing the training of young researchers

Networking science and increasing its international attractiveness requires an international focus in training for young researchers.

(i) Even after the restructuring of higher education within the Bologna Process adequate scope for studies abroad is needed. This includes plans for compulsory study periods abroad in some subjects. The main goal is to increase the international dimension of higher education in Germany: German students will be encouraged to acquire experience abroad, a greater part of them should be given an opportunity to go abroad or spend at least one semester abroad during their study course. The Federal Government has acted in accordance with its responsibility in education policy. It has pointed the way towards increasing internationalization by relaxing the rules for the awarding of grants under the 22nd law amending the

Federal Vocational Training Act (BAföG). Other players must now support these efforts. One way towards achieving the said goal is the inclusion of "mobility windows" in transborder study programmes on the basis of agreements with foreign partner universities. Further use must be made of the EU's successful ERASMUS programme, which must be adequately equipped in the long term.

(ii) Currently more than 10% of students at German universities are non-nationals who acquired their higher education entrance qualifications outside Germany; after the strong increase in numbers in recent years, the focus should now be on improving the selection of students, the quality of study programmes (including guidance and counselling) and the results of studies until completion of the course. A special focus will be on encouraging graduates of German schools abroad to take up higher education studies in Germany by extending the range of student grants available for that purpose. International promotion activities should in future increasingly address candidates for Master's and doctoral examinations. But other centres for international encounter at German universities may also serve to enhance the attractiveness of higher education in Germany.

(iii) Highly qualified foreign nationals should be able to apply their skills in Germany even after completing their studies and advanced academic training. Following the decisions taken by the Federal Cabinet at its meeting in Meseberg, the legal framework has already been adapted to make it easier for foreign graduates of German universities to find employment which matches their skills and abilities. The activities of the Project Group "Services provided by the Federal Office of Administration relating to Germans willing to return to Germany" are another asset for achieving improvement. Whether further alleviation may be necessary in future for meeting German industry's needs for skilled staff has still to be considered. Attention will be given to the consequences which a permanent skills drain would have for developing countries.

(iv) At European level, the Marie Curie measures should be more strongly linked with research funding from the thematic programmes of the Research Framework Programme in order to make the knowledge triangle of education, research and innovation a reality.

4.1.2 Supporting the mobility of researchers

Early experience in international research institutions provides the basis for internationally successful collaborations between researchers. Therefore:

(v) German researchers must be given an opportunity to acquire qualifications abroad. But existing funding programmes must also offer attractive return possibilities and career prospects in Germany. Bilateral agreements and projects, regional offices or independent branches will support the mobility of researchers.

(vi) Germany must offer attractive scientific careers in order to prevent a permanent brain drain, particularly to the USA. This means that support must be given to universities and research institutions to enable them to actively engage in personnel development on the basis of international experience, streamline appointment procedures and ensure adequate remuneration of research and teaching work by using the existing pay options beyond collective agreements.

(vii) A prize for attracting top-class international researchers (Alexander von Humboldt Professorship) and other measures of the universities will serve to increase the number of international professors at German universities (currently 8%) over the coming ten years. We aim to achieve a further increase in the number of international researchers at our research institutions (currently 15%). For this purpose, vacant posts will generally be filled in a competitive international procedure, and excellent researchers who are interested in conducting research in Germany within the framework of the European Research Council will be encouraged to stay and do research in Germany on a long-term basis.

(viii) The international mobility of researchers and students has also an important function in (foreign) cultural policy. The necessity of providing guidance and support for international students and researchers and the obligation of universities and research institutions, including their environment, and of the intermediary organizations to assume this intercultural and social task will be highlighted within the framework of the National Integration Plan (NIP).

4.1.3 Enhancing the possibilities for international research collaborations

Cooperative relations with the best research capacities in the world strengthen Germany's scientific and technological competence and optimize the value adding chains.

