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Research at a Glance – The German Research Landscape



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Introduction

Germany has a long, noble tradition in the field of research. It has produced outstanding scientists and inventors such as Johannes Gutenberg (1400–1468), Gottfried Wilhelm Leibniz (1646–1716) and the brothers Alexander (1769–1859) and Wilhelm von Humboldt (1767–1835).

German research flourished especially during a period of economic prosperity that began in the mid-19th century and lasted until the 1920s. That period will always be linked with outstanding names in German science, research and technology, including world-famous personalities such as Carl Zeiss (1816–1888), Werner von Siemens (1816–1892), Hermann Helmholtz (1821–1894), Nikolaus August Otto (1832–1891), Robert Koch (1843–1910), Wilhelm Conrad Röntgen (1845–1923), Max Planck (1858–1947), Heinrich Hertz (1857–1894), Robert Bosch (1861–1942) and Albert Einstein (1879–1955).

During the same period, a number of outstanding women scientists also earned recognition for groundbreaking findings and pioneering developments. Important representatives of this group include the astronomer Caroline Herschel (1750–1848), the mathematician Emmy Noether (1882–1935) and the physicist Hertha Spöner (1895–1968).

German research led to the birth and growth of a range of new industrial sectors, including electrical engineering, the chemical and pharmaceutical industries, and the automotive industry. At the beginning of the 20th century, Germany was widely recognised as a world leader in science and research. Its industrial products (“Made in Germany”) were acclaimed world-wide. And a key factor in this success was state support for basic research – support that was co-ordinated with industry.

In 1990, after the German reunification, all German science and research capacities were merged, organised within a common structure and integrated within the international research sector.

At present, in the 21st century, the German research sector has a broad, diverse and historically rooted spectrum of research structures, and it is intensifying its international co-operation both within and outside of the European Union.

Part 1: The German Research Landscape

1.1 Instruments of federal research funding

The Federal Government uses a number of different instruments in funding research and development. The German research system is financed both through targeted, short-to-medium-term funding (project funding) and through medium-term or long-term basic funding of institutional research.

1.1.1 Project funding

Project funding – especially that of the Federal Ministry of Education and Research (BMBWF), of the Federal Ministry of Economics and Technology (BMWi) and of the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) – is normally provided in the framework of general or specialised funding programmes, on the basis of applications for fixed-term projects.

Direct project funding is always provided for a concrete field of research. The purpose of such funding is to achieve high international standards of performance in selected areas of research and development.

The aim of indirect project support is to support research institutions and business enterprises – especially small and medium-sized enterprises – in research and development activities. In each case, such support is provided not for a specific research topic, but for a technological project that is not tied to a specific technology area. For example, such support is provided for the development and enhancement of research infrastructures, for research co-operation, for innovative networks and for personnel exchanges between research institutions and industry.

Generally speaking, such support is available both for individual projects and for collaborative projects conducted by equal partners working together closely in the framework of a co-operation agreement.

1.1.2 Use of project results

Funding recipients are obliged to use their research findings, and the importance of such commercialisation is growing. The primary purpose in requiring commercialisation of re-

search findings in the form of marketable, innovative products, processes and services is to strengthen Germany's research sector and economy.

- + **Beneficiaries own their project results; i.e. they have exclusive usage rights. They also retain all economic benefits resulting from commercialisation. New regulations have improved incentives and opportunities for commercialisation of results, and they will enhance the financial resources of highly innovative funding recipients.**
- + **Exclusive usage rights are granted in connection with new obligations to exercise commercialisation rights. The purpose of such obligations is to ensure that commercial use is made of project results wherever possible. The requirements are also designed to intensify transfer of findings from higher education institutions and research establishments to industry, with the aim of creating and protecting jobs.**

1.1.3 Project management organisations

Project management organisations, consisting of organisational units sited within Helmholtz Centres or other scientifically qualified institutions, carry out scientific, technical and administrative management tasks, in various areas, especially for the federal ministries BMBF, BMWi and BMU.

The main tasks of project management organisations consist in providing project support. Their work is focused on advising applicants in technical and administrative matters, preparing decisions on support, supporting ongoing projects and monitoring projects' success.

Project management organisations also perform a number of additional tasks, such as supporting the planning, analysis and evaluation of programmes, organising technical conferences and workshops, carrying out activities of international co-operation and advising applicants regarding the EU's specialised programmes.

1.2 Structure of German research support

The German research landscape is highly diverse and has a complex structure. For example, public-sector institutions are financed both by the state and by industry, while private research also receives public-sector support.

1.2.1 Federal Government and the Länder

The Federal Republic of Germany's federative system enables both the Federal Government and the Länder governments

to fund and promote German research in their respective spheres of responsibility, without having to issue special research-support laws for this purpose.

Pursuant to Article 91 b of Germany's Basic Law (Grundgesetz), in instances of supra-regional importance, the Federal Government and the Länder may co-operate, on the basis of agreements, in supporting scientific institutions and projects outside of the higher education sector, in funding scientific and research projects at universities and in financing research-sector structures at universities, including large research apparatus. This is in keeping with the Federal Government's and the Länder governments' joint responsibility for science and research, which in many cases calls for co-ordinated action in the interest of the nation as a whole.

Many of the key players in Germany's research landscape – such as the Deutsche Forschungsgemeinschaft (German Research Foundation – DFG), the Centres of the Hermann von Helmholtz Association (HGF), the Max Planck Society (MPG), the Fraunhofer-Society (FhG), the institutions of the Leibniz Association, and the Science Council (Wissenschaftsrat) established by the Federal Government and the Länder – are jointly funded by the Federal Government and the Länder governments.

1.2.2 Industry

In 2004, industry financed € 36.9 billion, or two-thirds, of the gross domestic expenditure on research and development (GERD), which totalled € 55.2 billion. The great majority of industry's total R&D expenditure remains within the industrial sector: that share accounts for some 92% of industry's € 38.6 billion in internal R&D business enterprise expenditures. The state, for its part, provides a total of some € 2.3 billion in research support for research projects of the business enterprise sector.

The automotive sector is the leading industrial spender on R&D; it accounts for over 40% of all industry R&D. Other key sectors in this category include producers of office machines, IT equipment and electrical equipment, which together account for about 19% of industry's total R&D expenditures. The next most important sectors in this regard are the chemical industry (17%) and machine tools (9%).

In recent years, business enterprises increasingly have been awarding R&D contracts to other business enterprises, universities and state research establishments, etc. Since the mid-1990s, such "external" R&D expenditures have been increasing considerably more rapidly than the business enterprise sector's internal R&D expenditures. In 2003, external expenditures had attained a share of nearly 19% of total expenditures.

In 2003, the science sector received nearly 13% of the business enterprise sector's external R&D contracts (including contracts of both business enterprises and institutions for co-operative research). An especially strong increase occurred in contracts to higher education institutes and professors; the share for this category increased from 7.7% in 2001 to 10.5% in 2003.

1.2.3 Foundations

Major science-promoting foundations make a valuable contribution to safeguarding the quality of research in Germany.

The Stifterverband für die Deutsche Wissenschaft e.V. (Association of German Academic Foundations) provides an important example of industry's concerted efforts to promote German science and research. At the end of 2005, this organisation had a membership of 350 foundations and managed total assets of € 1.4 billion. Other large German foundations – such as the Volkswagen Foundation, the Thyssen Foundation, the Robert Bosch Foundation, the German Foundation for the Environment (DBU – Deutsche Bundesstiftung Umwelt), the German Foundation for Peace Research (DSF) and the Bertelsmann Foundation – also sponsor projects or institutions throughout a wide variety of scientific fields and endeavours.

Eleven organisations for the promotion of young talents, financed largely from federal funds, play a particularly important role in the German system of foundations via the grants and scholarships they provide to undergraduate students and PhD candidates.

1.2.4 German Participation in the European Research Framework Programme

The Research Framework Programmes managed by the European Commission are playing an increasingly important role within the system of R&D-funding players. Above and beyond EU funding's considerable financial significance for the various scientific disciplines, the European research programmes play a key role in the development of science and research networks in Europe, which contribute significantly to the development of the European research sector's global reputation.

During the Sixth Framework Programme, the participation of German universities, research centres and enterprises rose to approx. 850 Mio. Euro annually, which constitutes 19% of the total budget for project funding. Within the thematic priorities, German institutions are involved in 82% of all RTD projects. While grants from the Framework Programme to German research institutions may only constitute around 5.5% of the overall German RTD expenditures from public sources, if correlated with BMBF research funding as such, this contribution equals to nearly 50% of BMBF funding.

1.3 Funding Organisations in Germany

1.3.1 The German Research Foundation (DFG)

The DFG (Deutsche Forschungsgemeinschaft) is the central self-governed organisation of German science.

Tasks

The main task of the DFG is to support research at universities and public research institutions, although most of its resources go to the university sector. DFG statutes furthermore stipulate the tasks of supporting co-operation between researchers, supporting young scientists, providing scientific advice for parliaments and authorities and fostering of relations between the science communities in and outside of Germany.

To fulfil these tasks, the DFG has the following instruments and procedures at its disposal:

- + **Individual grants programme – funding of research projects initiated by a single researcher, with a funding period of one to three years, and with possible extension;**
- + **Priority programmes – funding and co-ordination of work done by several researchers, at different locations, on a certain topic or project, with funding usually provided for six years;**
- + **Research units – co-operative ventures, lasting up to six years, involving small teams of scientists and focussed on especially innovative, usually interdisciplinary research projects;**
- + **Collaborative Research Centres – research institutions established at universities, for periods of up to 12 years, often in co-operation with non-university research institutions; at such centres, scientists work together in the framework of interdisciplinary research programmes;**
- + **Co-operation between scientists and users of findings, aimed at a rapid transfer of innovative ideas from Collaborative Research Centres into practical applications;**
- + **Research centres – strongly staffed and funded research centres at universities, established for periods of up to 12 years, that work on the basis of**

existing co-operation structures to concentrate and expand scientific knowledge in particularly innovative research areas;

- + **Research Training Groups – university programmes, established for up to nine years, designed to support young scientists and academics, during their doctoral work, by integrating them within active research efforts;**
- + **Emmy Noether Programme – support for young scientists carrying out early independent work during their post-doc phases;**
- + **Heisenberg Programme – support for highly qualified scientists following habilitation or earning of equivalent qualification;**
- + **Research fellowships;**
- + **Scientific networks**

The research grants awarded by the DFG in 2005 figured up to a total amount of €1,469.5 Mio.

www.dfg.de

1.3.2 The German Academic Exchange Service (DAAD)

The DAAD (Deutscher Akademischer Austauschdienst), as a joint institution of German universities, has the task of promoting international relations in higher education, especially via exchanges of students and scientists. Its programmes are normally open to all disciplines and all countries; Germans and foreigners are equally eligible. Its tasks also include promoting the internationality and attractiveness of German higher education institutions.

