

Securing Australia's Future - Project 9 Translating research for economic and social benefit: country comparisons

Germany

A Study of Measures to Encourage the Translation of Public Sector Research for Economic and Social Benefit in Germany

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1. Introduction

Population: 80.5 million (2013)

GDP per capita: €31,300 (2012)

R&D intensity (GERD/GDP): 2.92% (2012)

Private sector share of R&D: 67% (2012)¹

The German economy – the fifth largest economy in the world and Europe’s largest – is a leading exporter of machinery, vehicles, chemicals, and household equipment and benefits from a highly skilled labour force. Like its Western European neighbours, Germany faces significant demographic challenges to sustained long-term growth. Low fertility rates and declining net immigration are increasing pressure on the country’s social welfare system and necessitate structural reforms.

In 2012 Germany reached a budget surplus of 0.1%. The budget was essentially in balance in 2014. A constitutional amendment approved in 2009 limits the federal government to structural deficits of no more than 0.35% of GDP per annum as of 2016 though the target was already reached in 2012. The German economy suffers from low levels of investment, and a government plan to invest €15 billion in 2016-18, largely in infrastructure, is intended to spur needed private investment.²

Germany has the EU’s largest innovation system. It supports an export-oriented economy with a thick layer of internationally competitive firms, notably in manufacturing. Germany represents 9% of OECD-area GERD, 8% of scientific publications, and 12% of triadic patent families.³

Germany spent 2.98% of GDP on R&D in 2012, up from 2.53% in 2007. Public and business expenditures on R&D, at 0.96% and 2.02% of GDP, respectively, in 2012 are both well above the OECD average owing to the government’s focus on R&D and to Germany’s specialisation in R&D-intensive industries. GERD is targeted to reach 3% of GDP by 2020, and public investment in R&D and innovation continues to be a top political priority.⁴

A major distinguishing characteristic of the German R&D system is the existence of a broad variety of public and semi-public research institutions that complement and bridge the R&D activities of industry and universities. The most important of these institutions are the Fraunhofer Society (*Fraunhofer-Gesellschaft*), the Max Planck Society (*Max-Planck-Gesellschaft*), the Helmholtz Centres and the Federation of Industrial Research Associations.⁵

It is leveraged by strong links between industry and science, with a comparatively high proportion of public research funded by industry. The relative number of patents filed by universities and public labs is on a par with the OECD median and industry patenting is strong. Only 27% of the adult population is tertiary-qualified, but 37% of persons employed are in S&T occupations. It has 8.1 researchers per thousand total employed, close to the OECD median. Researchers are well integrated in international networks: 47% of scientific articles and 17% of PCT patent applications are produced with international collaboration.⁶

Innovation and research policies are not treated as separate within the German national system of innovation. In fact, policy makers perceive them as complementary if not inseparable. In many cases, R&D support policies target SMEs which are seen as essential drivers of innovation and the main success factor of the German economy. Consequently, almost all main political initiatives address both elements: research performed in research institutes (private or public) and innovation and technical development performed in enterprises (particularly SMEs). The clearest signal for this is the fact that most support programmes exclusively fund networks of companies and public research or higher education institutions.

The German Federal Government continues to make targeted investments in education and research even in times of budgetary consolidation. In 2012, the budget of the Federal Ministry of Education and Research (BMBF) was increased by 11%. In 2013 it grew by an additional 6.3% compared to 2012 (totalling about €13.75b) and, despite budgetary consolidation, was further increased in the 2014 by about €224 million, up to a total of some €14 billion.

The Federal Government's High-Tech Strategy (HTS) sets the strategic orientation for Germany's R&D and innovation activity and is periodically updated. First launched in 2006, it was designed among other things to address the fragmentation in STI policy resulting from the differences between the Federal Ministry of Education and Research (BMBF), responsible for research and the Federal Ministry of Economics and Technology¹ (BMWi) responsible for the support of innovation in companies. The approach adopted was a research and innovation policy "of one piece". The High-Tech Strategy took a full cross-departmental approach, involving all affected ministries and several policy areas, and includes a broad range of initiatives and programmes.

In July 2010, the 'High-tech Strategy 2020' passed Cabinet and updated the first edition of the Strategy launched in 2006. The High-Tech Strategy 2020 defined the central goals of Germany's research and innovation policy. The stated aim was to create lead markets in Germany, to intensify cooperation between science and industry, and to improve the framework conditions for innovations further.⁷

The strategy focused on five key priority areas of research linked to global challenges:

- climate and energy
- health and nutrition
- mobility
- security
- communication

A series of key technologies key technologies was identified:

- information and communication technologies
- optical technologies
- production technologies
- materials technologies
- biotechnologies
- nanotechnologies
- microsystems technologies

In addition, a number of cross-cutting activities were proposed to ensure a climate for innovation and innovation-friendly framework conditions, such as improving the climate for start-ups, increasing participation of SMEs in the innovation process and provision of venture capital in support of these priority areas.⁸

¹ Since renamed the Department of Economic Affairs and Energy

A new and central element of the High-tech Strategy 2020 was to identify broad forward-looking projects (*Zukunftspunkte*), with the objective of creating 'lead markets'. Ten such projects were launched in the 2010-14 period:

- The CO₂-neutral, energy-efficient, climate-adapted city
- Renewable resources as an alternative to oil
- The intelligent transformation of the energy supply
- Treating illness more effectively, with individualised medicine
- Better health via effective prevention and healthy diets
- Living an independent life well into old age
- Sustainable mobility
- Internet-based services for business and industry
- Industry 4.0
- Secure identities.

On 3 September 2014, the Federal Cabinet adopted a new German High-tech Strategy entitled "Innovation for Germany"⁹. The strategy aims to ensure coherence within Germany's innovation policy, and to strengthen prosperity and economic growth in Germany. It places a strong focus on speeding up the transfer of scientific findings into marketable products, processes and services, as well as on improving the overall environment for innovation. To this end, the German government invested €14 billion in both 2014 and 2015.

Unlike the strategy of the past, this HTS is designed to promote not only emerging technologies but will also address major societal challenges. It is shaped around a model for an innovative Germany. The aim is to move Germany forward on its path to becoming an innovation leader in Europe and the world:

- We want a society that is open to innovation and that lets itself be inspired by new technologies and innovation.
- We want a society that views differences primarily as opportunities. A modern social policy provides the framework for this. Innovative Germany needs to be shaped by all of us working together.
- We are orienting our efforts to a model for sustainable development that generates innovation from a position of responsibility for the present generation and future generations.
- We want a competitive, employment-strong industrial sector whose products and services can compete successfully with the products and services of the most innovative competitors worldwide. To that end, we want to spur a new dynamism in start-ups – and improve the necessary framework accordingly.
- We want to continue investing systematically in research and innovation. The foundations for prosperity in Germany depend on a continuing high level of investments in this area. We want it to be possible for research findings to be rapidly translated into innovative products and services.
- We are promoting innovations and future technologies not for their own sake but for their ability to provide clearly recognizable social benefits. Within our innovation culture, we are integrating processes for identifying and assessing the societal opportunities and risks that are tied to the introduction of new technologies.
- We want employees to work on new products and services in healthy and safe environments, and to work competently, with commitment and motivation. Good qualifications and good working conditions play a key role in enabling people to be innovative.

- We want to make efficient use of the innovation potential inherent in both men and women. To keep on solidifying and expanding our position as an internationally leading centre for innovation, we must enable both men and women to translate their innovative ideas into new products, services and technologies.¹⁰

The new High-Tech Strategy is based on five pillars:

- Priority task areas: priorities for research and innovation in areas with enormously dynamic innovation: the digital economy and society, the sustainable economy and its energy, the innovative workplace, healthy living, intelligent mobility and civil security.
- Better transfer: new instruments for improved regional, national and international networking between science and industry.
- Greater dynamism in innovation: strengthening the pace of innovation in German industry, and special support for SMEs and technology-oriented start-ups, with a view to enabling such companies to become technology leaders that can shape future markets.
- Improved framework conditions: optimising the supply of skilled personnel and the availability of financing
- Intensified dialogue: enhanced active participation by society.¹¹

The priority tasks areas, described as “core elements of a completely consistent innovation policy”, are further specified and new or renewed programs of support identified for each:

- The digital economy and society – Industry 4.0 (the 4th industrial revolution), smart services, smart data, cloud computing, digital networking, digital science, digital education digital life environment
- Sustainable economy and its energy – energy storage, electricity grids, solar construction, green economy, bioeconomy, sustainable agricultural production, raw material supply, city of the future, future of building, sustainable consumption
- The innovative workplace – work in a digital world, innovative services for future markets, competency building
- Healthy living – fighting major diseases, individualised medicine, prevention and nutrition, innovations in the care sector, drug research, medical technology
- Intelligent mobility – intelligent and capable transport infrastructure, innovative mobility concepts and networking, electromobility, vehicle technologies, aviation, maritime transport
- Civil security – civil security research, IT security, secure identities.

