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Invest Facts and *in Bavaria* Figures



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Invest Research and *in Bavaria* development



Infrastructure of innovation

Through the founding of five universities and a number of non-university institutes in the period starting in the 1960s, the network of facilities forming Bavaria's research community has been systematically and purposefully expanded and extended. Today, this network comprises 11 universities, 17 polytechnics, 3 facilities for the conducting of large-scope research, 11 Max Planck institutes and 10 centers maintained by the Fraunhofer Society. The size and output of this network make Bavaria one of the leading centers of innovation in Europe and in the world as a whole.

Research at Bavaria's universities

Operating objectives and responsibilities

In addition to educating students, the conducting of research has long been the main responsibility of Bavaria's universities. The universities carry out these activities in a great range of fields, and use an equally variegated spectrum of methods to do so. This diversity and depth of activity represents a highly important asset for Bavaria's scientific and industrial communities.

The value of this asset is realized through the transferring of technologies and other scientific findings. The scientists researching at Bavaria's universities possess a great store of problem-solving expertise, which is applied in commissioned research and collaborative projects.

Institutes of science maintained by Bavaria's universities and their focuses of research

Bavaria's universities carry out research in virtually all of today's areas of technological inquiry. These include:

Solid state physics

Munich's University of Technology, the Universities of Munich, Würzburg, Regensburg, Erlangen-Nuremberg, Bayreuth, Augsburg

Applied optics

University of Erlangen-Nuremberg, Munich's University of Technology, University of Bayreuth

Electric propulsion and control units

University of Erlangen-Nuremberg, Munich's University of Technology

Mechanical processing technologies, plant and industrial engineering, chemistry and fluid mechanics

University of Erlangen-Nuremberg, Munich's University of Technology, University of Bayreuth

Nanotechnologies

University of Munich, Munich's University of Technology, University of Würzburg

Manufacturing technologies

University of Erlangen-Nuremberg, Munich's University of Technology, University of Bayreuth

Experimental physics

Munich's University of Technology, Universities of Munich, Würzburg, Regensburg, Erlangen-Nuremberg, Bayreuth, Augsburg

Thermodynamics, fluid mechanics, hydraulics and energy technologies

Munich's University of Technology, University of Bayreuth

Laser technologies

University of Erlangen-Nuremberg, Munich's University of Technology, Universities of Würzburg, Bayreuth, Augsburg

Aviation engineering and space transport

Munich's University of Technology (working with the DLR—Germany's Aerospace Center), Munich's University of the German Army

Medical technologies

University of Erlangen-Nuremberg, Munich's University of Technology

Biotechnologies

University of Munich, Munich's University of Technology, Universities of Würzburg, Erlangen-Nuremberg, Regensburg, Bayreuth

Research into infectious diseases

University of Würzburg

Research into ecosystems

University of Würzburg, University of Bayreuth, Munich's University of Technology

The close working relationships existing between researchers at the state's universities and those working at non-university facilities constitute one important reason why companies with high-tech products flock to Bavaria.

The following examples detail the focuses of the research carried out jointly by Bavaria's universities and non-university research institutes.

Research into microstructures, including microelectronics

University of Erlangen-Nuremberg, Munich's University of Technology, Universities of Augsburg and Würzburg.

(This research is jointly carried out with Fraunhofer institutes and with working groups.)

Research into air pollution and other environmental problems

Universities of Bayreuth and Munich (working with GSF)

University of Augsburg (its Center of Environmental Sciences – WZU)

Basic research—the Max Planck institutes in Bavaria**Operating objectives and responsibilities**

The Max-Planck-Gesellschaft zur Förderung der Wissenschaften e.V.

- is an agency coordinating the work of some 80 institutes (as of this writing).
- carries out basic research into selected areas of the natural and social sciences and into the humanities.
- works to develop new areas of research. In doing so, it complements the research activities conducted at Germany's universities.
- works with the universities, providing them with access to its large-sized facilities and equipment.

Institutes

Eleven Max Planck institutes (MPIs) and one research office are located in Bavaria.

MPI for Astrophysics, Garching

MPI for Biochemistry, Martinsried, Munich

MPI for Neurobiology, Martinsried, Munich

Research Office for Ornithology, Andechs

MPI for the non-German and international law of patents, copyrights and the protection of competition, Munich

MPI for Physics (Werner Heisenberg Institute), Munich

MPI for Extraterrestrial Physics, Garching

MPI for Plasma Physics, Garching

MPI for Psychiatry, Munich

MPI for Research into Psychology, Munich

MPI for Quantum Optics, Garching

MPI for non-German and international societal law, Munich

Helmholtz Centers (large-sized research institutions) in Bavaria

Germany's states and its federal government have jointly set up a number of large-sized research institutes. These have been charged with the carrying out of large-scale, long-term technology development projects. Three Helmholtz Centers—one of the highest totals in the country—are located in Bavaria.