With its more than 200 individual programmes, the DAAD is active in the following main areas:

- + **Promoting individual qualification through cross-border mobility in research, teaching and study, made possible by individual grants, group programmes of German higher education institutions, support for students as interns and bilateral exchanges of university teachers;**
- + **Promoting institutional and project-based international scientific co-operation, via special regional programmes;**

- + **Placing of German-language teachers and instructors, offering special programmes for foreign scholars and specialists in German studies;**

- + **Supporting and assisting grant recipients**

In 2006 the DAAD had a total budget (planned) of € 257.4 Mio.

www.daad.de

1.3.3 The Alexander von Humboldt Foundation (AvH)

The main objective of the AvH (Alexander von Humboldt-Stiftung) is to give highly qualified foreign academics an opportunity to carry out research projects in Germany and to maintain resulting contacts with scientists in Germany. The Foundation also supports German scientists who spend time abroad for research purposes.

- + **Annually, it awards over 500 research grants to foreign post-docs no older than 40 years of age. There are no pertinent quotas with respect to countries or disciplines.**
- + **Within the framework of different programmes, the AvH awards up to 100 Humboldt research prizes annually to internationally renowned foreign scholars and scientists.**
- + **The AvH funds research stays abroad for German scientists.**

The AvH had a total budget (planned) of € 56.3 Mio. in 2006.

www.avh.de

1.3.4 The German Foundation for Peace Research (DSF)

The DSF (Deutsche Stiftung Friedensforschung) is charged with strengthening peace research in Germany, in keeping with the important role of such research in foreign policy and security policy, and with contributing to the political and financial independence of such research. The Foundation works toward these aims by supporting and initiating scientific projects, holding national and international scientific conferences and carrying out projects to support young scientists. In 2005 the research grants awarded by the DSF figured up to approximately € 650 Mio.

www.bundesstiftung-friedensforschung.de

1.3.5 The German Foundation for the Environment (DBU)

In its support activities, the DBU (Deutsche Bundesstiftung Umwelt) emphasises development of innovative, practically oriented solutions, especially in the areas of product-integrated and production-integrated environmental protection; climate protection via energy efficiency and technological optimisation of renewable energies; development of resources-efficient construction projects; sustainability-oriented chemical products and processes; and biotechnological products and processes, especially with a focus on industrial biotechnology. It does not fund basic research. The annual budget for research projects currently amounts to €10 Mio.; the total budget of the DBU for research grants amounts to approximately €44 Mio. annually.

www.dbu.de

1.3.6 The Foundation of German Humanities Institutes Abroad (DGIA)

The DGIA's (Stiftung Deutsche Geisteswissenschaftliche Institute im Ausland) main purpose is to promote research, primarily in the areas of history, cultural sciences, economics and social sciences, in selected countries, and to promote mutual understanding. The Foundation's institutes carry out research, train young scientists and, with their excellent libraries and events programmes, serve as contactpoints for the scientific communities in their host countries. In 2006 the DGIA disposed of a total budget (planned) of approximately €26,3 Mio.

www.stiftung-dgia.de

1.3.7 The German Federation of Industrial Research Associations "Otto von Guericke" (AiF)

As a self-governed organisation of the business enterprise sector, the AiF (Arbeitsgemeinschaft industrieller Forschungsvereinigungen "Otto von Guericke" e.V.) aims to support applied Research and Development (R&D) to the benefit of Small and Medium-sized Enterprises (SMEs), with the aim of using innovation to strengthen the country's economic competitiveness.

Since its founding, the AiF has been a competent partner to the Federal Government, working at the interface between industry and science, within the framework of various support measures. The AiF's work includes both sector-wide and company-specific activities, as well as activities oriented to universities of applied sciences (Fachhochschulen).

Since its founding in 1954, the AiF has been involved in the Industrial Co-operative Research programme for SMEs (IGF), a support effort of the Federal Ministry of Economics and Technology (BMWi). With the aim of strengthening innovation at SMEs, this programme supports pre-competitive-phase research projects that are initiated by industry and whose findings are made available to all interested companies, in one or more industrial sectors.

At international level, the AiF works to ensure that SMEs achieve appropriate participation in the European Union's R&D measures. It co-ordinates an EU ERA-Net project for industrial co-operative research that involves partners in a total of 17 European countries and regions. It also serves as the BMWi's project management agency for the "International Technology Co-operation Network". The AiF maintains 15 contact offices, located in central and eastern Europe, China and India, that support facilitation and execution of transnational research co-operation. The research grants awarded by the AiF figured up to approximately €300 Mio. annually.

www.aif.de

1.4 Organisations implementing research in Germany

1.4.1 The Max Planck Society (MPG)

The MPG (Max-Planck-Gesellschaft) currently maintains about 80 institutes, research agencies, laboratories and working groups. The Max Planck Society supports cutting-edge basic research, outside of higher education institutions, in the areas of biomedical research, chemical, physical and technical research and the humanities.

Max Planck institutes (MPI) emphasise new, highly innovative research directions that are not yet being pursued (or not being pursued to an adequate extent) by Germany's universities, that do not fit within university structures, due to their interdisciplinary nature, or that require staffing and apparatus that are beyond the means of higher education institutions.

In the worldwide rankings of the most-cited institutions, the MPG ranks first in the fields of chemistry, physics, space sciences and materials sciences. In the fields of biology, molecular biology, microbiology, genetics and biochemistry, the MPG has received third-, fourth- and sixth-place rankings. In addition, the Max Planck Society has had 16 Nobel Prize winners among its ranks since 1954.

The MPG enjoys a high degree of autonomy as a result of the high level of basic financing it receives from the Federal Government and the Länder, and it uses this autonomy very

successfully to identify emerging research fields and attracting the world's best scientists to work in them.

As a matter of principle, the activities of the MPG and its co-operative ventures are interdisciplinary in nature.

Since 1969, the MPG has supported outstanding young scientists in the framework of temporary "Independent Junior Research Groups". In 2006 the budget for institutional funding of the institutes of the MPG amounted to € 1,034.3 Mio.

www.mpg.de

1.4.2 The Fraunhofer-Gesellschaft (FhG)

The FhG (Fraunhofer-Gesellschaft) is the leading sponsor organisation for institutions of applied research in Germany. The Society is named after Joseph von Fraunhofer (1787–1826), a famous researcher, inventor and entrepreneur.

The Fraunhofer-Gesellschaft conducts contract research for industry, service-companies and the public sector, and it provides a range of information and services. It currently operates a total of 58 research institutes, spread throughout the country.

The activities of the Fraunhofer-Gesellschaft are consistently guided by the objective of translating research findings into new and innovative products, processes and services. Another important task of the Fraunhofer-Gesellschaft is strategic research. Within the framework of basic funding provided by Federal and Länder governments and ministries, the Fraunhofer-Gesellschaft carries out research projects that contribute to innovations in spheres of major public interest and in key technologies. These areas include information and communications technologies, life sciences, micro-electronics, surface technologies and photonics, production, defence and security research and materials and components.

The Fraunhofer-Gesellschaft employs some 12,500 people. Contract research accounts for over 90 % of its annual research volume. And the Fraunhofer-Gesellschaft generates some two-thirds of its revenue in this area via contracts with industry and the public sector.

Economic and research-sector globalisation is creating a growing need for international co-operation. The Fraunhofer-Gesellschaft maintains locations in Europe, the U.S. and Asia that stay in contact with the most important current and future economic centres.

The Fraunhofer-Gesellschaft relies on close co-operation with universities. Via such co-operation, it complements universities' basic-research resources and attracts young scientists. For their part, universities profit from co-operation with the Fraunhofer-Gesellschaft in the form of practically oriented student training and collaboration on research areas of practical relevance. Joint appointments to academic chairs/

honorary professorships and to the management of Fraunhofer Institutes are a characteristic feature of such co-operation. Institutional funding of the FhG by the Federal State and the Länder amounted to € 426 Mio. in 2006, the total budget amounting to appr. € 1,300 Mio. (figures of 2004).

www.fhg.de

1.4.3 The Helmholtz Association of German Research Centres (HGF)

The HGF (Helmholtz-Gemeinschaft Deutscher Forschungszentren), a registered association, comprises a total of 15 national centres for natural scientific, technological and biomedical research. With some 25,000 employees and an annual budget of about € 2.3 billion, it is Germany's largest science organisation.

Via strategically oriented cutting-edge research in its six overarching research areas, "Energy", "Earth and Environment", "Health", "Key Technologies", "Structure of Matter" and "Transport and Space", the Helmholtz Association identifies and studies major issues and topics of pressing interest for the sectors of society, science and economics. In co-operation with national and international partners, and using large scientific apparatus and related infrastructures, it studies highly complex systems. The Helmholtz Association combines research and technological development with innovative application-oriented and precautionary perspectives.

The Helmholtz Association has made promoting outstanding young scientists an important part of its mission. Since 2004, it has invited applications for 20 positions per year as heads of Helmholtz "young investigators' groups". These positions include options for permanent employment (tenure). The response to these calls for applications has been strong. Via a three-stage selection procedure, a total of 51 outstanding heads of young investigators' groups have been hired to date. Of these, twelve have come to Germany from institutions abroad, and 9 of those twelve are returnees to Germany. A total of 47 groups are being established, in co-operation with universities, as Helmholtz university groups of young investigators.

Universities are the most important national co-operation partners for the Helmholtz Association. Networking in this area is being expanded via formation of "virtual institutes". In "virtual institutes", research groups staffed with researchers from both universities and Helmholtz Centres join forces to create internationally known and attractive centres of excellence in important research areas. As of June 2005, a total of 65 virtual institutes had been established, with the support of the "Initiative and Networking Fund" ("Impuls- und Vernetzungsfonds") of the President of the Helmholtz Association. In

2006 the budget for institutional funding of the research centers of the HGF amounted to € 1,650 Mio.

www.hgf.de

1.4.4 The Gottfried Wilhelm Leibniz Science Association (WGL)

A total of 84 research institutes and service facilities are currently being jointly financed by the Federal Government and the Länder within a framework agreement on research support. In the most recent new effort in this area, an additional four institutions began receiving support as of 2005, by resolution of the Bund-Länder Commission for Educational Planning and Research Promotion (BLK). Funding for the programme is normally shared by the Federal Government and the Länder on a 50:50 basis, although funding for some institutes, especially service facilities, is split differently. The WGL (Wissenschaftsgemeinschaft Gottfried Wilhelm Leibniz e.V.) is the umbrella organisation for these institutes, which are known as “Leibniz Institutes”. The WGL's primary purpose is to enhance co-operation between the member institutes, via regular exchanges of experience and information, collaboration in matters of joint interest and joint representation of members' common interests.