An indication of the scale of investment is provided below:

The Framework Programme Research for Sustainable Development (FONA) (2010-14) supports research on climate change, mitigation and adaptation, sustainable resource management, and innovative environmental and energy technologies, with a budget of €2 billion. The National Research Strategy Bioeconomy 2030, with a budget of €2 billion for 2011-16, aims to strengthen the future competitiveness of the German biotechnology industry. Other sectoral programmes include the Nano Initiative – Action Plan 2015, the Photonics Research Germany program with €410 million over 2012-15, and the German Space Activities with an annual budget of €1.2 billion.¹²

The HTS contains strong messages about strengthening networking and knowledge transfer:

“Over the past few years, Germany’s science sector has continually intensified its transfer activities. In order to improve use of innovation opportunities in the future, the Federal Government is helping to strengthen the science sector’s innovation orientation. This involves raising awareness of how science can provide innovations for industry and society. It also calls for providing new impetus for transfer, via suitable incentives, and for further professionalization of transfer structures. The aim is to foster a culture of work in which transfer activities and successes are suitably appreciated and recognised...”

In order to improve commercialisation of research findings, the Federal Government plans to intensify its efforts to promote spin-offs from research institutions. In the ongoing updating of the Pact for Research and Innovation, agreements are to be reached, with science and research organisations, on intensifying exchanges and the resulting interactions with industry and society...

Via a new funding approach, the Federal Government plans to support universities in testing new strategies for cooperation in their surrounding regions, and in developing innovative cooperation formats. This effort is expected to contribute to the development of German universities’ profiles as attractive innovation partners for industry and society...

With its measure ‘Validation of the Innovation Potential of Scientific Research – VIP’, the Federal Government is helping to close the innovation gap separating academic research and industrial applications. Further development of validation funding is being based on a broad innovation concept that addresses both technological and societal innovations. Promotion of technology transfer from public-sector research into industry, in the framework of the “SIGNO” programme, is being further flexibilised with regard to funding terms, especially in connection with further development of patented early-phase technologies.”¹³

R&D performing firms are vital in Germany and therefore among the most important target groups for policy in Germany. Hence, most federal thematic R&D programs focus on those firms already performing R&D.¹⁴

A key element of the German research policy mix is the stimulation and further improvement of public-private collaborations in order to unfold the full potential of the German research and innovation system. Funding instruments in this respect are the thematic R&D programmes, including the SME-specific measure ‘SME Innovative’¹⁵, which aims at easing access of SMEs to the thematic R&D programmes, and cooperative R&D programmes targeted at SMEs within the ‘Central Innovation Program for SMEs’ (ZIM).

In addition, strengthening innovative clusters has gained increasing importance in recent years. The thematic R&D programmes can be seen as a major instrument in this respect since many thematic programmes contain cluster elements such as centres of competence in certain regions. Recently, two cluster-specific elements have embedded into the framework of thematic programs: the ‘Leading Edge Cluster Competition’¹⁶ program and ‘Innovation Alliances’¹⁷ that provide funding for strategic cooperation between industry and public research in key technology areas that demand a large amount of resources and a long time horizon, but promise considerable innovation and economic impacts.

The Budget for 2015 shows the following allocations:¹⁸

- ZIM will be among those benefiting from the increase in funding for non-university research set out in the Coalition Agreement; its budget is to grow by €30 million to €543 million euros
- The Go-Inno advisory programme provides SMEs with vouchers for targeted advisory services worth a combined €9 million
- Under the TuIT (transfer of technologies and innovation) umbrella program, €27 million is available to support the transfer of technology and innovation. This includes funding for the SIGNO patent initiative and for advancing standardisation

2. Selected Programs

Seven programs have been selected for review:

- Central Innovation Programs for SMEs (ZIM) which supports R&D and innovation
- Start-ups from Science (EXIST) designed to improve the entrepreneurial environment at universities and research institutes and increasing the number of technology and knowledge based company formations
- ERP Innovation Program which supports the pursuit of innovation in smaller companies
- Validation of the technological and social innovative potential of scientific research (VIP+), which encourages the evaluation of the commercial potential of research findings
- Protection of Ideas for Commercial Use (SIGNO) supports SMEs, universities and individual inventors in using IPR to protect and commercially exploit their innovative ideas
- Cluster Programs – the federal Leading Edge Clusters Program and the State (Lander) Cluster programs in Baden-Wuerttemberg
- The Steinbeis Foundation which commercially promotes technology transfer.

2.1. Central Innovation Programs for SMEs (ZIM)

<http://www.zim-bmwi.de/zim-overview>

The Federal Ministry of Economic Affairs and Energy (BMWi) combined the programmes PRO INNO II, NEMO and InnoNet into one support measure: Zentrales Innovationsprogramm Mittelstand (ZIM) - the Central Innovation Programme SME. The goal of the integration was to increase transparency and to reduce administrative costs of SMEs with respect to federal funding. The Central Innovation Program is designed to foster market-driven technology-based R&D work within German SMEs and to enhance companies' capacity to innovate and to strengthen their long-term competitiveness.

In particular, cooperation between companies and research institutes is encouraged to assist the formation of networks between industry and science. The effect is a direct transfer of expertise, which can lead to translation of new technological findings into marketable products, processes, and services.

Under ZIM, companies and the research institutes they work with can be awarded grants for ambitious R&D projects. Funding is not restricted to any particular field of technology or to specific fields of application. Whether or not an application for a grant is approved depends on how innovative the R&D project is and how marketable the results are likely to be.

The ZIM program comprises three schemes:

- ZIM-SOLO - the program provides funding for individual companies doing their own in-house R&D work. Funding is provided for the costs of the projects and may also be provided for support and consulting on innovation; total budget of €147m in 2012.
- ZIM-KOOP projects - the program provides funding for R&D work carried out jointly by two or more companies, or by one company and one or more research institutes. Funding may be provided for R&D cooperation projects between companies, or between companies and research institutes, for the development of new products and processes. These projects should be conducted in a balanced partnership in which all partners make innovative contributions. Funding may also be provided for support and consulting on innovation to foster use of the result. Total budget of €325m in 2012.
- ZIM-KOOP networks - the program provides funding for external network management of innovative networks that comprise at least six SMEs which jointly develop a common innovation (predecessor programme: ZIM-NEMO). Funding covering both management and R&D projects may be provided for network management services as well as individual projects and cooperation projects initiated by the network. Total budget of €20m in 2012.

Funding for networks typically occurs in two phases:

- Phase 1 - Development of network design and contracts, establishment of the network in the public domain and development of a technology roadmap setting out the development projects.
- Phase 2 - Supervision and implementation of the network design for the development projects in line with the technology roadmap and preparation for the market launch and stabilisation of the network. In the second phase of funding, support is available not only for management services but also for development projects conducted by network partners, and support and consulting on innovation. Such funding is provided in accordance with the rules applying to individual and cooperation projects

Activities eligible for funding under the *support and consulting on innovation* category include:

- Management consulting on:
 - business strategy and innovation strategy
 - sales and marketing
 - concepts for market launch
 - project-based financial services
- Technical support for
 - move to series production following conclusion of the project
 - technical consulting on product preparation and product launch (standardisation issues such as DIN) and process design
 - creation of product documentation and operating manuals (including translations)
 - product data sheets
 - manuals and process descriptions
- Technology transfer services

- information on research results
- listing in technology and user databases
- support for the internationalisation of project results (market entry abroad)
- fees for the presentation of new products in lectures, presentations, trade press, or at trade fairs, workshops, conferences etc.
- Training
 - participation in external project-based training on the implementation of the innovation
 - sales and marketing preparation
- Consulting in connection with acquisition, protection and trading of intellectual property rights and with licensing agreements
 - patent work
 - consulting on the acquisition of intellectual property rights and licensing agreements
- Consulting on the use of standards
- Costs of office space for product presentation
- Use of databases
- Certification

The total costs per application should be no lower than €1,000.

Eligibility

- ZIM-SOLO – SMES with staff of less than 250, turnover up to €50m and a balance sheet value up to €43m.
- ZIM-KOOP (projects) – SMEs, and public and non-profit private research institutes
- ZIM-KOOP (networks) - Eligibility criteria for funding applications for R&D projects initiated by the networks are the same as those for individual and cooperation projects.

For individual or cooperative projects, the criteria for selection include:

- The project seeks to develop a new product, process or new technical services which surpass existing products, processes or technical services in terms of their functions, parameters or features.
- The product is based on the international state of the art in technology and raises the level of technological performance and the innovative skills of the company.
- The project carries a significant, but predictable technical risk.
- The competitiveness of the companies will be permanently raised, new markets will be opened, and jobs will be created or safeguarded.
- Without funding, the project cannot be realised or can only be realised with a considerable time delay.

The project may not:

- be in receipt of other funding;
- begin before submission of the funding application has been confirmed; or
- be carried out on behalf of third parties.

Funding is available for the costs of personnel working on the project if proof of a specialist qualification and task can be provided and officially recognised for these persons.