(x) The further internationalization of research is expected to show effect soon. In the coming years, the amount of funding earmarked for European and international collaborations will be increased in keeping with budgetary requirements. Effects that stimulate growth and employment are important for Germany in this connection. The potentials and options of international collaborations will in future be systematically

included in programme planning and implementation if useful and applicable.² Future criteria for the evaluation of project proposals will include a possible increase in the chances of project success and an improvement in market prospects as a result of international cooperation. In view of the programme-specific differences, the aim should be an average participation³ of 20% by foreign partners in BMBF-funded projects if this is likely to mobilize additional EU funds, for example, or to optimize national projects in the interest of their goals by including know-how that is not available in Germany. We will consider whether an adaptation of existing instruments and procedures can make it easier for SMEs to participate in the internationalization process and derive special benefit from its implementation. Our aim is to give SMEs better access to cutting-edge research and to increase their participation in R&D expenditure in Germany.

(xi) With its extensive project funding experience, Germany can make a substantial contribution to Europe-wide cooperation between research funding organizations, for example within the framework of European research networks (called ERA-NETs) or the European Science Foundation (ESF). Relevant funding rules will have to be developed further to ensure integrated European procedures including coordinated calls, project evaluation and funding decisions as well as standard project monitoring in the interest of the joint programme goals and increasing efficiency. In these lengthy and costly processes, the cost-benefit ratio must therefore be constantly evaluated and improved.

(xii) Under the EU's 7th Research Framework Programme, we aim to increase the return rate to more than 20% and the rate of successful German applicants to more than 24%. Furthermore we want to increase the number of European cooperation projects in which German partners play a leading role. We therefore need an improved information and guidance system in Germany. At the same time, Germany will promote the user-friendly simplification of procedural rules in the EU programme committees. The EU must also make better use of the possibilities of cooperation with non-European third countries. Germany will actively seek to have relevant internationalization instruments reviewed and, if necessary, adapted within the framework of the mid-term evaluation of the Research Framework Programme.

4.1.4 Continuing to strengthen internationally oriented research infrastructures

(xiii) A first-rate infrastructure which enables research at the frontiers of knowledge is needed to ensure the attractiveness of research in Germany. This infrastructure should be used by many partners from all over

² The decision on implementing the measures in the special programmes of the individual government departments is taken by those responsible for the programmes.

³ This is not understood as a funding rate; the international partners must as a rule provide for the funding of their own research themselves.

the world and should therefore be established in a joint international effort. On the other hand, Germany will participate in suitable research infrastructures located in other European countries and also outside Europe. This is why national planning for research infrastructures must be increasingly coordinated with the EU and with relevant European and global initiatives.

Intergovernmental initiatives continue to be necessary as most of these investments will have to be provided from national sources in the future as well. Germany aims to play a leading role in European plans and considerations (including Europe's stance vis-à-vis science nations outside Europe) in view of the German research community's importance for Europe.

(xiv) The branches and regional offices of German universities and research institutions, independent German universities or research institutes, joint ventures with foreign partners and supporting activities carried out by the international offices of science and intermediary organizations and political foundations contribute substantially to training and recruiting partners for future scientific, economic and political collaborations in strategically important countries. To achieve this goal, the "sur place" grants of the Federal Foreign Office should also be used increasingly for foreign students and researchers participating in German higher education programmes abroad. The Federal Government and the Länder support the universities and research institutions in their efforts to extend collaborations with excellent international universities and research centres in strategically relevant countries and to actively contribute to shaping the European Research Area. In this context, we rely on cooperation with industrial companies at home and abroad as well as on synergies produced by "German science centres" abroad, which can also be financed from external funds.

4.2 International exploitation of innovation potentials

Not only companies but also research institutions and universities must try to find efficient ways and means for exploiting international innovation potentials in view of increasing international competition. The greater the participating actors' involvement in high-performing networks and the better their coordination on the basis of strategic concepts as well as their support by funding programmes, the more successful these efforts will be.

4.2.1 Strategic orientation of innovation funding programmes

(i) With its High-Tech Strategy, the Federal Government has pooled the funding measures for selected key technologies and aligned them strategically. These thematic fields will be examined for their international cooperation potential.

(ii) Efficient national competence networks will be opened up to the international community to make them more competitive wherever possible and reasonable. The leading-edge clusters competition provides a sound basis for such efforts. The competition will be accompanied by international research and investment promotion activities. An independent evaluation of this measure will identify the effects which stimulate growth and employment.