In comparison to other groups of project management organisations, Leibniz Institutes are more diverse in terms of orientation and structure. This is not surprising, in light of the main formal reason why the Leibniz Institutes are jointly supported by the Federal Government and the Länder: their supra-regional importance. The institutes have national importance in terms of science policy. Leibniz Institutes are interdisciplinary and combine basic research with a close focus on applications. The Gottfried Wilhelm Leibniz Science Association (WGL) thus has greater diversity than all other research organisations. At the same time, the WGL combines this key characteristic – which the Federal Government and the Länder support and promote – with scientific work of consistently high quality, effectiveness and efficiency. Within the WGL, institutes are organised within subject-area sections. Each section's institutes use the entire section's resources. Via a wide range of co-operative relationships, especially relationships with universities, other science organisations and industry, Leibniz Institutes help to shape Germany's scientific sector and give it innovative impetus. In 2005, Leibniz Institutes were involved in a total of 55 Collaborative Research Centres and 38 Research Training Groups of the Deutsche Forschungsgemeinschaft (German Research Foundation – DFG). In addition, the WGL's group of joint appointments, in which senior-level scientists from Leibniz

institutes teach as professors at neighbouring universities, increased in number from 121 in 2000 to 216 in 2005.

The 36 WGL institutions in the eastern German Länder have a significant impact on the cities in which they are located, and they play a key role in the economic development of the new Länder. In 2006 the budget for institutional funding of the institutes of the WGL amounted to € 757 Mio.

www.wgl.de

1.5 Universities

In Germany, the term “universities” (“Hochschulen”) refers to all state-accredited universities and universities of applied science (“Fachhochschulen”). Universities serve the advancement and development of the sciences and arts, by means of research, teaching, study programmes and continuing education programmes, and in keeping with their specific tasks. They prepare students for careers requiring the use of scientific knowledge and methods or special artistic skills.

Universities have traditionally been the backbone of the German research system. This eminent position results from the broad range of subjects and methods covered by university research, and it is maintained through support of young scientists and academics. Universities play a central role as the foundations and main hubs of the German research system and, jointly, as the largest and most comprehensive pool of publicly funded research resources in Germany. The performance of Germany's universities is a key factor in the success of the entire German research system. This is true both because of universities' institutional links between research, research-oriented training of junior scientists and teaching and because of non-university research institutions' strong dependence on universities – as centres for training junior scientists, as broad platforms for a wide variety of disciplines and forms of research and as partners for co-operation in selected fields of research.

Universities cover a broad spectrum of research activities, including basic research, applied research and development:

- + **“Basic research is experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundations of phenomena and observable facts, without any particular application or use in view” (cf. Frascati Manual 1993, Art. 224).**
- + **“Applied research is also original investigation undertaken in order to acquire new knowledge. It is, however, directed primarily towards a specific practical aim or objective” (cf. Frascati Manual 1993, Art. 229).**

- + **“Experimental development is systematic work, drawing on existing knowledge gained from research and practical experience, that is directed to producing new materials, products and devices; to installing new processes, systems and services; or to improving substantially those already produced or installed” (cf. Frascati Manual 1993, § 233).**

“Associated Institutes” (“An-Institute”) are legally independent institutions that are located at and integrated within higher education institutions – but are not integral parts of these – with respect to organisation, staffing and facilities. As links between higher education institutions and industry, their task is to research commercially relevant areas within the spectrum between applied research and market-oriented product development. A range of co-operation involving such associated institutes has developed – in universities, between such institutes and with non-university institutions. Such co-operation especially includes co-operative research projects, Collaborative Research Centres and transfer units.

When universities of applied sciences (Fachhochschulen) were established in Germany at the beginning of the 1970s, they initially followed the tradition of their predecessor institutions by conducting little or no research and instead confining themselves to teaching. And in some Länder, they were allowed to conduct research only if the research was directly related to their teaching. Today however, universities of applied science are playing an increasingly important role in application-oriented research and development. Because of their practical orientation and their integration within specific regions, they function as important links between the science and business communities, and they are “natural” partners for businesses in their regions, especially for small and medium-sized enterprises without R&D departments of their own.

Technically, universities of applied science are not officially charged with training junior scientists. Nonetheless, these institutions' growing significance in application-oriented research and development projects has also been enhancing their role in qualification. At the end of 2005 there were 372 public and approximately 110 private institutes of higher education (universities and universities of applied science).

1.6 Federal and Länder institutions carrying out R&D

Federal institutions with research tasks, which are mainly federally financed, carry out their activities within the context of the tasks of the federal ministries to whose spheres of responsibility their activities belong. Their research is thus aimed at obtaining scientific findings in support of their relevant min-

istries' tasks (“departmental research”). At the same time, they also contribute to the general search for knowledge.

Department research is research (or research and development) aimed at obtaining scientific findings that are directly related to a department's or ministry's areas of activity. Such findings provide the basis for decisions in keeping with proper fulfilment of specialised tasks. Where required knowledge is not available, usually federal institutions with research tasks are called on to act (in the case of Länder ministries, this applies to Land/state research institutions).

1.7 Academies

Seven German academies of science, located in Berlin, Düsseldorf, Göttingen, Heidelberg, Leipzig, Mainz and Munich, have banded together in the “Union of the German Academies of Sciences and Humanities”, with the aim of co-ordinating their basic research and presenting themselves more effectively to other science organisations in Germany and abroad. Some 1,500 scientists, representing a broad range of different disciplines, have been elected as ordinary, corresponding or extraordinary members of one of the seven academies.

The academies' central tasks are to co-ordinate and support long-term basic research projects and to develop and cultivate interdisciplinary dialogue. The academies have also taken on the additional task of advising society with regard to general and specific issues of science, including emerging issues. The academies carry out symposia and public events, thereby contributing to intensive dialogue between science, society and industry. With considered opinions, the academies support policy-makers and the public in finding suitable answers to current issues and problems. In 2006 the budget for these seven academies amounted to a total of € 43,3 Mio.

In addition to these seven academies, the Deutsche Akademie der Naturforscher Leopoldina (German Academy of Natural Science) in Halle, a supranational society of scientific and medical experts, is funded by the Federal Government (BMBF; 80%) and the State (Land) of Saxony-Anhalt (20%). Founded 1652 it is the world's oldest continuously existing academy for natural sciences and has currently 1200 members. The Academy's chief mission results from the objectives of promoting natural science and medicine research as well as their science history, economic and social science and psychological borderline areas in accordance with its founders' motto of exploring nature to the benefit of the human being. Further tasks comprise deepening and disseminating insights in natural science both orally and in writing. To this end, the Academy conducts academic events and issues printed publications.

1.8 Business enterprises

Business and industry account for two-thirds of all research carried out annually in Germany. In the second half of the 1990s, following a weak period in the first half of the decade, industrial R&D expenditures grew very rapidly, thereby contributing significantly to the growth of R&D expenditures in Germany. In 2004, the business enterprise sector was responsible for research and development investments totalling € 36.95 billion (this figure refers only to industry – other parts of the sector contributed an additional € 1.42 billion).

It is very difficult to compare industry's research efforts with those of state research institutions and of higher education institutions. Industry concentrates its research efforts on development of marketable products. According to informal estimates, only some 5% of all industrial research expenditures go towards basic research. By contrast, in its funding the state emphasises basic, knowledge-oriented research.

The manufacturing sector is the leading sub-sector within the business enterprise sector in terms of R&D investments. In 2004, industry (manufacturing) accounted for a total of 91.5% of all R&D expenditures, and of some 90% of all R&D staff, in the business

enterprise sector. At least 40% of all companies in the German industrial sector carry out their own research and development. About 25% of the companies in this group carry out R&D on a continual basis, while the group's other companies carry out R&D sporadically. Companies in the chemical industry, the mechanical engineering industry and the areas of medical, measurement and control technology are particularly active in R&D. More than half of all companies in these sectors are active in research.

In the services sector, research plays a much less important role than it does in the manufacturing sector. Only about one out of every ten companies in this group reports that it carries out research and development. R&D is particularly prevalent among technical services providers (30%). IT and telecommunications are also relatively active in R&D (17%). By contrast, only one out of every twenty providers of distributive services – trade and transport – participates in the research process.

Not surprisingly, commitment to R&D grows with company size. A total of 80% of all large industrial companies conduct research (SME: 54%). In the services sector, 38% of large companies carry out R&D; this is four times the percentage of small and medium-sized companies active in R&D.

Part 2: The German High-Tech Strategy

For the first time ever, the German government has developed a comprehensive national strategy for all its ministries with the aim of putting Germany at the top of the world's ranks in tomorrow's most important markets. All political sectors that affect research and development will be geared to a clearly defined goal. This strategy puts innovation policy front and center in government activities.

The vision is a country that respects and rewards achievement in science and industry. Germany wants to encourage people to strike out on new paths and to become a curious, learning society. Furthermore, Germany wants to foster talent in all spheres – from the natural sciences to the humanities, from small start-ups to sizable SMEs. The goal is the generation of new ideas, new products and new system solutions. To achieve this goal, Germany is following up the High-Tech Strategy with concrete action: The German government is investing an additional €6 billion in research and development during the current legislative period. A total of some €15 billion will be allocated for cutting-edge technology through the year 2009. This will bring Germany's federal government, Länder (state) governments, trade and industry closer to achieving their common goal: Boosting research expenditure to three per cent of the gross domestic product by the year 2010.

Germany's High-Tech Strategy establishes objectives for 17 cutting-edge fields of the future - fields that will generate new jobs and prosperity in Germany. The focus here will always be on opening up new markets or developing existing markets into lead markets. Logistics, security and health are examples of areas where this could be done within a short time.

Key elements of the German High-Tech Strategy:

- + **Translate ideas into practice: The High-Tech Strategy places innovation policy at the heart of government action. It is the first national strategy to show how Germany can become and remain a global leader in the most important cutting-edge technologies.**
- + **Create more freedom for new ideas: This central policy thread has been woven into all parts of the High-Tech Strategy. More freedom for research and industry**

means that research findings will become products faster.