Project costs eligible to receive support in all projects include:

- personnel costs
- costs for project-related contracts to third parties (up to 25% of personnel costs or 25% of the total costs in the case of network management)
- other costs (lump-sum based on personnel costs) for companies: up to 100% for research institutes: up to 75%.

The co-financing requirements are:

- R&D projects for companies: 35-55 % of the costs eligible for support, up to a maximum of €350,000 per sub-project
- for research institutes: 90-100% of the costs eligible for support, maximum support per KF sub-project: €175,000 (for cooperation projects: €350,000)
- for cooperation R&D projects: the costs eligible for support for the whole project are limited to €2m
- For network management, the central funding is progressively reduced, from 90% in the first year, to 70% in the second, 50% in the third and 30% in the optional fourth year. The maximum support available for network management is €350,000, with no more than €150,000 issued in phase 1.

Applications for a grant are approved for about 4,500 research and development projects annually. ZIM is thus the most successful support programme for the promotion of innovative SMEs in Germany.

Project proposals can be submitted at any time to the project management agencies that are responsible for the management and implementation of the support measure. These are:

- ZIM-SOLO -EuroNorm GmbH in cooperation with VDI/VDE-IT GmbH
- ZIM-KOOP (project) - AiF Projekt GmbH
- ZIM- KOOP (networks) VDI/VDE Innovation + Technik GmbH

The proposals have to state economic and technical criteria for success that can be used for an ex post evaluation of the success.

In general, final decisions about funding are made by the Federal Ministry of Economics and Energy (BMWi). With regard to collaborative R&D projects, the BMWi decides continuously after it receives suggestions for funding by the project management agency. In the context of networking projects, external experts are consulted that examine the project proposals and decisions about funding are made quarterly.

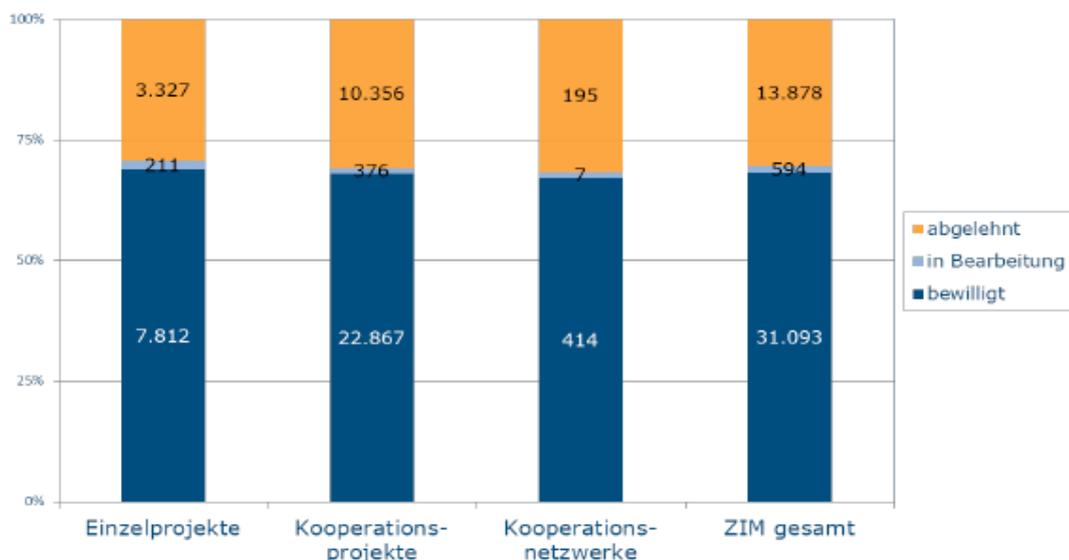
Information required for application

- on applicant:
 - legal declarations
 - funding received from other programmes (last 3 years)
- Further requirements for companies:
 - extract from trade register or trade registration
 - declaration of status as an independent, associate or partner company
- Further requirements for private research institutes:
 - extract from register of associations, articles, membership list
 - for non-profit limited companies: current extract from trade register and proof of non-profit status
- Project abstract:
 - justification and description of the project objectives and their effects (plan of how results are to be used)
 - workflow plan
 - E-draft of cooperation agreement
- Break-down of requested funding:
 - personnel and cost planning
 - information on creditworthiness and financing of own contribution
- Concept for monitoring success

Since the start of the programme in 2008, 27,750 applications have been submitted. 19,265 projects with a funding volume of €2.5b have been approved. 14,500 projects have been conducted by SMEs and 4,765 projects by research institutions in collaboration with firms.

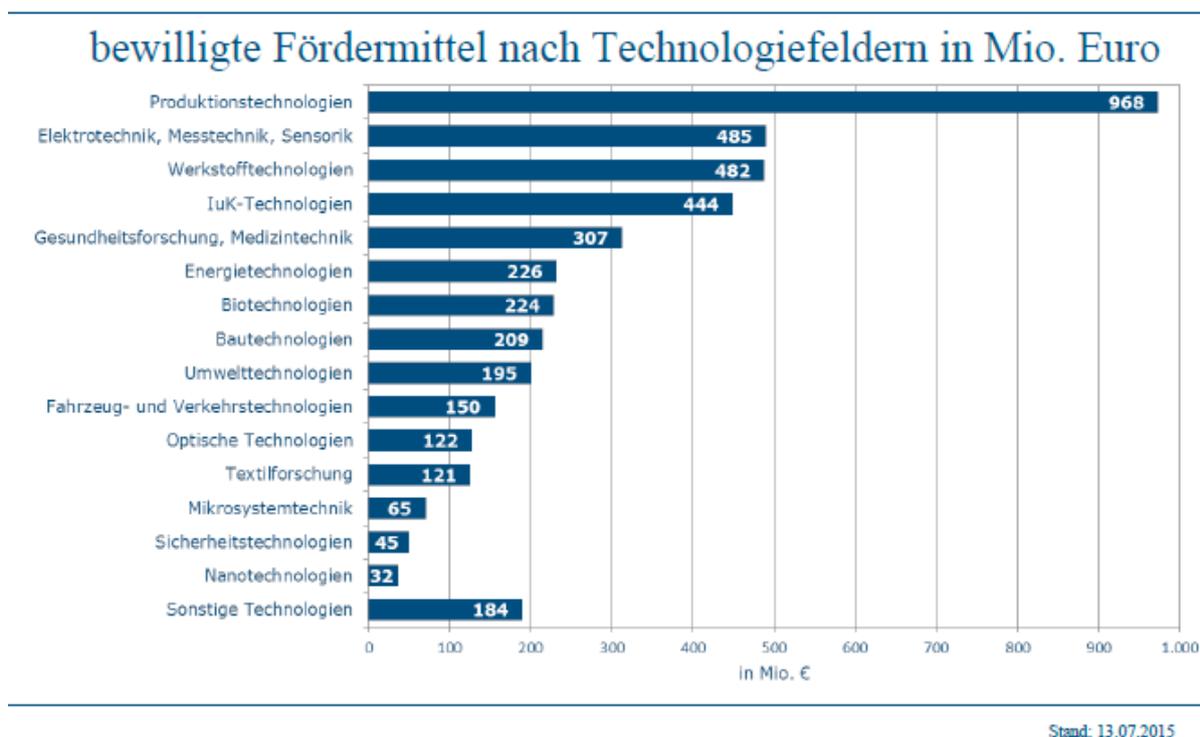
The status of applications as of July 2015 is shown below¹⁹:

Stand der Antragsbearbeitung nach Programmmodulen



Stand: 13.07.2015

The levels of approved funding by technology field are reproduced below:



The first evaluation was conducted in 2009/2010 by Fraunhofer ISI and Gesellschaft für Innovationsforschung und Beratung mbH (GIB). The evaluation results were positive. The evaluators concluded that ZIM meets the claim to be a central innovation programme for SMEs. The demand for the programme was rather high. No need for changes regarding structure, conditions and administration was identified.²⁰

A second evaluation study focused on the macroeconomic effects of the ZIM programme and attested a substantial leverage effect. Production, value added and employment effect were found. ZIM also stabilized the business cycle during the economic crisis.²¹ Based on a macroeconomic evaluation ZIM has given rise to a substantial leverage effect. The initial funding of €1.3b (2009-01/2011) gave rise to R&D projects summing up to a total of €3.7b. This is 2.8 times the sum of the initial funding. Between 2009 and 2011 ZIM induced an additional production of €7.7b which includes a value added of €3.9b. Moreover, up to 69,500 jobs were secured or newly created with a total income of €7.4b.

Following the recent HTS release, redefined ZIM guidelines have been published on 15 April 2015 and applications can be submitted continuously until 31 December 2019.²² Plans call for further optimisation and simplification of the relevant application and approval procedures. In addition, international cooperation is being promoted via conclusion of additional agreements, with other countries, on joint funding of research and development projects by SMEs.²³

2.2. Start-ups from Science - (Existengründungen aus der Wissenschaft – EXIST)

http://www.exist.de/EN/Home/home_node.html

Cooperation between institutions of higher education and industry is traditionally close in Germany in areas such as engineering and chemistry. Many doctoral theses are completed in close cooperation with industry or often within industry. There are also special programmes at state level which encourage mobility and exchanges of scientists between research institutions and business sector, with a particular emphasis on SMEs.