(iii) Innovative small and medium-sized companies are the drivers of innovation in Germany. Their international links along the entire value-added chain are of major importance for successfully maintaining and extending global competitive positions. Specific programmes for funding international strategic R&D collaborations of German SMEs will be developed further in an interdepartmental approach, which should ensure that the additional effort and cost of international cooperation does not outweigh the benefit for SMEs. A new approach to funding international cooperation between high-tech SMEs is pursued by the European EUROSTARS Programme, under which most European states, including Germany, and the EU will pool their financial resources and test integrative forms of joint evaluation of proposals and project management within the framework of the EUREKA initiative.

(iv) European Technology Platforms (ETPs) have been created in strategic innovation fields; some of them have formed Joint Technology Initiatives and are funded under the 7th EU Research Framework Programme. There are various links between the Technology Initiatives and the High-Tech Strategy. Germany will therefore use its EUREKA Presidency (2009-2010) to review the potential of this instrument – also as a focus of bilateral R&D cooperation – and continue to exploit it, if appropriate.

(v) A German fund for innovation alliances will be established to support research projects carried out jointly by science and industry in selected fields on the basis of the budgetary requirements mentioned above.

(vi) Project funding will be accompanied by a systematic study of standardization in high-tech fields with the aim of increasingly integrating international standardization efforts into the research process in order to promote the international dissemination of German technology standards.

(vii) Internationally oriented competence networks can present their strengths on the platform "Kompetenznetze Deutschland" and forge contacts with networks, companies and partners abroad to exploit international innovation potentials.

4.2.2 Improving the general conditions for R&D investments

(i) Federal government departments, science, industry and the Länder will consider whether and, if so, how suitable measures can be taken to further enhance Germany's attractiveness as a location for research and innovation in order to increase future international R&D investments in Germany. These investments should compensate for the reduction in domestic R&D capacities and contribute to reversing the trend in investment decisions taken by German companies.

(ii) German institutions' activities to observe international markets, innovation trends and investment opportunities will be made more effective by improved coordination and communication and greater transparency as the potential and strengths of the German research community are underrated abroad. The work of marketing institutions to promote research, innovation and investment in Germany must be evaluated regularly with regard to the effectiveness of coordinated campaigns and must be adapted to new requirements.

(iii) On the basis of the German initiative for a European Charter dealing with intellectual property rights, Germany must support modern, internationally accepted and observed rules for the protection of intellectual property. These rules should safeguard the interests of strong innovation countries and also of countries which are weaker in scientific and economic terms. The main goal of national funding measures will, of course, continue to be the utilization of intellectual property in the interest of positive employment and growth effects at home. Germany participates in negotiations for the international harmonization of substantive patent law which also deal with the introduction of a grace period.

4.3 Intensifying the cooperation with developing countries in education, research and development on a long-term basis

Germany will also position itself in due course as a partner of future new science and industry centres in developing countries and emerging economies. Scientific and technological cooperation will support collaborations of excellent research groups and innovative industry clusters with German research groups and competence networks.

(i) Consideration is given to the possibilities of coordinating the various instruments used in development cooperation with those of scientific and technological cooperation in order to optimize synergies and lastingly increase collaborations with developing countries in education, research and development.

(ii) The provision of modern training for executive and specialized staff in developing countries together with a system for continuing advanced training provides the basis for sustainable development and for economic and scientific cooperation. Cooperation in the area of initial and continuing training is reviewed and coordinated on the basis of development goals and existing instruments for individual support (fellowships), cooperation between education institutions, education marketing and export promotion for German training programmes.

(iii) An international education and research dialogue similar to the dialogue with China on the rule of law is planned to be established to deal in particular with priority topics such as climate, health and the efficient use of resources. The Federal Ministry of Education and Research and the Federal Ministry of Economic Cooperation and Development will support this dialogue with the instruments of scientific and technological cooperation and of development cooperation. Taking the responsibilities of the Länder into account, both Ministries will aim to:

- Create incentives for German universities and research institutions by developing innovative cooperation models in order to overcome the weaknesses of the training and science systems in developing countries together with partners from these countries and to prevent the drain of scientific expertise, particularly from Africa;
- Ensure that teaching and research at German universities and science institutions will continue to deal adequately with issues of globalization, development processes and problems of the developing countries in cooperation with powerful research centres in these countries. This is to support the development of scientific excellence in the interest of a sustainable economic, social and political development of the partner countries;
- Support not only research in the natural sciences and engineering but also research in the humanities and social sciences in order to make substantial contributions to development processes in society as well as to the understanding of cultural characteristics and to gain new insights by systematically studying other cultures of knowledge;