- + **Foster and support good minds: Germany wants to become the most research-friendly country in the world. To achieve this goal, we will foster and support talent and capability as early in life as possible and work to ensure that performance and accomplishments receive greater recognition.**
- + **No ideological blinkers: Germany will be open and receptive to new technologies. In areas such as green biotechnology and security technology we will seek opportunities and market potential.**
- + **Goals for the markets of the future: To create lead markets, the High-Tech Strategy has laid down clear-cut goals and developed a timetable complete with concrete activities for each of its targeted 17 cutting-edge fields. New strategic partnerships will arise as a result of the close coordination between the players involved.**
- + **New ideas for SMEs: Support for small and medium sized businesses and collaboration between science and industry take center stage in the High-Tech Strategy. All funding instruments and political reforms will be geared to this.**
- + **Push the strategy forward: The "Forschungsunion Wirtschaft-Wissenschaft" will provide flanking support during the implementation of the High-Tech Strategy. The experts in the Research Alliance will issue regular reports to document the strategy's progress.**

Part 3: Examples of EU-funded research projects under German coordination

3.1 Citizens and governance in a knowledge-based society

Co-ordination Action on Human Rights Violations

Acronym: CAHRV

The Co-ordination Action on Human Rights Violations (CAHRV) addresses interpersonal violence within a human rights frame-

work. In multi-country comparative studies it examines the prevalence and impact of violence, the roots of violence in men's gendered practices, the effectiveness of legal and social intervention strategies, and protective factors to secure human rights. CAHRV is building sustainable structures for cooperation and dialogue across different fields and intellectual traditions.



Violence against women and abuse of children have been recognized as serious human rights violations. This framework needs to be extended to include elderly and male victims and to encompass awareness that unchecked interpersonal violence represents a threat to democracy and social cohesion. The field of interpersonal violence typifies fragmentation in addressing human rights violations. Each type of violation has been seen as a distinct concern; theoretical and practical links have been neglected.

CAHRV aims to understand and overcome fragmentation in research, policy and practice. It integrates parallel research discourses on violence to:

- + unify a theoretical and empirical basis for policy,
- + survey a wide territory with a case study approach,
- + structure co-operation through sub-networks,
- + identify further sites of excellence.

In a practical perspective, CAHRV aims to:

- + build a research foundation for recognizing good practice,
- + make standards for services and interventions available on a European level,
- + contribute to policy-related data collection,
- + improve dissemination and co-operation with NGO's, agencies and governments.

Focal thematic areas are being studied in four sub-networks:

Sub-network 1: Identifying and profiling victimisation (Co-ordinator: Manuela Martinez, University of Valencia, Spain)

Sub-network 2: The roots of interpersonal violence: gendered practices, social exclusion and violation (Co-ordinator: Irina Novikova, University of Latvia, Latvia)

Sub-network 3: Addressing gender-based human rights violations (Co-ordinator: Jalna Hanmer, University of Sunderland, UK)

Sub-network 4: Protective environmental factors securing human rights (Co-ordinator: Ralf Puchert, Dis-sens e.V., Germany)

CAHRV also examines when policies and interventions are effective and what context variables need to be considered for transfer. High-profile conferences, cross-cutting workshops and expert groups articulate a distinctively European voice in the global discussion of human rights in everyday life.

Published results include:

- + an overview of European research on prevalence, health and human rights impact, and comparative re-analysis of data,
- + a data base of research on masculinities and violence,
- + research synopses on the justice system as an arena for the protection of human rights, and on evaluation of interventions and measures and their potential for transfer,
- + an interdisciplinary research map on the web of protective factors in work, families and social networks.

Project status: ongoing

Programme: Citizens and Governance, Coordination Action (CA)

Coordination: Carol Hagemann-White, University of Osnabrueck (Germany)

Duration: 3 years

Budget: € 650,000

Partner countries: Austria, Czech Republic, Denmark, Finland, France, Latvia, the Netherlands, Norway, Poland, Spain, Sweden, Switzerland, United Kingdom, with experts from Belgium, Estonia, Hungary, Italy and Lithuania contributing actively to the work

Partner institutions: University of Osnabrueck, Dissens e.V., Berlin, University of Bielefeld, Medical University Vienna, Austrian Women´s Shelter Network, Vienna, Masarykova Univerzita v Brne, Aalborg University, Svenska handelshögskolan, Helsinki, Institut National D´Etudes Demographiques Paris, University of Latvia, Riga, University of Groningen, The Work Research Institute Oslo, Warsaw School of Social Psychology, Warsaw University, University of Valencia, Göteborg University, Stockholm University, Social Insight, Zürich, Lancaster University, London Metropolitan University, University of Sunderland

Project-Website: www.cahrv.uni-osnabrueck.de



3.2 Energy

Network of DER Laboratories and Pre-Standardisation

Acronym: DERlab

Sustainable Development requires the use of cleaner energy resources. The connection of new decentralised and clean energy resources to the grid can help in reducing the environmental impact of power production. However, the integration of these new energy resources and technologies requires an important research, development and testing effort in order to make the most effective use of the new energy concepts and to guarantee the highest level of reliability and quality of the supply.



DERlab is the European Network of Excellence (NoE) of independent laboratories, working in the area of the integration of distributed energy resources (DER) into electricity grids and the preparation of related standards and test procedures. The main objectives are:

- + **setup of a distributed, independent world-class DER laboratory for Europe,**
- + **support for the development of European and international standards,**
- + **achievement of durable networking between European laboratories.**

As new decentralised energy resources are integrated in the distribution network, it will be necessary to use laboratory tests to validate the new concepts for analysis, planning, control, and supervision of the electricity supply and distribution in order to take these new components into account in the performance optimisation of the whole system.

The DERlab Network of Excellence (NoE) will provide critical support to the development of a common European research and development platform related with DER integration in the power system, taking into account the needs and concerns of the EU utilities and manufacturers. It will also strongly support the consistent development of DER technologies and contribute to the creation of a European competence through highly skilled human resources working at the leading edge of DER technology. Expected achievements are:

1. **A distributed world-class DER laboratory for Europe: The objective is to develop a Pan-European laboratory,**

which will be recognised as a leading laboratory in the field of Integration of DER.

2. **Support for the development of European and international standards:** This will be achieved by exemplarily executing research activities on specific fields and by initiating new research activities, which aim to provide required technical information and input to the standards.
3. **Durable networking between European laboratories:** DERlab aims at creating long-lasting European competence through the establishment of a Pan-European expert group in the area of “New DER technologies and their Integration into the Future Distribution Network” consisting of highly skilled researchers working at the leading edge of DER technology.

Project status:	ongoing
Programme:	Sustainable Energy, Network of Excellence (NoE)
Coordination:	ISSET e.V., Kassel (Germany)
Duration:	6 years
Budget:	€ 4.1 Mio.
Partner countries:	Germany, United Kingdom, the Netherlands, Spain, Denmark, Austria, Greece, Italy, France, Bulgaria, Poland
Partner institutions:	ISSET, The University of Manchester, KEMA, LABEIN, RISOE, ARSENAL, ICCS/NTUA, CESI Ricerca, CEA, TU Sofia, TU Lodz
Project-Website:	www.der-lab.net



3.3 New and Emerging Science and Technologies (NEST)

European Expert Platform for Measuring Human Feelings and Emotions

Acronym: FEEL EUROPE

In FEEL EUROPE the project partners will organise a workshop and more than 30 experts will be invited for discussion about possibilities, positive and negative effects and gender aspects of measuring human feelings and emotions in the human life. With the workshop an expert platform will be created to set up a competent environment for the above-mentioned topic.



The objective of FEEL EUROPE is to create a European expert platform for the measurement of human feelings and emotions and thus to create the basis for novel research topics, technologies, cooperation and innovations across various applications and industrial branches.

FEEL EUROPE will bring together more than 30 experts from different disciplines such as scientists in medicine, biology, psychology, philosophy, neurology, materials science, and engineers in biomedicine, architecture, telecommunication and acoustics, designers as well as experts from automobile, textile, light, sports and consulting industries.

Human feelings under discussion are comfort, wellness, effects of light, music, emotions, colours, nutrition, odour and the surroundings as well as pain, biorhythm and body language. FEEL EUROPE not only enables the European experts to discuss the scientific and technical possibility of measuring human feelings and emotions but also enables them to discuss the ethical and gender impacts e.g. is it considerable to measure feelings in the workplace or are there any differences between female and male feeling.

This project enables the European experts, with the help of a very well organised workshop, to find and develop novel kinds of technical cognitive systems, which can understand the human behaviour and thus improve the Human Machine Interfaces.

The achievements of the workshop will be published in a white paper. This white paper brings together the state of the art, novelties, ideas and possibilities in scientific, technologic and ethic aspects of measuring feelings and emotions.

Project status:	ongoing
Programme:	New and Emerging Science and Technologies (NEST), Specific Support Action (SSA)

Coordination: Prof. Dr. Klaus-Peter Hoffmann, Fraunhofer Society – Institute for Biomedical Engineering, St. Ingbert (Germany)
Duration: 1.5 years
Budget: € 195,395
Partner countries: Spain
Partner institutions: Universidad Miguel Hernandez Facultad de Medicina



3.4 EURATOM

Performance Assessment Methodologies in Application to Guide the Development of the Safety Case

Acronym: PAMINA

The Integrated Project PAMINA brings together organisations from the major radioactive waste producing countries within the European Union in order to improve and harmonise methodologies and tools for demonstrating the safety of deep geological disposal of long-lived radioactive waste and spent nuclear fuel in different geological environments. The results may be exploited by different stakeholders such as national waste management organisations, regulators and the public at large.



The main objective of the Integrated Project (IP) PAMINA within the 6th Framework Programme of the EU is to improve and harmonise integrated performance assessment (PA) methodologies

and tools for various disposal concepts of long-lived radioactive waste and spent nuclear fuel in different deep geological environments. The IP PAMINA aims at providing a sound methodological and scientific basis for demonstrating the safety of deep geological disposal. This basis will be of value to all national radioactive waste management programmes, regardless of waste type, repository design, and stage, that has been reached in PA and safety case development. A handbook describing the state of the art of safety assessment methods will be prepared which includes the experiences of organisations directly involved in preparing safety assessments as well as of regulators and other organisations using such results.