EXIST is a support programme of the Federal Ministry of Economics and Energy (BMWi) aimed at improving the entrepreneurial environment at universities and research institutes and at increasing the number of technology and knowledge based company formations. It was established by BMBF but BMWi took responsibility for the program in 2006.

The objectives of the programme are:

- to establish a lasting “culture of entrepreneurship” at universities and research establishments
- to support consistent transfer of scientific knowledge into commercial output
- to promote the enormous potential of business ideas and entrepreneurial personalities at universities and research institutions in a targeted manner
- to increase the number and the chances of success of innovative business start-ups.²⁴

Even though the rate of university-based business start-ups is low, the potential in creating jobs is higher than for other types of business foundations. For that reason EXIST tries to support the activities at universities and research institutes to increase the number of new start-ups. University-based business start-ups are also important for the knowledge transfer from science to industry.

The EXIST programme is part of the High-tech Strategy for Germany, referred to above, and is co-financed by funding of the European Social Fund (ESF).

There are three program lines - Culture of Entrepreneurship, Business Start-Ups Grants and Transfer of Research²⁵:

EXIST-Gründerhochschule (Culture of Entrepreneurship) supports universities to build an entrepreneurial and start-up oriented environment at their institution. The programme consists of two phases. For the first conceptual phase the university receives a non-repayable grant up to €70,000 over a six months period. The second project phase can last up to 5 years and funding can be up to €1m.

Business Start-Up Grants supports the preparation of innovative business start-up projects at universities and research establishments. The grant aims to help scientists, university graduates and students develop their business ideas into business plans and to advance their ideas for products and services. To cover their living expenses, the entrepreneurs receive a grant between €800 and €2,500 per month, depending on their degree, for a maximum period of 12 months. In addition, they receive materials and equipment (worth €10,000 for solo start-ups and €17,000 for team start-ups),

funding for coaching (€5,000) and, if necessary, child benefit of €100 per month per child. The university or non-university research institute offers them infrastructure during the pre-start-up phase and provides technical and start-up-related assistance.

Transfer of Research promotes especially sophisticated technology-based business start-up projects in the pre-start-up and the start-up phase. This program complements the broadly targeted EXIST "Business Start-Up Grants" with an excellence-oriented measure for high-tech start-ups. The purpose of the first funding phase is to support research teams at universities or research institutes to enable them to provide proof for the technological feasibility of their product idea and to prepare the business start-up. The funding includes staff expenses for up to four staff members and €60,000 for materials and equipment. After one year, funding is available for another person with managerial skills to become a member of the start-up team. The maximum funding period is 18 months in the pre-start-up phase. During the second funding phase, the newly founded technology-oriented companies can be supported with up to €150,000 to continue the product design, for instance up to the prototype realisation and to be able to solicit external funding for their company.

The program was funded to €32.1m in 2012. Within the EXIST programme line Culture of Entrepreneurship almost €85m were allocated in the first three phases, EXIST I - EXIST III (1998-2011).

An important corresponding program is the High-tech Start-up Fund.²⁶ The High-Tech Gründerfonds invests venture capital in young, high-opportunity technological companies implementing promising research results in an entrepreneurial manner. The fund provides technologically oriented company foundations with start-up capital and ensures the necessary supervision and support for their management.

The main target group are spin-offs from public research institutions and universities as well as corporate spin-offs. On average, start-up projects receive funding of about €0.5m. Funding is delivered through a combination of equity investment and a second-tier loan. In the first year, enterprises will be exempted from interest payment.

As a special feature, high-tech start-ups need to engage a coach (i.e. an experienced entrepreneur) in order to receive equity investment from the fund. The fund was established in 2005, has a total volume of €272 million and was financed from federal government sources and by a small number of large German enterprises. In October 2011, the second High-Tech Start-Up Fund (*Gründerfonds II*) was introduced with an additional investment volume of €289m.

The project management agency "Forschungszentrum Jülich GmbH, Projektträger Jülich (PtJ)" is in charge of the technical and administrative coordination and implementation of the sub-programmes.

In addition, the Fraunhofer Institute for Systems and Innovation Research (Fraunhofer ISI) provides scientific support for the programme, including:

- monitoring of the projects and developments
- analyses of particular aspects
- verification of results and experiences.

Winners of the competition "EXIST - Gruenderhochschule" are selected by a jury consisting of 9 experts. Applications in the two other programme lines are evaluated against formal and conceptual aspects, if necessary involving external experts.

Eligible costs include labour costs (including overheads), equipment, external expertise (consultants, studies)

Although EXIST has been funding various start-up initiatives since the end of 1998, it was not originally intended as such a long-term endeavour, and the programme has had a strong evolutionary character, based on learning from the various stages.

The programme has covered four different phases to date in its core area - the funding of university start-up initiatives ("EXIST Culture of Entrepreneurship"), with considerable variation in the number of start-up initiatives being funded but only slight variations in the assistance mechanisms. The four phases of the programme saw:

- EXIST I 1998-2004 - Funding for 5 EXIST model initiatives, with 20 universities
- EXIST II 2001-2006 - Funding for 10 EXIST transfer initiatives (EXIST transfer), with 37 universities
- EXIST III 2006-2008 - Funding for 47 EXIST projects after 3 rounds of funding (EXIST III), with 86 universities
- EXIST IV 2010-2013 - Funding for 22 EXIST IV projects with 24 universities (EXIST entrepreneur university).

In more detail:

1998 EXIST: five EXIST modell regions (EXIST I)

Universities cooperating with partners from the fields of science, business and politics could apply. These regional networks were to lay the prerequisites for motivating, training and assisting entrepreneurial personalities and a suitable offer was to be developed for students, staff and graduates. A jury chose five model regions from 200 applicants.

2000 support programme EXIST-SEED

This support programme was initiated to motivate students, graduates and scientists at the universities in the five EXIST model regions to start up a business. Innovative start-up projects at universities were funded for a maximum period of one year. EXIST SEED was extended to universities nationwide in the year 2005.

2002 EXIST-Transfer: ten Entrepreneurial Networks (EXIST II):

A further ten networks from the German academic community were chosen for the support. The corpus of knowledge of the five model regions from EXIST I was transferred to the ten Entrepreneurial Networks. A broad exchange of experience with a further 20 partner regions took place.

2006 The Support of 47 Entrepreneurial Networks for universities and research institutes (EXIST III)

The EXIST III support programme, "Promoting Entrepreneurship at Universities and Research institutes" was to fill the remaining gaps in the qualification and support services provided. Particular importance was laid on including research institutes. EXIST III concentrated on clearly defined and differentiated projects that would be carried out together with partners. Some of these projects are still going on.

2007 Support programme EXIST Business Start-up Grants

As a follow-up measure of EXIST SEED, students, university staff as well as graduates receive the EXIST Business Start-up Grant for a year to prepare a start-up business. Funding for personnel costs come from an individual grant. A separate budget for coaching is given to the start-up teams being funded.

2010 Start of the competition: EXIST Culture of Entrepreneurship - Entrepreneur University (EXIST IV)

Universities are supported in developing and implementing a university-wide strategy of developing their status as institutions with a reputation for entrepreneurship. Universities taking part are requested to improve their entrepreneurial management and to position themselves as universities with an entrepreneurial profile.²⁷

An indication of the progressive shift in objectives is provided by the changed guidelines for EXISTIV:

"University-based start-up initiatives entered a new phase of funding in 2010. Key objective 1 of the EXIST programme is particularly concerned with changing the institutional conditions. In order to achieve this, the guidelines of the fourth phase of the programme set significantly more ambitious demands for the universities to be funded than was the case in the earlier phases.

This point of departure represents the crucial point in the reorientation of EXIST IV: An "excellence approach" is now being employed in order to support universities and universities of applied sciences which would like to further develop their status as institutions with a reputation for entrepreneurship, with a view to sustainably exploiting the potential for technology-oriented and knowledge-based start-ups in a given university location and enhancing the entrepreneurial approach and behaviour adopted by students and academic staff.

The aim is for the university as a whole to make the subject of entrepreneurship part and parcel of the institution, and not just an external funding project supported by a professorship in entrepreneurship and/or the technology transfer institution. The university should try to establish a culture of entrepreneurship in its teaching, research and management. To do this, the "EXIST Culture of Entrepreneurship" requires the funded universities in the duty to anchor entrepreneurship support in their general principles and the incentive system for professors and academics. They must also attach a specific level of importance to start-ups based on property rights and research findings in the patent and commercialisation strategy, formulate a strategy for becoming involved in spin-offs and communicate this within the university, and ensure that regulations are firmly in place for the use of laboratories and the research infrastructure.