Each of the Helmholtz Centers has its own particular areas of specialization, in which it handles the following kinds of projects:

- those necessitating a large amount of expenditure for planning and management
- those whose carrying out encompasses the securing of input from a number of disciplines on a regular basis.

The institutes' work comprises everything from the conducting of basic research to the configuration of technologies in accordance with market needs.

Max Planck Institute for Plasma Physics (IPP)

Operating objectives and responsibilities

The Max Planck Institute for Plasma Physics (IPP) has dedicated itself to the development of nuclear fusion. This research has been primarily oriented towards producing ways of harnessing the energy produced by the fusing of the nuclei of the hydrogen atoms (thus creating helium). This technology would provide all of the earth's regions with an almost inexhaustible supply of energy. The IPP's central responsibility consists of coming up with an understanding of the physics of plasma. This will, in turn, be employed in the construction of a fusion-based power plant capable of generating energy by fusing hydrogen atoms' nuclei. To that end, the IPP is carrying out two large-sized experiments.

These involve the operation of the ASDEX Upgrade tokamak and the WENDELSTEIN 7-AS stellarator. Now being created is the latter's successor, the WENDELSTEIN 7-X, at the ancillary institute founded by the IPP in 1994 in Greifswald. The IPP has some 1,000 staff members, one of the largest totals of any Europe-based center of research into fusion. One of the workforce's responsibilities is the development of those new technologies needed to carry out the IPP's experiments and which haven't been created by companies.

Germany's Aerospace Center in Oberpfaffenhofen

The development of aviation and space transport technologies remains one of the most fascinating scientific challenges of our time. The DLR (Germany's Aerospace Center) is today Germany's largest institute of engineering-based research. It maintains eight dedicated facilities and four outposts.

The DLR's responsibilities are the

- Planning high-complexity aviation, space and mass transport systems
- Planning high-complexity flight navigation systems
- Optimizing the performance and environmental compatibility of systems propelling airplanes and space transport vehicles and supplying energy
- Remote-access direction and tracking of airplanes and space vehicles
- Developing advanced materials and the systems producing them
- Developing remote-access surveillance and data transmission systems
- Managing high-complexity projects and operating large-sized facilities

DLR's facilities in Bavaria are found in Oberpfaffenhofen, a southwestern suburb of Munich, and in Weilheim. Oberpfaffenhofen has been developed since the late '60s, on a step-by-step basis, into the center of operations and data-processing for the pan-European space program. The German Satellite Observation Center (GSOC) is also located on its premises. The center of research has a staff of 1,100 and an annual budget of some € 100 million. Oberpfaffenhofen also handles important responsibilities entrusted to it by ESA (the European Space Agency).

DLR maintains in Oberpfaffenhofen units conducting flight missions, Germany's Center for Remote Access Data and the space operations control facility. Also in Oberpfaffenhofen are the institutes researching and creating methods of compiling remote-access data (forming part of a dedicated cluster), high-frequency technology and radar-based systems, communication and navigation methods, the physics of the atmosphere, automation and mechatronics (the melding of industrial and telecommunications engineering).

Over the past few years, the DLR has developed into a major supplier of advanced communication systems, software-based design and simulation tools, medical technologies, advanced materials, and automatization methods. These are primarily employed by Germany's SMEs (small and medium-sized enterprises). The DLR is setting up a department dedicated to the concurrent development of automotive technologies.

GSF – Forschungszentrum für Umwelt und Gesundheit GmbH

All of GSF's scientific activities are undertaken to improve the long-term protection of the health of human beings and of the ecosystems sustaining them. The objectives of GSF's research are to identify the risks threatening this health, to decode the mechanisms causing disease, to determine the limits of the impositions borne by our environment, to calibrate the strength of the human being's defenses against ailment, and to develop systems precluding and palliating the outbreak of disease and the instance of environmental intrusion.

Maintained by the Federal Republic of Germany and by the Free State of Bavaria, GSF forms part of Helmholtz-Gemeinschaft Deutscher Forschungszentren e.V., which is the largest community of public sector research institutes in Germany. With 1,600 staff members and a budget of € 164.4 million (2005), GSF is the largest non-university research institute in Bavaria.

Institutes carrying out research commissioned by corporations

The Fraunhofer institutes

Headquartered in Munich, the Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e.V. (FhG) carries out research commissions placed by the private and public sectors. Encompassing both the natural sciences and engineering technologies, the research contracts processed and the services provided by the FhG have long been a major force in the transforming of research findings into marketable products and technologies.

Especially worthy of note among the Fraunhofer institutes in Bavaria are:

- Fraunhofer Institute for Integrated Circuits, Erlangen
- Fraunhofer Institute for Research into Operational Reliability and Micro-Integration, Munich
- Fraunhofer Center for Communication Systems, Munich
- Fraunhofer Institute for Integrated Systems and Components, Erlangen
- Fraunhofer Institute for Research into Silicates, Würzburg
- Fraunhofer Institute for Processing and Packaging Technologies, Freising
- Fraunhofer Institute for Construction Physics, Holzkirchen Center
- The Fraunhofer Society's patent office for Germany's research community, Munich.