Starting from a comprehensive overview of PA methodologies, tools and experiences, methodological advancements will be investigated, evaluated or developed. This includes inter alia a framework for treating and managing uncertainty during PA and safety case development, improvements of methods and tools regarding process understanding and conceptualization and the needs for implementing more sophisticated modelling approaches in PA.

The participating organisations represent all major radioactive waste producing countries within the European Union. The consortium includes national waste management organisations, a regulator, several technical safety organisations (TSO) that closely support the regulator, universities and research organisations and two SMEs. From their different roles within their national radioactive waste programme, the participants bring in complementary viewpoints and experiences into the project which allows exploitation of the project results by national waste management organisations, regulators as well as the public at large.

Project status: ongoing
Programme: Euratom Research and Training Programme on Nuclear Energy, Integrated Project (IP)
Coordination: Gesellschaft für Anlagen- und Reaktorsicherheit (GRS) mbH, Braunschweig (Germany)
Duration: 3 years
Budget: € 7.6 Mio.
Partner countries: Belgium, Czech Republic, Finland, France, Germany, the Netherlands, Spain, Sweden, Switzerland, United Kingdom
Partner institutions: Niras, SCK-CEN, AVN, NRI, VTT, Posiva, ANDRA, CEA, IRSN, Univ. Claude Bernard Lyon, GRS, BGR, FZK-INE, DBETec, NRG, Enresa, UDC (Univ. La Coruna), UPVLC (Univ. Politécnicna de Valencia), Enviros, SKI, Facilia, Nagra,

Colenco AG, Nirex, Galson Scientific, EC Joint Research Centre Petten (total 26 institutions)

Project-Website: www.ip-pamina.eu



3.5 Information Society Technologies (IST)

wearIT@work – Empowering the Mobile Worker by Wearable Computing

Acronym: wearIT@work

For wearable mobile computing a new paradigm supporting complex tasks with a minimum of active human-machine interaction is developed.



Mobile professionals keep their attention focused on the work environment supported by valuable information provided by LivingLab solutions of wearIT@work. With the four application domains of healthcare, production, maintenance and emergency response most important sectors of Europe's economy are addressed.

A new field of business is expected to evolve based on the project results.

With **workplace studies** and **design workshops** in LivingLabs processes are studied at the end users' sites. Prototypes are designed and evaluated together with the end users. Each of the project partners is at least involved in one of the application domain oriented LivingLabs.

Based on the **know-how** brought by the partners to the project – like the belt computer QBIC – and results of the first innovation cycle – like an interaction wristband – a **technology repository** was set-up beside a collection of **demonstrators**. Possible **take-up actions** will be promoted during road shows in 2006. With the **IFAWC** (International Forum for Applied Wearable Computing) a scientific community building process around the project was established.

A new generation of optimised **collaborative man-machine interfaces**, with body-near context detection and innovative

input and output devices was developed and will be marketed already at this stage of the project. Further **hardware** and a first version of the **software framework** are available.

The **open wearIT@work hardware platform** consists of a core wearable computing unit, input and output devices, general peripherals, and sensor and communication subsystems. The platform provides the end-user with a seamless access to heterogeneous networks and allows the integration of different sensor devices for the context detection and for human computer interaction devices reflecting the working environment requirements.

The **open wearable computing software framework** (OWSF) is based on the common hardware platform which is of great importance from the perspective of within and outside the project. The OWSF impacts the exploitation of wearable computing solutions within and outside the project.

The addressed standardization pushes developers of devices, components and systems. Beside a service registry and high level services the OWSF covers core services like context awareness, communication, I/O, and security. Systems integrators and consultants develop their business based on the OWSF.

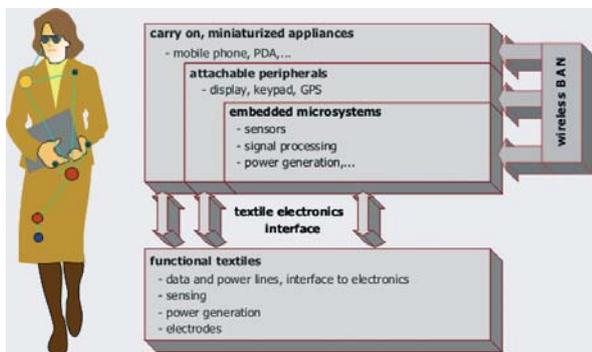
In the first innovation cycle wearIT@work developed and evaluated six demonstrators together with the end-users, one for healthcare, one for the maintenance pilot, and two each for the production and emergency response pilots developed. The **demonstrators** showed that the integration of information technologies in nearly every working process can be mostly based on commercial-off-the-shelf components.

The **Open Wearable Computing Group** (OWCG) was established by the project and prepares the ground for a paradigm-centered standardization body coping with the different aspects related to wearable computing in an interdisciplinary fashion, bringing together developers, integrators, users, policy makers, associations, etc.

Project status:	ongoing
Programme:	Information Society Technologies, Integrated Project (IP)
Coordination:	TZI - Universität Bremen (Germany)
Duration:	4.5 years
Budget:	€ 23 Mio.
Partner countries:	Germany, Italy, France, Israel, Iran, Switzerland, Austria, Greece, Turkey, Denmark, Czech Republic, Poland, Sweden, Spain, Belgium
Partner institutions:	TZI Universität Bremen, BIBA, BIA, Fraunhofer FIT, Infoconsult, Microsoft, Mobile Solution Group, SAP, Universität Paderborn, Siemens, Carl Zeiss, Unity, DoCoMo, ENEA, Giunti Labs, Hewlett

Packard, Paris Firebrigade, EADS, Thales, Comarch, Edna Pasher, CIT, ETH Zürich, Gespag, Ionian, Mobilera, Mobintech, Multitel, Tekniker, Grado Zero Espace, Systema, Rosenbauer, Skoda, TEAM, UMIT, CDT.

Project-Website: www.wearitatwork.com



3.6 Lifesciences, genomics and biotechnology for health

Role of lycopene for the prevention of cardiovascular diseases

Acronym: LYCOCARD

Cardiovascular diseases are a main mortality cause in Europe and all developed territories. Lycopene is a plant pigment found in high concentration, among others, in tomatoes, Europe's second-most important agricultural crop and the main lycopene source in the diet. There is evidence that lycopene protects against this disease. However, its content in tomato products and its beneficial effects have not been sufficiently linked because research has lacked a “total food chain” approach.



During the next five years, the 15 LYCOCARD partners from six countries will investigate the role of lycopene in reducing the risk of cardiovascular diseases, by addressing each link in a “farm to fork” approach to increase the understanding of diet and health.

LYCOCARD's multidisciplinary, intersectorial consortium of scientists, technologists, and patient organisations contains the critical mass to achieve these ambitious aims.

The specific goals are:

1. Genetic, molecular, biochemical and physiological functions of lycopene (and related compounds) in protecting against cardiovascular diseases will be investigated in various ways: aspects of lycopene bio-availability in in vivo and in vitro models and of oxidative catabolism of lycopene; protective antioxidant potential of physiologically relevant isomers and metabolites; modulation of endothelial functions by these compounds; effects of lycopene and its derivatives on cell signalling pathways involved in cardiovascular health, investigated in in vitro and ex vivo models, with two negative factors – cigarette smoke and cholesterol.
2. This more detailed knowledge of the protective effects of lycopene and tomato products will enable the industrial partners to develop products with higher protective impact on cardiovascular health. For this, they will select tomato varieties and improve processing conditions. Human trials will assess the effect of lycopene and tomato products on parameters involved in cardiovascular diseases.
3. Based on the research outcomes, two patient organisations will develop new health and dietary guidelines for primary prevention, aimed at reducing the incidence of cardiovascular diseases as well as providing guidelines for those people at risk. An example could be: “Eat five fruits and vegetables, including a tomato product, per day”.
4. Through effective communication with for example medical associations and other patient advocacy groups, the results will be disseminated to health professionals, the general public and the food industry. In addition, the project will strengthen the position of the European food industry, mainly by enhancing opportunities for small and medium-sized enterprises. Workshops and training courses will add to this process.

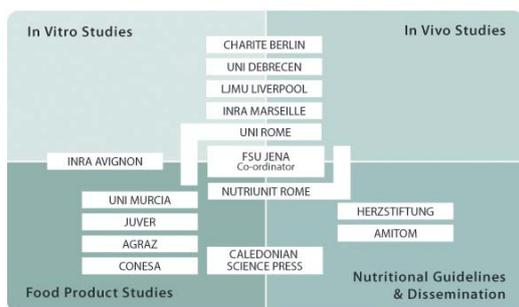
The project website www.lycocard.com will be regularly filled with ongoing results related to the topic “tomatoes and heart”, making it an information platform for science, industry, patient organisations and consumers.

Project status:	ongoing
Programme:	Lifesciences, Integrated Project (IP)
Coordination:	PD Dr. Volker Böhm, Institute of Nutrition, Friedrich Schiller University Jena (Germany)
Duration:	5 years
Budget:	€5.2 Mio.

Partner countries: Germany, France, Italy, Spain, United Kingdom, Hungary

Partner institutions: Friedrich Schiller University, Jena, Charité, Berlin, INRA, Avignon, University of Debrecen, Liverpool John Moores University, University of Murcia, INRA Marseille, Catholic University Rome, Nutriunit Rome, Deutsche Herzstiftung, Frankfurt, JUVER, Murcia, AMITOM, Avignon, AGRAZ, Villafranco del Gadiana, CONESA, Villafranco del Gadiana, Caledonian Science Press, Sitges

Project-Website: www.lycocard.com

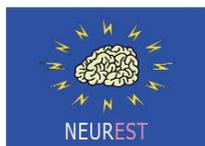


3.7 Marie Curie Actions – Human resources and mobility

Training Europe's future neuroscientists

Acronym: NEUREST

Understanding the brain and combating diseases of the nervous system is a major goal of the European Union's health policy. Sixteen young scientists from nine countries have been awarded a Marie Curie fellowship to work on a cutting-edge research project and to participate in specialised neuroscience training in Göttingen.



Despite major advances in molecular, cellular and systems neurobiology, causative therapies of major neuropsychiatric diseases, such as dementia, epilepsy, schizophrenia, Parkinson's and Alzheimer's disease are not yet available in most cases. Research in this area is especially important as the incidence of these disorders has increased dramatically in the ageing population. Major research efforts are needed to understand the

underlying disease mechanisms and thus pave the road for inventing new therapeutic strategies.