A further requirement is for entrepreneurial support ("Entrepreneurship Centre") to be anchored into the institution for the long term; this should cover broad sections of the university in a sustainable and cross-departmental fashion. The "EXIST Entrepreneurial University" is a continuation of the previous five action areas from EXIST III in terms of the person-based starting points, as well for the intermediaries and in the infrastructure sector.

Only universities wanting to take such a far-reaching step receive significant financial support from the BMWi in EXIST IV. The requirements of EXIST IV presuppose a longer process of development in the final years for entrepreneurial support structures, and these requirements cannot be satisfied by a university which has not previously been supported by funding programmes such as EXIST or a federal state measure. This was demonstrated by the 83 applications for concept phase funding in EXIST IV that were received after the first notice of the competition in 2010.

These applications do, however, also emphasise that a surprisingly large number of universities and, above all, those who manage these universities are very much interested in the programme and are prepared to become a university with an entrepreneurship profile, with the far-reaching consequences in individual university departments. With a maximum funding of €2.5 million per university, EXIST gave the universities the incentive to develop and become a university with such an entrepreneurship profile. This amount is considerably higher than was the case in phases II and III and is also provided for up to 5 years. By doing so, the "EXIST Entrepreneurial University" is pursuing an approach which promotes excellence."²⁸

The most recently available data on funding for the Research Transfer Program show:

Research Transfer by Funding Round



EXIST Forschungstransfer Statistik 2014
Stand 31.12.2014 | Seite 1 von 8

1. Exist Forschungstransfer nach Förderrunden

	Einsenderunden	Skizzen	Anträge	Jury positiv	Bewill.	Ph II Bewill.	Ph II Anteil
1	31.01.2008	54	26	15	14	11	79%
2	30.06.2008	42	17	13	13	7	54%
3	31.12.2008	42	16	13	12	6	50%
4	30.06.2009	57	20	13	13	11	85%
5	31.12.2009	54	21	14	13	10	77%
6	30.06.2010	45	19	14	14	11	79%
7	31.12.2010	43	18	13	13	9	69%
8	30.06.2011	45	16	11	11	3	27%
9	31.12.2011	45	21	16	16	8	50%
10	31.07.2012	47	23	16	16	4	25%
11	31.01.2013	48	16	12	11	0	
12	31.07.2013	57	22	16	16	0	
13	31.01.2014	63	21	15	15	0	
14	31.07.2014	73	26	18	0	0	
	Gesamt	715	282	199	177	80	

Skizzen = Sketch, Anträge = Issued, Bewill. = grants, Anteil = share

EXIST Phase 1 Grants



EXIST Forschungstransfer Statistik 2014
Stand 31.12.2014 | Seite 1 von 8

1. Exist Forschungstransfer nach Förderrunden

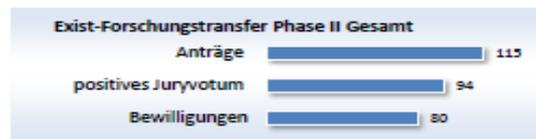
	Einsenderunden	Skizzen	Anträge	Jury positiv	Bewill.	Ph II Bewill.	Ph II Anteil
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12	31.07.2013	57	22	16	16	0	
13	31.01.2014	63	21	15	15	0	
14	31.07.2014	73	26	18	0	0	
	Gesamt	715	282	199	177	80	

EXIST Phase 2 Grants

9. EXIST-Forschungstransfer Phase II Gesamt

Anträge	115
positives Juryvotum	94
Bewilligungen	80

* Die Differenz ergibt sich aus zurückgezogenen und noch nicht bewilligten Anträgen.



10. EXIST-Forschungstransfer Phase II nach Bundesländern

3. Anträge und Bewilligungen nach Jahren

Jahr	2007	2008	2009	2010	2011	2012	2013	2014	Gesamt
Anträge	146	280	343	361	261	272	301	246	2211
Bewill.	86	161	200	172	161	130	145	131	1186
Quote	59%	58%	58%	48%	62%	48%	48%	53%	54%



A recent evaluation by the Fraunhofer ISI concluded that the program is successful, but that more input from outside the universities are needed in order to fully reach the ambitious goals of EXIST. So far, the program has helped to increase the motivation of students and scientific assistants at universities and research facilities to go into business for themselves. Changes at universities have taken place in order to provide entrepreneurship education, and support and guidance on the topic of self-employment. The initiatives of the programme have positive spillover effects on other institutions. In order to reach a sustainable development additional financial support must be granted to universities and research facilities due to their limited resources.

Although EXIST-Seed, which is now the start-up Grant, is primarily a programme for direct financial support at universities, it had an important function in the EXIST programme namely to establish a culture of entrepreneurship. While most EXIST initiatives aim at students, the sub-programme EXIST-Seed focused more on scientific workers in order to motivate and support them to go into business. Hereby, professors at universities and successful entrepreneurs acted as mentors and encouraged scientific workers use their research results to establish their own business. As the establishment of an entrepreneurial culture is a long process it is too early to evaluate the effectiveness of the program.

Following the new HTS, the funding program is being expanded via two new funding lines, EXIST–Start-up Grant (EXIST–Gründerstipendium) and EXIST–Transfer of Research (EXIST–Forschungstransfer), and its funding terms are being improved with a view to better addressing requirements in the areas of energy and clean technologies. To give innovative start-ups in Germany better access to venture capital, the Federal Government, via its funding programme INVEST – Subsidy for Venture Capital (INVEST – Zuschuss für Wagniskapital), awards investment subsidies to business angels who invest in start-ups and young companies. To enable the INVEST incentives to have maximum effect these subsidies are to be exempted from taxation.²⁹

The EXIST funding programme aims to establish a culture of entrepreneurship at universities and research establishments and to increase the number of spin-offs from scientific institutions. A total of €23 million has been allocated to support the INVEST scheme, which encourages business angels to provide venture capital in Germany.

In addition to this, funding for technology-driven start-ups will also be made available by the High-tech Start-up Fund, which, since 2013, has been entirely financed by the ERP Special Fund. Over the 2014 to 2016 period, the ministry will provide an annual €5 million in fixed allocations to the ERP.³⁰

2.3. ERP Innovation Program - ERP Innovationsprogramm

<http://www.bmwi.de/EN/Topics/Technology/Strong-policy-framework/technology-neutral-project-support,did=438202.html>

The rationale for this program is stated strongly. SMEs suffer from a lack of access to credit financing of innovations while at the same time having limited in-house resources to finance R&D and innovation. There are several market failures responsible for this lacking access to credit financing:

- information asymmetries over the technical and commercial potential of R&D projects of small firms restrict banks in accurately assessing the likely risk of these projects
- Many R&D intensive SMEs do not have sufficient collateral to offer
- Moral hazard and adverse selection add to the resistance of commercial banks to credit finance innovations
- High risk exposure of R&D and innovation projects rates lead to very high interest rates for loans to finance these activities.

The ERP innovation program administered by BMWi is aimed at small and medium-sized companies and self-employed people working in the professional-services sector. The focus is on cooperation with research institutes. The objective is to promote innovation and to quickly bring new practical applications to market. The budget was €1,309m in 2011, funding 695 projects.³¹

There are two parts of the program, which companies can apply for separately:

- Part I provides funding for close-to-market research and for the development of new products, processes, and services in Germany.
- Part II provides support for the launch of new products, processes and services into markets in Germany, and is available to SMEs only.³²

Both program parts can be used independently from each other, but it is also possible to combine the two. The programme offers SMEs a loan which typically consists of two tranches: a classical bank loan (though offering below market-rate interest rates), requiring collateral as a normal bank loan would, and a subordinate loan (50-60% of the total loan, depending on the size of the total loan). These loans are provided from the ERP Special Fund and can thus be offered at lower interest rates. There are special low interest rates for very small firms. As for the subordinate loan, no collaterals are needed. The loan is delivered through the house bank of the SME, which receives the money to finance the loan from the state-owned KfW Banking group. Repayment of the loan typically starts after 2 years for the bank loan tranche and after 7 years for the subordinated loan tranche.

Applications can be submitted by established companies in trade and industry, and by self-employed individuals who have been on the market for a minimum of two years and who are either implementing their own innovative project in Germany or making an innovative contribution to a project. Applicants must provide proof of their creditworthiness. In most cases, applicants' group turnover must not exceed €125 million. This threshold can be raised to €500 million if the project is considered particularly worthy of funding, i.e. if it is the first of its kind in Germany. Financing is available to cover the costs incurred during the development phase, up until the point where the product or service is ready for commercial use. Loans can cover up to 100% of eligible costs, up to a maximum of €5 million per project.

As part of the German energy reforms, special support is given to projects for the development of technologies that render the generation, storage, and transmission of energy more efficient. Projects that are linked to the energy reforms are eligible for loans of up to €25 million euros per project. The cap for individual companies is €50 million per calendar-year.

Firms must be older than 2 years. For Program Part II, only firms that meet the EU SME criteria are eligible. For Program Part I, typically firms should have an annual turnover of less than €125m, except if the innovation to be funded is new to Germany. In the latter case, also firms with an annual turnover of up to €500m are eligible.