- Support the individual promotion of highly qualified researchers by developing international networks of individuals and/or alumni while strengthening the institutions in developing countries in order to build, maintain and extend robust science structures;
- Increase support for the establishment of professional organizations of scientific self-government, effective higher education management structures and the development of individual research management skills;
- Develop European Community instruments and other multilateral instruments further for the cooperation with developing countries in education and research (e. g. activities of international development banks such as the World Bank and the Asian Development Bank) in view of the above-described goals. European programmes (mainly the Research Framework Programme and the instruments of development cooperation and economic cooperation) should be better coordinated;
- Facilitate access to current scientific and technological knowledge for developing countries, for example by promoting open access initiatives, while meeting the requirements of intellectual property protection.

4.4 Assuming international responsibility and mastering global challenges

Germany will pursue an interdepartmental overall approach in meeting the global challenges and carefully use its considerable scientific and technological potential together with its international economic and political relations. The main fields for action are: Climate change, poverty reduction, resource efficiency, security and health.

(i) A long-term international research dialogue will help identify the most important research fields for addressing global tasks, set the stage for global research collaborations and decisions on research infrastructures and develop scenarios for implementation. The big emerging economies will increasingly be included in this dialogue in addition to the G8 countries. The Federal Government will assume its international responsibility and strengthen Germany's role in multilateral forums (e. g. G8) and organizations such as the OECD and the United Nations (e. g. UNESCO, United Nations University) wherever international collaborations and coordination processes can be supported by special national competences.

(ii) In an initial phase, this international research dialogue will focus on the topics resource efficiency, health research and environmental research. In this context, sustainability research is of special importance

against the background of the German High-Tech Strategy for Climate Protection. Germany will therefore start bilateral and multilateral dialogues with major emerging countries in this field. A further focus is on approaches towards increasing the efficiency when using non-renewable resources and on combating infectious diseases which are of global relevance.

(iii) We will only be able to adequately shape the science- and innovation-driven globalization process, which again has an impact on science, if we understand its causes and manifestations and conduct scientific research to that effect. The funding initiative "Free scope for research in the humanities" provides important contributions with its international research schools in the humanities and the establishment and extension of interdisciplinary competence networks for regional studies.

(iv) On the basis of the decisions taken at the Heiligendamm Summit, the Federal Republic of Germany will enter into a dialogue with the most important emerging economies (G5 – Brazil, China, India, Mexico and South Africa) together with its G8 partners to discuss issues including the promotion and protection of innovations as well as ways to increase energy efficiency and technology cooperation in the areas of power plants, transport and buildings (Heiligendamm Process).

5. Generic measures

5.1 Presence abroad

The increasing internationalization of science policy requires systematic external representation. This makes it easier for German research

- to gain access to global centres of excellence and high-tech markets and to specific regional background knowledge;
- to promote Germany as location for research more effectively and recruit highly qualified staff;
- to create networks and establish strategic partnerships with institutions abroad.

In order to optimize and coordinate Germany's presence and presentation abroad, the activities of research centres, contact points, information offices and advisory services of German science, funding and intermediary organizations, the activities of universities and industrial research efforts in major partner countries will be coordinated and, if possible, pooled by establishing German science centres, which may also be financed externally. These centres will serve as a showcase for German research, increasing the visibility and accessibility of German universities and research establishments, and will enhance the efficiency and coordination of local activities together with the representations of German industry and culture. The German missions abroad play a double role in this respect: While making a more substantial contribution to Germany's visibility, they must also fulfil a major coordination and service function.

5.2 International monitoring

(i) The successful development and implementation of national strategies depends on the analysis of international trends in research and innovation and the examination of relevant political strategies and measures. Strategically important information from international players will be made available at an early stage within the framework of international monitoring and evaluated in the context of national innovation strategies. The quality and early availability of information depends mainly on the competent local presence including direct personal contacts with relevant institutions.

(ii) A basis for collecting standardized, internationally compatible data for an international benchmarking of the German science system and its performance will be provided in a joint effort with the German science organizations.