The NEUREST programme (Neuroscience Early Stage Training) has been established in Göttingen to educate future neuroscientists at the highest possible level. A faculty of 40 scientists from the Max Planck Institutes for Biophysical Chemistry and Experimental Medicine, and from neuroscience labs at Göttingen University have joined forces to implement a unique and structured neuroscience training programme. The programme is supported by the European Union within the framework of Marie Curie Actions and will receive funds of € 2.5 Mio. over a period of four years.

Training is offered in all areas of neuroscience covered by the participating faculty members. Based primarily on a focused and cutting-edge research project, the programme includes the development of complementary skills such as scientific writing, presentation skills and project management. Last but not least, the students are integrated into a series of organized events aimed at improving intercultural exchange.

Funds are at disposal to cover the monthly living and travel allowances of the fellows and to contribute to their research expenses. The 15 young doctoral students (five men and ten women) from nine European and non-European countries are expected to receive their PhD degree from Göttingen University after three years of training.

Besides achieving scientific excellence based on research-oriented training, the fellowships will have a strong impact on the career development of the young scientists and equip them with the skills they will need to become group leaders in neuroscience research. The project will ultimately have a significant impact on the treatment of neuropsychiatric disorders in Europe and elsewhere in the world, to the benefit of those suffering from such diseases and improving the quality of their lives.



Project status: ongoing
Programme: Marie Curie Actions – Human resources and mobility: Fellowship

Coordination: Reinhard Jahn & Joachim Bohrmann, Max Planck Institute for Biophysical Chemistry, Goettingen (Germany)
Duration: 4 years
Budget: € 2.5 Mio.
Partner countries: Germany
Partner institutions: Max Planck Institute for Biophysical Chemistry Göttingen
Project-Website: www.neurest.mpg.de

3.8 Materials

Advanced Interactive Materials by Design

Acronym: AIMS

More than 120 monoclonal antibodies are currently being developed and tested. They could theoretically be used for successful treatment of various illnesses like for example cancer or Alzheimer's disease. However, therapy costs are extremely high and production capacities fall short when these products are launched on the market. The Integrated Project AIMS (Advanced Interactive Materials by Design) focuses on the investigation of possibilities to improve production technologies for biotech pharmaceuticals on the example of monoclonal antibodies (MABs).



AIMs deals mainly with the purification and separation of biotech pharmaceuticals, which causes nearly half of the overall production costs. The selective purification steps by using specific ligands constitute the highest cost reduction potential.

Up to now, research activities have focused either on the production and optimisation of selective ligands or on the optimisation of the process design. AIMS is the first scientific project to combine the two thematic aspects. Thus, the researchers hope to attain higher efficiency of their activities and to bring about a significant cost reduction, decrease in process development time and an increase in production performance.

The key to the solution of this complex problem is a cooperation of experts in various areas, and the Integrated Projects of the European Commission provide a suitable instrument. Only in the frame of such an Integrated Project, the indispensable 8 industrial partners, 14 universities, stakeholders and publishers could be brought together to form a multidisciplinary team. AIMS comprises 6 sub-projects dealing with different topics around the purification and separation of monoclonal antibodies: starting from the development of suitable carriers and

selective ligands over the identification of their physical characteristics, and the separation and purification characteristics when using these materials in chromatography, extraction and membrane units up to the overall process development itself. Parallel socio-economic studies on the patients' ability to work as well as on the economics in general will be executed, and a comprehensive training programme is planned.

The AIMS researchers' intention is to initiate a paradigm shift in the field of biotech pharmacy towards a stronger orientation on products and to enhance sustainable competitiveness of European pharmaceutical industry on the global market.

After two years of project duration, the first scientific and technical results have already been achieved and presented during international conferences, among others SPICA 2006, Euromembranes, ESBES.

Computational simulation of the interaction between affinity ligands and support materials by the University of Milan and the X-ray crystallography studies executed by the Technical University of Lodz provide a better understanding on molecular level. In parallel, benchmark and new materials have been tested and characterised for all three unit operations: chromatography, membrane separation and extraction. The developed mathematical models make predicting the experimental results possible and provide hints concerning the material performance in real production processes.

AIMs is divided into 6 individual sub-projects. The sub-projects are all headed by internationally experienced sub-project leaders and are interlocked to ensure an optimum exchange of both knowledge and technology. In the frame of AIMS, new materials will be developed as a combination of support structures, ligands and linkers.

Project status: ongoing
Programme: Nanosciences, Nanotechnologies, Materials and new Production Technologies, Integrated Project (IP)
Coordination: Prof. Dr.-Ing. Andrzej Górak, Department of Bio- and Chemical-engineering, Universität Dortmund (Germany)
Duration: 4 years
Budget: € 11.5 Mio.
Partner countries: Austria, Switzerland, Germany, Finland, France, Hungary, Italy, the Netherlands, Poland, Portugal, Slovakia, United Kingdom
Partner institutions: Bayer Technology Services GmbH, DSM Biologics, Merck KGaA, Sartorius AG, GVS S.p.a., Prometic Biosciences Ltd.,

Syncom B.V., Xeptagen, ABO Akademi University, Budapest University of Technology and Economics, Central Institute for Labour Protection, CNRS-Université de Provence, ETH Zürich, Instituto Superior Técnico Lisboa, Montpellier University, Politecnico di Milano, Slovak University of Technology in Bratislava, Technical University of Lodz, University of Bologna, University of Dortmund, University of Twente, University of Vienna, Elsevier Ltd, Dechema e.V.

Project-Website: www.aims-eu.de



3.9 Microsystems technology

Micro-Nano System for Automatic Handling of Nano-Objects

Acronym: NanoHand

The continuing trend towards complex and intelligent products goes beyond the limits of conventional manufacturing technologies and processes. Thus it is important to develop and implement reliable and economic manufacturing concepts. The NanoHand project aims at the development of microrobotic systems for automated handling of nanometer sized objects like carbon nanotubes (CNT) or nanowires. Hence, solving the problem of handling CNTs efficiently may be generalised to the vast number of non-CNT nanowires and related objects.

NanoHand will provide industrial technology to handle single nano-objects thus providing tools for the industrial production of new nano-enabled electronic products and services.

In the NanoHand project a system consisting of micro/nano based subsystems for automatic handling of nanometer sized objects like carbon nanotubes and nanowires will be developed. The goals of the project are driven by the needs of upcoming semiconductor technology. Two demonstrators will be built, which have a short term as well as a long term perspective. The former one aims at an automated decoration of scanning probe microscope probes with CNT-enabled supertips and supertips grown by focused electron beam induced deposition. In the long term perspective handling and assembly of CNTs for the construction of nanoelectronic devices will be supported.

The cornerstones of the NanoHand project are the important basic R&D results of the FP5 GROWTH project ROBOSEM (Development of a Smart Nanorobot for Sensor-based Handling in a Scanning Electron Microscope) which was successfully finished in 2005. The goals of NanoHand go beyond the transfer of these results towards an industrially applicable, automated handling system for nanoobjects and its application. The new possibilities offered by the microrobotic techniques will be assessed in two industrially highly relevant applications mentioned above. The know-how developed in both techniques and tools for handling nanoobjects and their applications will positively impact both the SME involved in the project, as equipment manufacturers, and the semiconductor industry, which is involved as the end-user.

The project rests on the pillars of four subprojects. Substantial R&D activities are carried out in Subproject 1 with the goal of tailoring a versatile robotic system for the demands of the applications. In a second subproject these industrial applications are realized and evaluated. Subproject 3 deals with the effective Europe-wide exploitation and dissemination of the project results. Subproject 4 manages the project.

The project's consortium gives almost a guarantee for the project's success as it consists of a number of Europe's most experienced and internationally leading research institutes in the field of microrobotics and nanohandling, the biggest semiconductor company in Europe, and a number of dynamic SMEs in the field of nanotechnology. Moreover, the exploitation of the project results will be done most effectively by the biggest Europe-wide network of SMEs in the field of microsystems technology.

Project status: ongoing
Programme: Information Society Technologies (IST), Integrated Project (IP)
Coordination: Oldenburger Forschungs- und Entwicklungsinstitut für Informatik-Werkzeuge und -Systeme (OFFIS), Oldenburg (Germany)

Duration: 3 years
Budget: € 4.9 Mio.
Partner countries: Germany, Denmark, Italy, United Kingdom, Switzerland, Czech Republic
Partner institutions: Oldenburger Forschungs- und Entwicklungsinstitut für Informatik-Werkzeuge und -Systeme (OFFIS), Swiss Federal Laboratories for Materials Testing and Research (EMPA), Mikroelektronik Zentrum (MIC), STMicroelectronics (ST), Swiss Federal Institute of Technology (EPFL), Swiss Center for Electronics and Microtechnology, Inc. (CSEM), VDI/VDE Innovation + Technik GmbH (VDI/VDE-IT), FUTUREtec – Gesellschaft für angewandte Informatik mbH (FUTUREtec), Dr. Volker Klocke Nanotechnik, Tescan, Nanoscale Technologies GmbH (Nascatec), Eurexcel
Project-Website: www.nanohand.org

3.10 Nanotechnologies and nanosciences, knowledge-based multifunctional materials and new production processes and devices

Cell Programming by Nanoscaled Devices

Acronym: CellPROM

CellPROM unites 27 academic and industrial research partners from 12 countries for a period of four years to achieve its main objective of non-invasive »programming/differentiation« of individual cells on an industrial scale.



CellPROM – beginning March 2004 – is the largest Integrated Project within the thematic priority of “Nanotechnologies and nanosciences, knowledge-based materials and new production processes and devices” (NMP) of the 6th EU Framework Programme.

The main objective of the project running over four years is the non-invasive »programming/differentiation« of the destiny of individual cells on an industrial scale.

The principle relies on specific reactions of immobilised cell surface receptors in response to contact with customised nanostructured surfaces – the NANOSCAPES – whose macro-molecular landscapes mimic biological functions routinely

exerted via surface contacts, e.g. by immune cells in the human body and cell differentiation.

Since the transmission of the programming or differentiation information from the surface receptor to the nucleus of the cell occurs via natural intracellular signal pathways and without further technical interference, this approach promises a minimisation of undesirable side effects of artificial cell imprinting, while its mastery on an industrial scale opens up important areas of application in the fields of biotechnology, medicine, pharmacy and general technological development. The project CellPROM gives a strong push to and knits together interdisciplinary research in nanostructuring and on signal pathways in biological cells because large-scale production and use of these NANOSCAPES require the development of suitable tools – e.g. reusable nano-stamps – and their testing on cells as well as the adaptation of current methods of cell handling and characterisation to the technical requirements of the imprinting process. At the end of the project, functional modules are to be provided that already incorporate first solutions to these technical challenges. They can serve as vantage points for further development until maturity phase as well as for the design of subsequent applications whose aggregated effects will considerably bolster the significance of the location Europe in the key market of nano-biotechnologies.