The selection process is based on evaluation of the innovation project with respect to its degree of novelty, its contribution to increased competitiveness of the firm, the financial status of the firm, and the availability of collateral for the bank loan part of the total loan financing.

Eligible costs include equipment, external expertise (consultants, studies), infrastructure (buildings), labour costs (including overheads), training (including study trips) and marketing of new products.

An evaluation of all ERP programs (i.e. all programs funded out of the ERP fund) by Prognos AG in 2001 found that all these programs, including the ERP innovation program, were successful in terms of meeting the goals and using the money efficiently.

In 2011, the ERP programs, including the innovation program, were evaluated by Ramboll Management Consulting who also provided a positive assessment regarding the efficiency and implementation of the innovation program. On average, the firm could create 18 new jobs and secure 75 existing jobs between 2005 and 2009 with the funding.³³

2,171 credits were granted between 2005 and June 2011 with a credit volume of €4.3b. The average credit volume is about €1.2m.

At the end of 2011, the Central Innovation Programme was presented with the Dieselmedaille award for the best funding programme for innovation, and was rated best practice for the third consecutive time in the innovation report published by the German Chambers of Industry and Commerce.

2.4. Validation of the technological and social innovative potential of scientific research - Validierung des Innovationspotenzials wissenschaftlicher Forschung – VIP+

<http://www.bmbf.de/de/2391.php>

With the new high-tech strategy, a broader concept of innovation has been applied to the promotion of R&D to include technological and social innovations equally. To encourage significant innovation, the bridge between the research and the exploitation and application of research findings needs to be further strengthened. This is the goal of the funding measure "validation of the technological and social innovation potential of scientific research - VIP +".

Knowledge and knowledge transfer encompasses research in natural sciences, life sciences and engineering as well as from the humanities, social and cultural sciences, opening up innovation potential for the economy and society. Particularly promising are interdisciplinary approaches, because significant innovation often arises at the interface of different disciplines, issues and perspectives.

To encourage significant innovation, the bridge between research and the exploitation and application of research findings needs to be further strengthened. For this purpose the innovation potential of research findings needs to be checked at an early stage and if promising, lead to low-risk final development with third party financial participation.³⁴

This program builds on the prior pilot project VIP. Under this program almost 140 projects have been approved some of which run until 2017. 25 projects were funded in the life sciences,³⁵ 56 in engineering,³⁶ 41 in the natural sciences,³⁷ and 10 in service research.³⁸

This funding measure invites scientists from all disciplines, to develop economic value or social application from their research. It is designed to assist scientists to examine the innovation potential of research findings and evidence as well as to open up potential applications, so creating the conditions for further development of research results into innovative products, processes or services.

The program targets researchers at universities, public research institutions, and federal institutions with R&D activities to test the technical feasibility and the commercial potential of research results, e.g. projects might focus on a proof of concept or proof of technology, on the analysis of the application potential, or opening up of new application areas.³⁹ Applicants are eligible for up to €0.5 million per year for up to 3 years.⁴⁰

The knowledge and technology transfer consists of three phases: (1) identification phase in which promising research results are identified that offer the promise of a significant innovation; (2) validation phase in which the technical feasibility and the commercial potential are identified and proved; the legal and ethical framework as well as the acceptance of the market and society are to be considered; (3) exploitation phase in which the results are transferred into marketable products, processes, or service, directly, or by licensing.

For the identification phase the BMBF relies on existing structures of universities and research institutions. For the exploitation phase federal and state funding programmes are available. The federal government focuses with this program on the validation phase. The programme is embedded in the High-Tech Strategy and supplement activities by thematic programmes.

Criteria for the evaluation of proposals are, among others, the quality of the project, uniqueness of the technology, the utilisation plan for intended results, necessity for the grant, and appropriateness of the financial planning.⁴¹ The funding decision is based on the evaluation of external experts.

Eligible costs include: equipment, labour costs (including overheads), training (including study trips), material costs, travel expenses, and in exceptional cases, project-specific investments. The funding can cover relevant training costs for participating young researchers. Costs for IPR protection during the funding period are also eligible for funding (if the institution is not funded within SIGNO).

Projects may include:

- Studies as proof of concept
- Development of demonstrators or functional models, tests or pilot applications to demonstrate the suitability and acceptance
- application-oriented basic research to development in the field of application or to adapt to new applications
- evaluative analyses to demonstrate the economic and social innovation potential
- Intellectual property rights analysis and assurance.⁴²

The project is required to submit and implement a “binding support concept”, which shows how:

- possible applications and user groups for the research results to be validated are identified,
- the user requirements and the requirements of potential recyclers or users shall be determined using the validation,
- legal and ethical framework to be considered and
- a utilization or application after being prepared for validation.⁴³

The planned budget of the BMBF for projects regarding knowledge and technology transfer under the umbrella of the high-tech strategy was set at €10m in 2011. VIP + projects are eligible for up to 1.5 million euros to support further research and development for up to three years. Some 59 projects have been approved for funding until November 2012. Most of the projects over the last three years received funding of €1.4-1.5m.⁴⁴

The agency administering the project is VDI/VDE Innovation + Technik GmbH.

No evaluation has apparently been conducted of the VIP Program. The VIP+ was only initiated in 2015.

2.5. Protection of Ideas for Commercial Use - Schutz von Ideen für die Gewerbliche Nutzung - SIGNO

http://www.signo-deutschland.de/index_eng.html

1.1 Objectives

SIGNO supports SMEs, universities and individual inventors in using IPRs to protect and commercially exploit their innovative ideas. The main objectives are overcoming information and financial barriers to use IPRs by universities, SMEs and individual inventors and to raise awareness about the relevance of IPRs for commercialising innovations. It is Germany's largest network for inventors and patents.

SIGNO comprises three sub-programs:

- SIGNO Universities consists of two measures. It offers support to universities for making better use of IP commercialisation infrastructures available to universities (particularly the Patent Commercialisation Centres) and to establish demand-oriented commercialisation strategies at universities, including industry-science cooperation.
- SIGNO Enterprises consists of three individual measures: The SME Patent Initiative offers grants (up to €8,000) to SMEs that want to use IPRs for the first time. In addition an Innovation Market Place provides a marketplace for inventors and innovators to find companies that assist them in financing and bringing their products onto the market. Also the Innovation Action aims at enabling enterprises and start-ups to establish internal innovation processes on a permanent base by offering consulting services through a network of IP consultants. The latter two measures no longer have funding associated.
- SIGNO Inventors comprises two small measures: The Inventor Information Service provides inventors with key information on how to use IPRs. The inventors' competition targets young inventors. Awards are given to the most innovative and creative ideas.⁴⁵

The selection criteria for the SIGNO University program are:

- Quality of the proposed project
- Originality and sustainability of the project's strategy
- Impact of the proposed projects towards the realization of the overall aims of SIGNO
- Sustainability of the proposed activities
- Scope of influence
- Contribution to the conceptual enhancement of the utilization of R&D results

There is a two-stage selection process for the strategy funding: pre-selection of projects on the basis of short proposals is carried out by "Projektträger Jülich (PtJ) of the Forschungszentrum Jülich" and the BMWi. The final selection and granting among all preselected projects on the basis of more detailed proposals is carried out by "Projektträger Jülich (PtJ) of the Forschungszentrum Jülich" in cooperation with external experts.

The budget for SIGNO in 2012 was €16.5m.

It is reported that 33 SIGNO Enterprise partners processed a total of 560 consulting cases per year. The majority of patent applications are granted (71%). For SIGNO Universities, 23 Patent Commercialisation Centres are supported which realised a total revenue of about €22m between 2002 and 2008.

An evaluation of SIGNO by Prognos AG and BOEHMERT & BOEHMERT in 2010 concluded that, overall, the funding system differentiated by the target group has been proven successful. They provided some recommendations for each of the three sub-programmes.⁴⁶

2.6. Cluster Programs

http://www.bmbf.de/en/20741.php?piwik_campaign=TagCloud&piwik_kwd=Leading-Edge%20Clusters

The Leading-Edge Cluster competition was intended to take Germany to the top of the league of technologically advanced nations. The Federal Ministry of Education and Research launched the competition in the summer of 2007 under the slogan "Germany's Leading Edge Clusters - more innovation, more growth, more employment". The high-performance clusters were to be formed by business and science in strategic partnerships with the objective of boosting Germany's innovative strengths and economic success.

Three rounds of competition were held in 2008, 2011 and 2014. In each round of the competition, up to €200 million was made available to five Leading-Edge Clusters over a period no longer than five years. The implementation stipulated a matching level of financial participation on the part of businesses and private investors. It has been funded to a total of €1.2 billion since 2007 (50% private funds and 50% from BMBF).

The basis for the selection and funding of a Leading-Edge Cluster was the development of common strategic goals and the definition of future development projects in a particular area of technology. The involvement of the key players in the region's innovation and value-added chains is a major prerequisite.