(iii) The network of science counsellors at the German embassies will be made more effective. At the same time, communication will be improved between the political, economic, scientific and cultural contacts and partners and the players in development cooperation.

5.3 Promoting Germany as location for higher education, research and innovation

This Internationalization Strategy promotes Germany as an attractive location for research, development and innovation in important target countries.

(i) We will continue the international campaigns for higher education in Germany and keep competing for students, doctoral candidates and graduates of German schools abroad.

(ii) Science, industry and politics are invited to support the objectives of this Internationalization Strategy with a joint concept for advertising the advantages of research and innovation in Germany.

(iii) International promotion campaigns for research will be especially successful if all measures are pooled under one umbrella ("Research in Germany") and closely coordinated with other campaigns of the Federal Government (particularly "Germany – Land of Ideas" and "Invest in Germany").

6. Plans for the future

As the main purpose of the Internationalization Strategy is to provide political orientation, detailed concepts will be developed for the outlined fields of actions where necessary. The details will, for example, refer to the special situation of the European Research Area and to selected partner countries that are given priority.

6.1 Strategy for Europe

Germany wants to become the driver of European strategy development in research and innovation policy. Since research, development and innovation will become more important in the EU budget as agreed in the current Financial Perspective, we want to contribute to making Europe a modern and internationally competitive research area. The method of open coordination set out in the Lisbon Strategy offers numerous possibilities for better coordination and new Europe-wide measures. The Internationalization Strategy for the European Research Area should include the following key points (relevant measures will be described in a detailed implementation concept):

- Strengthening basic research in Europe with the European Research Council, which has already been established;
- Aligning the funding instruments with the criteria of performance, expertise and scientific excellence;
- Enhancing Europe's innovative capacity and competitiveness including the aspect of mobility;
- Increasing the effectiveness and efficiency of European cooperation with non-member countries;
- Enhancing links between German R&D policy and European measures.

Pursuing these central ideas, the Federal Government will

- Actively contribute to the further development of the European Research Area, which was initiated with the Green Paper submitted by the European Commission;
- Work to retain the European Research Council's autonomy and improve its operating conditions;
- Encourage new combinations of European and national funding instruments on the basis of Joint Technology Initiatives and the co-funding of joint programmes by the EU;

- Improve the competitiveness of German science in order to ensure adequate participation in European research funds awarded in a competitive procedure; this includes guidance and counselling for German researchers and adequate career opportunities;
- Encourage and support the proper selection of candidates for posts at working and executive level in European institutions and strengthen European competencies in German institutions.

6.2 Strategies for particular countries

In order to use the financial and human resources of German science effectively the above-mentioned goals must be especially pursued with relation and in cooperation with a number of selected countries and/or world regions. The variety and openness of the German research system, which has resulted in numerous international contacts and collaborative relations, is the basis of future country or regional focuses. The aim of these country strategies is to coordinate measures and instruments with stakeholders from the Federal Government and the Länder, from science and industry and with intermediary and implementing organizations in order to avoid duplication of funding initiatives, exploit the potential for synergy and thus find more effective ways of achieving not only individual cooperation goals but also the general objectives of this Strategy.

Scientific and technological cooperation will be realigned against the background of this Strategy's orientation, and specific strategies will be developed for countries which are selected in keeping with the German research community's interests (starting with China, India and Brazil).

6.3 Implementation, evaluation and updating

The Ministries will implement their own measures for internationalizing science and research independently within the framework of their responsibilities while coordinating their activities with the other government departments involved. The Federal Foreign Office with its cross-cutting responsibilities supports the international contacts and measures of the other government departments via its missions abroad and within the framework of its foreign science policy.

An alliance of science, industry and politics is needed, given the strategic importance of the internationalization of the German science and innovation system. Therefore, a high-level strategic Panel on Internationalization will meet at regular intervals to consider the Strategy's benefit for Germany on the basis

of relevant evaluation results, coordinate specific organizational strategies and measures and agree joint initiatives. Coordination with the Länder will mainly be organized by the Joint Science Conference (GWK).

The Internationalization Strategy will be reviewed at intervals of three to five years by panels which include international and independent experts, and it will be adapted if required for political and technical reasons. Whether and to what extent it will be possible and necessary to collect standardized, internationally compatible data concerning the German science system and its performance will be considered in cooperation with the German science organizations.