The project features multiple nano- and biotechnological challenges which will lead to breakthroughs in nanotechnological device development and, moreover, drastically advance our understanding of biological signals relevant to cellular differentiation. A potential device for the mass production of such precisely differentiated cell samples will follow a modular approach. Within this Integrated Project, we will address those modules by highly interlinked work packages, each of them dedicated to a special module development.

Project status: ongoing
Programme: Nanotechnologies and Nanosciences, knowledge-based multifunctional materials and new production processes and devices (NMP), Integrated Project (IP)
Coordination: Fraunhofer Institute for Biomedical Engineering (IBMT), St. Ingbert (Germany)
Duration: 4 years
Budget: € 17.6 Mio.
Partner countries: Austria, Belgium, Switzerland, Germany, France, Spain, Israel, Italy, Lithuania, Portugal, Sweden, Slovenia
Partner institutions: The universities of Lausanne, Barcelona, Saarbruecken, Vienna,

Kaiserslautern, Pavia, Ljubljana, Tel-Aviv and Vilnius; research institutes of Fraunhofer-Gesellschaft, Royal Institute of Technology, Institute of Experimental Biology and Technology, Institute Pasteur, Institute of Analytical Sciences, Institute for New Materials, Georg-Speyer-Haus and Max-Planck-Institute for Biophysical Chemistry; the companies Evotec Technologies, Leister Process Technologies, GeSIM, Sysmelec, Eurogentec, Silex, Surface Imaging Systems and AMO; EURICE and tp21

Project-Website: www.cellprom.net



3.11 Science and society, women and science

Roberta-Goes-EU

Acronym: Roberta-EU

Highly qualified engineers are essential for the sustainability of our society. Young people need to be encouraged to take up engineering studies. Roberta-Goes-EU takes girls and young women into the fascinating world of robots, where they learn about science and technology in an exciting yet realistic way. Roberta-Goes-EU teaches teachers, builds a European network of Roberta Regional Centers, and encourages the participation of student teams in robotics competitions like RoboCupJunior.



Motivation

According to the German Association of Engineers (VDI), the labor market in Germany is short of 20,000 engineers annually. Many other EU member states face a similar situation. It is obvious that there is an urgent need for training more engineers. Highly qualified engineers in key areas like IT, mechatronics, and robotics are essential for the sustainability of our society. Girls and women present a huge untapped source for engineers, but technical subjects and professions interest girls even less than boys. Young people, and especially girls, need to be encouraged to take up engineering studies.

Approach

Roberta takes girls and young women into the fascinating world of robots, where they can learn science, technology and IT in an exciting and realistic way. Using real robots! Robotics allows for a hands-on introduction to technology. With the help of educationally and technically adapted robots, children can learn the basics of robot construction and programming within one day. By designing, constructing, programming, and testing autonomous mobile robots, children learn that technology is fun and how technical systems are developed. This helps them gain knowledge in IT, electrical engineering, mechanics and robotics. Constructing and using robots is the ideal way to communicate the types of knowledge that are important for understanding technical problems. The attractiveness of robots helps to overcome inhibitions, because the playful approach reduces skepticism. In addition, children become fascinated by robot development, which encourages their interest in the subject and their willingness to learn more.

Roberta-Goes-EU

Roberta-Goes-EU provides training courses and comprehensive teaching materials in several European languages to teachers. Roberta instructors are specially trained in gender-sensitive course organization. Starting from 15 regional centers in Germany, Roberta-Goes-EU builds a European network of Roberta Regional Centers and encourages the participation of student teams in robotics competitions like RoboCupJunior.

Results

The attractiveness and quality of the courses are continuously assessed and empirically evaluated. The results show that Roberta courses achieve their goals of generating an interest in technology, encouraging the children's willingness to learn, strengthening their self-confidence, and making learning fun for

them. Of the girls participating, 94% said the course was fun, 88% would recommend it to their friends, and 72% would like to have more courses. Until fall 2006 more than 200 teachers have taken a Roberta training and more than 2,600 girls and boys participated in Roberta courses in Germany. Training and education has just started in other countries. By the end of 2007 we aim at building 12 new regional centers, training 100 additional teachers, and giving Roberta courses for more than 1200 girls and boys.

- Project status:** ongoing
- Programme:** Science and Society, Specific Support Action (SSA)
- Coordination:** Fraunhofer IAIS (Germany), St. Augustin Prof. Dr. Gerhard K. Kraetzschmar
- Duration:** 2 years
- Budget:** € 632,281
- Partner countries:** United Kingdom, Sweden, Italy, Austria, Switzerland
- Partner institutions:** Burgenländisches Schulungszentrum, Neutal, FH Joanneum, Graz, ZIMD, Wien, Pädagogische Hochschule Bern, Hochschule Winterthur, Universität Zürich, Pädagogisches Institut für die deutsche Sprachgruppe, Bozen, University of Rome La Sapienza, Örebro University, The Open University, Milton Keynes (more to come)
- Project-Website:** www.roberta-home.eu



European Platform of Women Scientists EPWS

Acronym: PLATWOMSCI

Women make up half of the student population in Europe but on average hold only 15% of senior academic positions. The European Platform of Women Scientists EPWS addresses this situation and gives women scientists a voice in the EU policy process, connects and supports existing national, regional and international networks of women scientists of all disciplines and contributes to networking among women scientists, particularly in Central and Eastern Europe and in the private sector.



Designed as a democratic, inclusive, permanent, sustainable and politically active non-profit making association with its administrative seat in Brussels, the European Platform of Women Scientists EPWS seeks to empower women scientists to participate in the research policy debate and to enhance their professional and career advancement. The Platform supports the work of national, regional and international networks of women scientists in all disciplines to counter the still significant under-representation of women in science. The Association's primary target group are networks of women scientists but the Platform also addresses individual women scientists who want to network or are seeking information beyond their existing networks. Preparatory work started in February 2005 with opening a provisional office in Brussels. A range of high-ranking women scientists from all over Europe and associated countries have been committed as Founding Members of the Association. In November 2005, EPWS was legally established as an international non-profit association under Belgian law (AISBL). In January 2006, the Association moved to its new permanent premises, where the secretariat staff took up work in February 2006.

The European Platform of Women Scientists

- + represents with democratic legitimacy and transparent decision-making structures the concerns, needs, aspirations and interests of European women scientists in dialogue with national, European and international institutions,
- + “networks the networks” of women scientists and promote networking among women scientists in particular in Central Eastern Europe and the private sector,
- + acts as a structural link between women scientists and policymakers,

- + coordinates EU value-added support activities for women scientists,
- + assumes the role of key strategic actor in the research policy debate,
- + makes women scientists more comprehensively understand the role they can play in the research policy debate and how to fully benefit from these opportunities by bundling their powers and forces,
- + assists the preparations of the 7th EU Framework Programme for Research, Technological Development and Demonstration Activities to integrate research by, for and about women,
- + promotes the understanding and the inclusion of gender issues in science and research,
- + supports awareness raising for women in industrial research,
- + develops public relations and profiles the work of women scientists.



EPWS Secretariat

Project status:	ongoing
Program:	Science and Society; Specific Support Action (SSA)
Coordination:	Center of Excellence Women and Science CEWS, Social Science Information Centre, Bonn (Germany)
Duration:	28 months
Budget:	€ 2 Mio.
Partner countries:	Belgium; external experts from Belgium, Bulgaria, Finland, France, Germany, Israel, Italy, Luxembourg, the Netherlands, Spain and the United Kingdom
Partner institutions:	European Platform of Women Scientists EPWS, AISBL
Project-Website:	www.epws.org

3.12 Specific Small and Medium-sized Enterprises activities (SMEs)

Temperature tag for food freshness: Integrated approach to enable traceability of the cold chain of fresh, chilled meat and fish products by means of tailor-made time/temperature indicators

Acronym: Freshlabel

New European Union regulations require the food industry to establish traceability of the cold storage chain to ensure that food products keep their freshness en route from farm to fork. With 21 partners from eight countries the Collective Research Freshlabel project is aimed at developing temperature-sensitive tags to give small and medium-size enterprises (SMEs) an inexpensive method for verifying that cold storage temperatures are correctly maintained at all points along the food chain.



Spoilage of fresh, chilled meat and fish food products mainly stems from breaks in the cold chain during transport and storage. Since many different people and companies handle these products along their way to the consumer, it is currently impossible to ensure that correct storage temperatures are maintained throughout. The Freshlabel project aims to develop time-temperature indicator (TTI) tags that provide consumers and inspectors with clear visual information about the freshness of chilled and fresh meat and fish products.

Led by the research and technology developer Technologie-Transfer-Zentrum, of Bremerhaven, Germany, the project will use TTIs from the Israeli SME partner FreshPoint Quality Assurance. Other RTDs include National Technical University of Athens and Rheinische Friedrich-Wilhelms-Universitaet of Germany, as well as the Technical Research Centre of Finland VTT. The project will optimise TTIs for eight specific meat and fish products of partner SMEs, including the Centro Frigorifico Conservero of Spain, French meat wholesaler Civial, and wholesaler Kuopion Kalatuote of Finland.

Freshlabel's industrial association/grouping (IAG) partners range across Europe, including France's Syndicat National de l'Industrie des Viandes, Finland's Pro Fish Association, the Norwegian Seafood Association and, from Germany, the Bundesverband der Deutschen Fischindustrie und des Fischgrosshandels, and the Bundesverband der Deutschen Fleischwarenindustrie.

The type of TTIs used by the Collective Research project will be based on organic microcrystals that react to changes in temperature over time by losing colour, thereby indicating the freshness of temperature-sensitive products. The crystals turn dark blue when exposed to ultraviolet (UV) light. The amount of UV light applied will be calibrated during production, according to specific food products' relevant parameters, such as temperature requirements and shelf-life. Parameters will vary widely for various fish, meat and other products. The crystal will be encased in transparent plastic foil to block UV light, to prevent further colouring. The tag can either be part of a product's packaging or label.

Used properly, TTIs can significantly improve traceability of the cold chain followed by these food products, increasing food safety and satisfying the new EC regulations. Consumers will be able to easily see whether a food product is fresh or not, so this should help restore some of their confidence in the food supply.