The following criteria were seen as pivotal in terms of strategy:

- Significant financial involvement of industry and private investors
- Planned projects build on strengths and lead to sustainable changes
- Increase in innovative capability and development of competitively relevant unique selling points to attain/consolidate a leading international position
- Measures to develop and try out innovative forms of co-operation, including professional cluster management
- Cluster-specific training, qualification and promotion of young talent

Selection process



Period of funding



By sector, the clusters are:

Digitisation, production and communication

- Cool Silicon - In the Chemnitz-Freiberg-Dresden region, more than 100 cluster partners are working together on the development of energy-efficient information and communications technologies (ICT)
- It's OWL – Intelligent Technical Systems OstWestfalenLippe - 174 companies, universities, research institutes and organisations have pooled their expertise to jointly address the innovation leap from mechatronics to intelligent technical systems.
- MicroTEC Südwest 26 Software-Cluster - This cluster unites more than 350 firms, institutions, universities and research facilities, including companies such as Bosch, Daimler, Festo, Roche Diagnostics, Zeiss, Endress+Hauser, Sick and Testo, as well as many innovative SMES, to develop innovations in the field of microsystems technology.

- Software Cluster - around the software development centres of Darmstadt, Karlsruhe, Kaiserslautern, Saarbrücken and Walldorf, partners from science and industry, including Fraunhofer Institutes, are developing corporate software that can transform companies into completely digital enterprises where ICT is the key driving force for product and process innovations.

Energy and resource efficiency

- BioEconomy Cluster - in this cluster scientists from more than 60 companies and research and education institutes conduct closely interwoven research in 26 joint and 85 sub-projects along the wood and chemical value chains.
- Forum Organic Electronics - In the Rhine-Neckar metropolitan region, 30 partners from companies such as BASF, Merck and SAP, universities and research institutes are working together in the field of organic electronics.
- Solarvalley Mitteldeutschland – This cluster has established itself internationally as a broad-based cluster for photovoltaics. It includes representatives of conventional power generation, grid operators and electricity suppliers, manufacturers and suppliers of products for renewable electricity.

Health

- Biotech Cluster Rhine-Neckar (BioRN) - partners such as the University of Heidelberg, the German Cancer Research Center (DKFZ), the European Molecular Biology Laboratory (EMBL), international companies such as Roche, Merck Serono and AbbVie, as well as 80 small and medium-sized enterprises, work together to develop new therapeutic approaches, drugs and services.
- Cluster for Individualized ImmuneIntervention (Ci3) - in the Ci3 cluster in the Rhine-Main region, more than 120 different partners from science and industry work to develop highly selective active ingredients for the patient-specific treatment of cancer as well as infectious and autoimmune diseases.
- Medical Valley EMN – this cluster around Nuremberg is an internationally leading cluster in the medical engineering sector.
- Munich Biotech Cluster m4 – in this cluster scientists from hospitals, research institutes as well as biotech and pharma companies work together in the field of red biotechnology in order to improve the efficacy and safety of new drugs and diagnostics and to reduce costs in the health sector. New individual diagnostic and therapeutic concepts are developed for personalised medicine in 50 joint projects.

Mobility and logistics

- EffizienzCluster LogistikRuhr - more than 160 companies and twelve scientific institutes work on joint and associated projects in Europe's largest research and innovation cluster for logistics.
- Electric Mobility South-West - incorporates more than 80 players from universities and research institutes and companies such as Bosch, Daimler, EnBW, Porsche and IBM to work together on new concepts for ecologically sustainable and economically competitive electric mobility.

- Hamburg Aviation - the cluster partners from companies such as Airbus, Lufthansa Technik and Hamburg Airport, research institutes such as Hamburg's four universities, and the German Aerospace Center (DLR) work together to pursue a "new kind of aviation" strategy which embraces the entire life cycle of civil aircraft, in order to make flying more economical, more ecological, more reliable, more flexible and more comfortable.
- MAI Carbon - there are around 80 companies, education and research institutes as well as supporting organisations cooperating in this cluster, including founding partners Audi, BMW, Premium Aerotec, Airbus Helicopters, Voith Composites, and the SGL Group who share an interest in high-performance fibre composite materials, in particular carbon-fibre reinforced plastics (CFRP).

Key players in the clusters are the Fraunhofer Institutes⁴⁷. Fraunhofer is Europe's largest application-oriented research organisation. At present, the Fraunhofer maintains 66 institutes and research units. The majority of nearly 24,000 staff are qualified scientists and engineers. The research budget in 2014 was €2 billion. Of this sum, €1.7 billion is generated through contract research. More than 70% of the Fraunhofer contract research revenue is derived from contracts with industry and from publicly financed research projects. Almost 30% is contributed by the German federal and Länder governments in the form of base funding.

Unlike other German public research institutions, which rely almost exclusively on institutional funding to support their research, the Fraunhofer's budget includes only 20- 30% public institutional funding. Moreover, the amount of funding is linked directly to their success in contract research for public and private clients. Therefore, their research orientation is largely demand driven. The close relationship between the Fraunhofer and German universities is institutionalised through the appointment of Fraunhofer directors as university professors. Thus, it plays a strong bridging role between academic and industrial research.⁴⁸

A status report on the cluster program in 2015⁴⁹ reported that:

The Leading-Edge Clusters have developed sustainable structures, established efficient cluster management teams, and already initiated numerous product and process innovations. Moreover, the impetus created by the competition extends beyond the clusters selected for funding: Many of the clusters not chosen are implementing the strategies they developed for their applications.

Cluster programs in Baden-Wuerttemberg⁵⁰

The state government of Baden-Wuerttemberg systematically supports the (further) development of clusters, cluster initiative and the federal state's networks of regional, national and international visibility. Numerous cluster initiatives have already been awarded for winning national and regional competitions. Cluster policy is a central element of the federal state's innovation policy aiming to strengthen the innovation capacity and competitiveness of small and medium-sized companies.

A strong cluster landscape has progressively developed in Baden-Wuerttemberg. A large number of companies, research institutes and universities are integrated in regional cluster-initiatives and networks at federal state level.

Clusters have been established in more than twenty-five fields, including automotive, biotechnology, energy, finance, forest and wood industry, health, ICT, lightweight construction, logistics, aerospace, mechatronics, media, medical technology, new materials, pharmaceuticals, photonics, production

technology, satellite navigation, safety engineering, telecommunication, textiles, environmental technology, packaging and business services.

Baden Württemberg strives to support and strengthen active networks and innovation platforms throughout the state as well as regional cluster initiatives, for example with the following measures:

- A regional cluster atlas describes the recognised clusters and gives additional topics which, according to the assessment of regional representatives, show development potential for regional clusters. A detailed directory with internet addresses enables quick contact with contact persons.
- Holding an ideas contest to strengthen regional clusters. The winners, chosen by an independent jury, can apply for funding for their project idea from the European structural funds for the strengthening of “regional competitiveness 2007 to 2013”. With the funding of professional cluster management, regional cluster development should be pushed forward on this basis.
- Support of the Clusters of Excellence in Baden-Württemberg which have been boosted by the Federal Ministry of Education and Research within the cluster competition, part of the German high tech.

The cluster participants are promoted by a variety of measures and activities. These include:

- Financial support for innovative projects of the cluster initiatives
- Promotion of the cluster initiatives’ internationalisation
- Organization of cluster events at federal state and regional level
- Studies on cluster-related issues
- Qualification offers for cluster managements
- Publications
- Transparency and information

In order to ensure a coordinated and strategic approach and a uniform positioning, the Ministry of Finance and Economy, the Association of Baden-Wuerttemberg’s craft industry as well as the Association of Chambers of Industry and Commerce have defined a common understanding of cluster policy in a strategic paper.

The ClusterAgentur has the mission to train the cluster managements in such a way that they will henceforth be able to offer their members even more tailor-made services. Furthermore, it assists the Ministry of Finance and Economy in implementing the objectives of Baden-Wuerttemberg’s cluster policy. It operates in a close partnership between actors from VDI/VDE Innovation + Technik GmbH, the Steinbeis-Beratungszentren GmbH and the Baden-Württemberg International GmbH.

Together with the cluster initiatives and regional networks in Baden-Wuerttemberg, the ClusterAgentur develops new services to be implemented by the cluster and network managements themselves in joint initiatives with their members. The team of the ClusterAgentur has long-standing national and international experience in the areas of cluster management, coaching and cluster policy.

A particular feature of the Baden-Wuerttemberg cluster strategy is the Quality label Cluster of Excellence. Baden-Wuerttemberg's stated aim with regard to its cluster policy is to help the cluster and network management organizations enhance their level of professionalization and improve their quality. The Quality label 'Cluster Excellence Baden-Wuerttemberg' provides the possibility for cluster initiatives and networks at federal state level to review their quality, to continuously improve their performance and to have their excellence certified.

The quality label is made up by a set of 34 quality indicators representing the categories structures, processes, activities and strategies used to measure the various aspects of cluster and network management organisations. The quality indicators have been defined according to a practical relevance and are based on the results of the 'European Cluster Excellence Initiative' supported by the European Commission. Each quality indicator is assigned a specific threshold value that has to be achieved in order to prove the respective value of excellence for each indicator. The quality label 'Cluster Excellence Baden Wuerttemberg' may be awarded if certain minimum criteria are fulfilled and if at least 80% of the maximum number of the possible 'Cluster Management Excellence Score' points are reached.

2.7. Steinbeis Foundation⁵¹

Steinbeis is a global purveyor of R&D, consulting and technology transfer services. The foundations of our organisation were laid in the 19th century by Ferdinand von Steinbeis in Baden-Württemberg who established the first Steinbeis Foundation in 1868 to foster the vocational training of young people.

The foundation was re-established in 1971 under the German Civil Code and a key service provider in supporting SMEs in the German federal state of Baden-Württemberg. The interdisciplinary Technology Consulting Service Centres emerged as one of the key instruments in providing services. At the time, they were associate institutions to the universities of applied sciences in Baden-Württemberg and arranged for knowledgeable technical advisors to support SMEs throughout the area.

Steinbeis has developed into an international network spanning 1,006 transfer enterprises. They take a variety of forms: legally dependent Steinbeis Transfer Centres, Steinbeis Research and Innovation Centres, Steinbeis Consulting Centres, Steinbeis Transfer Institutes, companies of an independent legal nature and enterprises operating under franchising arrangements or minority shareholdings. In 2014, 79 new Enterprises joined the Steinbeis Network. This network encompasses 6,000 experts contributing to the network with their specialist knowledge and working on individual challenges in interdisciplinary teams. In 2014 Steinbeis Enterprises achieved a total turnover of €144,4 million, worked with 1,744 employees and 3,691 contractors, and employed a total of 717 professors in 2014.

Acting as an umbrella organization over the Steinbeis Network is the non-profit Steinbeis Foundation for Economic Development (StW). The guiding principles for the work of the foundation are laid down by an independent Board. Responsibility for all commercial activities involving knowledge and technology transfer, as well as the central Steinbeis framework itself, lies with a Steinbeis subsidiary - Steinbeis GmbH & Co. KG für Technologietransfer (StC). It is the StC that has formal responsibility for managing the Steinbeis Network.

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References

- ¹ http://erawatch.jrc.ec.europa.eu/erawatch/opencms/information/country_pages/de/country
- ² CIA World Factbook, <https://www.cia.gov/library/publications/the-world-factbook/geos/gm.html>
- ³ [file:///H:/SAF09/Germany/Germany%20 %20Innovation%20Policy%20Platform.htm](file:///H:/SAF09/Germany/Germany%20%20Innovation%20Policy%20Platform.htm)
- ⁴ OECD, STI Outlook 2014, Paris, p. 327.
- ⁵ Technology Transfer Systems in the United States and Germany: Lessons and Perspectives <http://www.nap.edu/catalog/5271.html>, p. 242.
- ⁶ [file:///H:/SAF09/Germany/Germany%20 %20Innovation%20Policy%20Platform.htm](file:///H:/SAF09/Germany/Germany%20%20Innovation%20Policy%20Platform.htm)
- ⁷ <http://www.hightech-strategie.de/en/350.php>
- ⁸ http://erawatch.jrc.ec.europa.eu/erawatch/opencms/information/country_pages/de/policydocument/policy_doc_0013
- ⁹ <http://www.bmwi.de/EN/Topics/Technology/hightech-strategy.html>
- ¹⁰ The New High Technology Strategy: Innovations for Germany, Federal Ministry of Education and Research (BMBF), 2014, p.10.
- ¹¹ Ibid, p.11
- ¹² OECD, STI Outlook 2014, Paris, p.325.
- ¹³ Ibid pp31-32.
- ¹⁴ http://erawatch.jrc.ec.europa.eu/erawatch/opencms/information/country_pages/de/policydocument/policy_doc_0016
- ¹⁵ http://erawatch.jrc.ec.europa.eu/erawatch/opencms/information/country_pages/de/supportmeasure/supp_ort_mig_0010
- ¹⁶ http://erawatch.jrc.ec.europa.eu/erawatch/opencms/information/country_pages/de/supportmeasure/supp_ort_mig_0040
- ¹⁷ http://erawatch.jrc.ec.europa.eu/erawatch/opencms/information/country_pages/de/supportmeasure/supp_ort_mig_0018
- ¹⁸ <http://www.bmwi.de/EN/Ministry/budget,did=646316.html>
- ¹⁹ <http://www.zim-bmwi.de/statistik> in order, rejected, pending and approved.
- ²⁰ www.zim-bmwi.de/download/studien-berichte-expertisen/zim-endbericht-kurz_08-2010.pdf
- ²¹ www.zim-bmwi.de/download/studien-berichte-expertisen/IWH_ZIM-Gutachten.pdf
- ²² <http://www.zim-bmwi.de/zim-overview>
- ²³ The New High Technology Strategy: Innovations for Germany, Federal Ministry of Education and Research (BMBF), 2014, p. 37.
- ²⁴ http://erawatch.jrc.ec.europa.eu/erawatch/opencms/information/country_pages/de/supportmeasure/supp_ort_mig_0038
- ²⁵ EXIST: Transfer of Research, Federal Ministry of Economic Affairs and Energy, 2015; EXIST: Business Start-up, Federal Ministry of Economic Affairs and Energy, 2015.
- ²⁶ http://erawatch.jrc.ec.europa.eu/erawatch/opencms/information/country_pages/de/supportmeasure/supp_ort_mig_0003
- ²⁷ <http://www.exist.de/EN/programme/About-EXIST/EXIST-review/content.html>
- ²⁸ Dr Marianne Kulicke, 15 Years of EXIST "University-based start-up programmes" Development of the EXIST funding programme between 1998 and 2013, Working paper from the scientific research supporting the "EXIST – University-based start-up programmes", Fraunhofer-Institut für Systemund Innovationsforschung ISI Breslauer Straße 48 76139 Karlsruhe, April 2014, accessed at http://www.exist.de/SharedDocs/Downloads/EN/Entwicklung-Exist-1998-2013-EN.pdf;jsessionid=80A8D3A7D7EF7776BB6D8AE90C392DEB?_blob=publicationFile
- ²⁹ The New High Technology Strategy: Innovations for Germany, Federal Ministry of Education and Research (BMBF), 2014, p. 38.
- ³⁰ <http://www.bmwi.de/EN/Ministry/budget,did=646316.html>
- ³¹ <http://foerderreport.kfw.de/programm/ERP-Innovationsprogramm/index.html>
- ³² http://erawatch.jrc.ec.europa.eu/erawatch/opencms/information/country_pages/de/supportmeasure/supp_ort_mig_0026
- ³³ www.ramboll-management.de/news/~/_media/FA190CB3FA87456B9FD0B84AD553567E.ashx
- ³⁴ <http://www.bmbf.de/foerderungen/26079.php>

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- 35 [http://www.bmbf.de/pubRD/VIP_Lebenswissenschaften\(1\).pdf](http://www.bmbf.de/pubRD/VIP_Lebenswissenschaften(1).pdf)
- 36 http://www.bmbf.de/pubRD/VIP_Ingenieurwissenschaften.pdf
- 37 http://www.bmbf.de/pubRD/VIP_MathematikNaturwissenschaften.pdf
- 38 http://www.bmbf.de/pubRD/VIP_Dienstleistung.pdf
- 39 [http://erawatch.jrc.ec.europa.eu/erawatch/opencms/information/country_pages/de/supportmeasure/supp
ort_0044](http://erawatch.jrc.ec.europa.eu/erawatch/opencms/information/country_pages/de/supportmeasure/supp
ort_0044)
- 40 http://www.bmbf.de/pub/Innovationspotenziale_erschliessen.pdf
- 41 <http://www.bmbf.de/de/2391.php>
- 42 <http://www.bmbf.de/foerderungen/26079.php>
- 43 Ibid
- 44 <http://www.bmbf.de/de/2391.php>
- 45 [http://erawatch.jrc.ec.europa.eu/erawatch/opencms/information/country_pages/de/supportmeasure/supp
ort_mig_0001](http://erawatch.jrc.ec.europa.eu/erawatch/opencms/information/country_pages/de/supportmeasure/supp
ort_mig_0001)
- 46 <http://www.signo-deutschland.de/e5072/e6287/SIGNO-EvaluationAbschlussberichtApril2010.pdf>
- 47 <https://www.fraunhofer.de/en/about-fraunhofer/facts-and-figures.html>
- 48 Technology Transfer Systems in the United States and Germany: Lessons and Perspectives
<http://www.nap.edu/catalog/5271.html>, p. 242-3.
- 49 http://www.bmbf.de/pub/Deutschlands_Spitzencluster.pdf
- 50 <http://www.clusterportal-bw.de/en/cluster-policy/>
- 51 <http://www.steinbeis.de/en/steinbeis/about-steinbeis.html>