Project status: ongoing
Programme: SME-specific measures: Collective Research
Coordination: ttz Bremerhaven (Germany)
Duration: 3 years
Budget: € 1.54 Mio.
Partner countries: France, Finland, Belgium, Norway, Spain, Israel, Greece
Partner institutions: Technology Transfer Zentrum Bremerhaven, Syndicat National de l'industrie des Viandes, Pro Fish Association, Liaison Centre for the Meat Processing Industries in the EU, Norwegian

Seafood Association, Bundesverband der Deutschen Fischindustrie und des Fischgrosshandels e.V., Federació Catalana de Industrials de la Carne, Freshpoint Quality Assurance Ltd, Heinrich Abelmann GmbH Fischfeinkost, Windau GmbH and Co Kommanditgesellschaft Fleischwarenherstellung, Kuopion Kalatuote Oy, Covial S.A., Myrskylän Savustamo Oy, Centro Frigorífico Conservero, Interfish Aquaculture S.A., Bundesverband der Deutschen Fleischwarenindustrie e.V., Remo Brodr A.S., Asociación Nacional de Fabricantes de Conservas de Pescados y Mariscos, National Technical University of Athens, Rheinische Friedrich-Wilhelms-Universität Bonn, VTT Technical Research Centre of Finland

Project-Website: www.freshlabel.net

3.13 Aeronautics and space

Advanced Service Centre for Risk Prevention and Crisis Management in Mountainous Areas

Acronym: ASSIST – Alpine Safety, Security & Informational Services and Technologies

Some 30% of the EU territory, including 30 million inhabitants, lies in or nearby mountainous



areas. Natural hazards such as avalanches, landslides and floods pose constant serious threats to residents, tourists and infrastructure in these regions. An advanced disaster management system can reduce the risks for life and property. The aim of the ASSIST Project is to deliver such a system by combining existing services and related infrastructure with the effective use of Earth observation data.

In the context of GMES, the project ASSIST (Alpine Safety, Security & Informational Services and Technologies) aims at improving the capabilities of risk warning and crisis management systems in alpine regions. The project's main objective is to deliver a pre-operational information service which shall be based on existing systems and products and make use of satellite-based navigation and Earth observation data. The underlying idea is to develop and implement a flexible and distributed system architecture for the production and exchange of rele-

vant static and dynamic data products required for risk prediction and disaster management.

The backbones of the overall concept are the so-called “Service Nodes”. These nodes will be autonomously operated by organisations which are responsible for risk and/or crisis management. The Service Nodes are capable of:

- + **requesting and ingesting raw input data (satellite-borne, air-borne and terrestrial),**
- + **processing the input data into products suitable for risk prevention and crisis management,**
- + **distributing the products within the “User Network” (fixed and mobile regional risk management centres and – in case of crisis – up to the mobile staffs in field),**
- + **exchanging products with other Service Nodes operated by different organisations (e.g. police, hospitals, ambulance services, air rescue, fire fighters, etc.).**

The nodes will be laid out to support two scenarios: a) day-to-day monitoring and predictions of risk scenarios, and b) operation during concrete crisis situations, each with different requirements in terms of data availability and distribution. The related project consortium is composed to reflect both scenarios. It consists of organizations with experience in different application fields: avalanche prediction, mountain rescue, IT system solutions and data management, generation and analysis of Earth Observation products, SAR interferometry, satellite navigation, development of end user devices, etc. Thus, for instance, the layout of the information network will profit to a great extent from the profound experience at hand in designing space flight control centres. The initial validation of the system will be performed within a transborder region covering Austria, Italy and Switzerland. However, the developed architecture will be so generic that it can easily be transposed to other mountainous areas in the world.



Project status:	ongoing
Programme:	Aeronautics and Space, Specific Targeted Research on Innovation Project (STReP)
Coordination:	VCS Aktiengesellschaft, Bochum (Germany)
Duration:	2.5 years
Budget:	€1.1 Mio.
Partner countries:	Germany, Austria, Switzerland, Italy, Slovakia
Partner institutions:	VCS AG, Gamma Remote Sensing, ASI Tyrolean, SLF Davos, Telematica, Tele+ Italia, Joanneum Research plus ZAMG, Province Bolzano and Mountain Rescue Slovakia as associated users
Project-Website:	www.assist-gmes.org

3.14 Sustainable development, global change and ecosystems

Assessing Large-scale environmental Risks for biodiversity with tested Methods

Acronym: ALARM

Based on a better understanding of terrestrial and freshwater biodiversity and ecosystem functioning ALARM aims to develop and test methods and protocols for the assessment of large-scale environmental risks in order to minimise negative direct and indirect human impacts.



ALARM research focuses on the assessment and forecast of changes in biodiversity and in the structure, function, and dynamics of ecosystems. This relates to ecosystem services and includes the relationship between society, economy and biodiversity. In particular, risks arising from climate change, environmental chemicals, biological invasions and pollinator loss in the context of current and future European land use patterns have to be assessed. There is an increasing number of case studies on the environmental risks subsequent to each of these impacts. This yields an improved understanding of how these act individually and affect living systems. In contrast, the knowledge about how they act in concert is poor and ALARM is the first research initiative with the critical mass needed to deal with such aspects of combined impacts and their consequences.

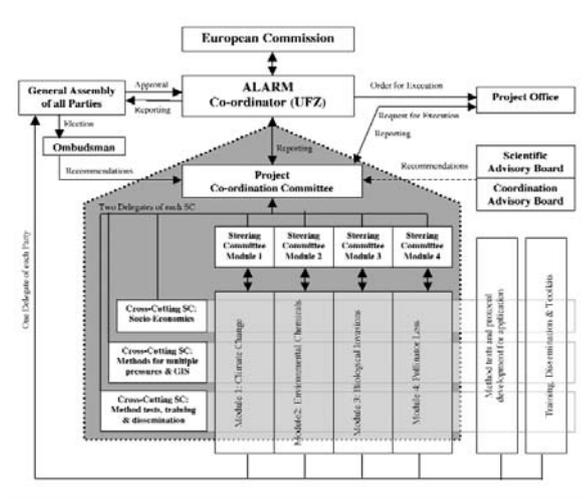
Risk assessments in ALARM are hierarchical and examine a range of organisational (genes, species, ecosystems), temporal

(seasonal, annual, decadal) and spatial scales (habitat, region, continent) determined by the appropriate resolution of current case studies and databases.

Socio-economics as a cross-cutting theme contribute to the integration of driver-specific risk assessment tools and methods and allow to develop instruments to communicate risks to biodiversity to end users, and indicate policy options to mitigate such risks.

The ALARM consortium combines the expertise of 67 partners from 33 countries. ALARM encompasses several SMEs as full partners with central responsibilities. Total project value is around 26 Mio Euro, with an EC contribution of € 12.7 Mio.

- Project status:** ongoing
- Programme:** Sustainability, Integrated Project (IP)
- Coordination:** PD Dr. Josef Settele, Helmholtz Centre for Environmental Research – UFZ, Halle (Germany)
- Duration:** 5 years
- Budget:** € 12.7 Mio.
- Partner countries:** 33
- Partner institutions:** 67
- Project-Website:** www.alarmproject.net



3.15 Transport

Brenner Rail Freight Action Strategy Aimed At Achieving A Sustainable Increase Of Intermodal Transport Volume by Enhancing Quality, Efficiency, and System Technologies

Acronym: BRAVO

An increase of the transport volume by about 30 percent in unaccompanied combined transport via the Brenner corridor during its two-year duration BRAVO-Project has been reported by the operators and railway undertakings involved. During their annual meeting, representatives of transport ministries and regions of Germany, Austria and Italy, expressed their satisfaction at achieving the targeted volume and the implementation of the measures developed.



The modal shift from road to rail has been achieved by an extension of the service offered by additional train departures, further direct trains, establishment of new relations in transalpine traffic and the consequent connectivity of services in gateway terminals.

The participating railway undertakings Lokomotion and Rail Traction Company are using the modern multi-system locomotives (MSL) in border-crossing freight traffic and have thus contributed to achieving interoperability. The advantage of MSL is to minimize waiting and operation times at the border stations and to optimize rotation plans. Disposition of traction units allows to react with more flexibility to customers expectations, as about 1, 200 through-trains have demonstrated.

One of the peculiarities of the mountain track at Brenner is that heavy freight trains have to be propelled in double traction and pushing mode on the steep north ramp. Until now two locomotive drivers were necessary, while ÖBB Traktion has successfully tested a radio controlled pushing operation which will be approved for regular use, so that 3 locomotives of in total about 15,000 Kilowatt can be hauled safely by only one trained driver.

BRAVO-Partners have documented the agreed quality objectives and all relevant processes in a unique Quality Manual. The manual contains the optimised processes of – for the first time – all involved companies active on the Brenner corridor – while maintaining the existing competition. The system is currently implemented and shall contribute to further increase quality of service.

In order to inform customers timely in case of irregularities, railways and intermodal operators have developed a customer information system which has been technically realised by HaCon. The system has already been supplied with data from the

infrastructure managers and allows to monitor cross border train movements in real time. A tool to deliver the estimated time of availability in consideration of train paths and terminal availability is currently under development. Information of customers is performed – like already today – by the established CESAR system.

In order to broaden the market potential of combined transport, “mega” semi-trailers with 100 cubic metres volume shall be loaded in pocket wagons. The new pocket wagons have been developed by Ferriere Cattaneo in collaboration with Kombiverkehr. After performing extensive running, braking and loading tests the German “Eisenbahn-Bundesamt” (Federal Railway Office) has certified the wagon to be operated on public railway networks. The first 10 articulated “double” wagons have been used by Kombiverkehr since May 2006.

BRAVO-Project could fulfil all expectations. Project manager Uwe Sondermann concludes that a consortium of companies active in international rail freight transport ensures a direct implementation of project results into real business, and the transferability to other European Corridors.

Project status:	ongoing
Programme:	Transport, Integrated Project (IP)
Coordination:	KombiConsult GmbH, Frankfurt am Main (Germany)
Duration:	3 years

Budget:	€10.3 Mio.
Partner countries:	Austria, Belgium, Germany, Greece, Italy, Switzerland
Partner institutions:	Cemat, Darmstadt University of Technology, Technical Ferriere Cattaneo, HaCon, Hellas Transport, Intercontainer Austria, Interporto Bologna, Kombiverkehr, Lokomotion, Ökombi, Österreichische Bundesbahnen, Rail Cargo Austria, Railion Deutschland, Rail Traction Company, Trenitalia, UIRR
Project-Website:	www.bravo-project.com



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