Forschungsstelle für Energiewirtschaft e.V., der Gesellschaft für praktische Energiekunde

This research office has one of Germany's largest troves of expertise on energy and how to use it in an efficient way. The office is maintained by Gesellschaft für praktische Energiekunde e. V., a non-profit organization founded in 1949 and run by representatives from the energy supply, manufacturing, scientific and administrative communities.

The FfE's staff members are experts in electronics, industrial engineering and physics. They participate in the development of the following technologies, systems and services:

- technologies used in the measuring and managing of the energy used in buildings
- forecasting of energy consumption, structures of use and market trends
- technologies used in improving buildings
- the staging of exhibitions and the dissemination of information
- systems enhancing mobility and alternative propulsion technologies
- regenerative energy
- hydrogen and fuel cell technologies
- full-range analyses of energy use, of output and costs of emissions; certification.

The FfE's main objective is to help to deploy scientific breakthroughs to further the efficient use of energy. To that end, it devotes itself to working scientific findings into methods and systems which can be applied to the conservation of energy.

The Arbeitsgemeinschaft industrieller Forschungsvereinigungen Otto von Guericke e.V. (AiF)

The AiF is an organization supported by Germany's business community. It was created to foster research into the natural sciences and new technologies, and to carry out related development projects. This network of scientific innovation is supported by Germany's manufacturers and is comprised of more than 100 research associations. Their members include some 50,000 SMEs and 700 supporting research institutes.

The AiF's fundamental objective is to promote R & D links. The AiF's institutes in Bavaria include:

- The Foundation for Paper-Manufacturing Technologies (PTS), Munich (technologies for the producing and processing of paper)
- The Society for Research into Printing (FOGRA), Munich (printing technologies)
- Supporting Association of the South German Plastics Processing Center (FSKZ), Würzburg (plastics processing and inspection technologies)
- Institute for Research into Insulation (FIW), Gräfelfing, a suburb of Munich (the use of insulation in the construction sector and in construction physics)
- The Center for Welding-Related Instruction and Experimentation (SLV), Munich (materials engineering and welding-related processes and technologies)
- German Society for Research into Wood (DGfH), Munich (wood processing).

Bayerisches Institut für Angewandte Umweltforschung und -technik—BIfA GmbH

BIfA supplies solutions to a large number of environmental problems. To do so, the institute applies and adapts the products of the R&D activities conducted by its partners. Spanning the entire value-added chain, BIfA's activities comprise the carrying out of applied research, the compilation of feasibility studies, the formulation of solutions, the designing and construction of prototypes, the building (on a turnkey basis) and commissioning of facilities, and the creation (working on a joint basis) of market-viable products and services. The institute's activities are carried out by its staff members, who are experts in their fields, and who avail themselves on dedicated laboratories, technical infrastructure and other requisite equipment.

BIfA's areas of expertise are process and system technologies, technical and environment-derived chemicals, environment-informing biotechnologies, IT and business administration.

The institute's areas of specialty include

- preclusive and end-of-the-pipe environmental technologies
- preparatory and recycling technologies
- processing of wastes ensuing from the creation of high-tech materials
- environmentally compatible production operations
- optimization of biologically-based treatment facilities
- IT-based information systems
- the compilation of analyses of eco-efficiency
- the handling of hygiene-imperiling wastes.

BIfA's objective is to provide its customers, which are in the public and private sectors, with solutions optimally meeting their highly individual needs, and, by doing so, to strengthen their ability to compete on national and international-level markets.

The Bayerische Zentrum für Angewandte Energieforschung e.V. (ZAE Bayern), Würzburg

The ZAE Bayern's activities center around the application of energy. It also provides related vocational training and occupational education programs, consulting services, information and documentary materials. It has a trove of knowhow in high-vacuum insulation, photovoltaic and fuel cells-related technologies.

The ZAE has three divisions, located in Erlangen, Garching and Würzburg. To promote the application of scientific discoveries, the ZAE Bayern sets up working relationships with industrial corporations, universities and scientific institutes. The organization stages scientific and inforamatory events, and provides counsel on matters relating to the researching of the applications of energy.

ATZ Center of Development, Sulzbach-Rosenberg

Since being relaunched in 2003 the center has devoted itself to supplying services which develop processes and materials needed by the energy provision sector. The services range from the conducting of studies to the carrying out of pilot production activities. The focus of the center's research is the creation of innovative thermal and biological-based processes and of related, corrosion and wear-proof materials.

Scientific input is forthcoming from a network of R & D institutes. These include Munich's University of Technology, the center for applied energy research (ZAE), the Northern Bavarian Center of Expertise, and the university of applied sciences in Amberg and Weiden. Also working on ATZ's projects are doctorate-track students. Its projects make ATZ a center of knowhow dissemination. This knowhow is in strong demand by small and medium-sized industrial engineering companies.

Research consortia

A number of Bavaria's research programs are jointly carried out by two or more of the state's universities, are interdisciplinary in nature, involve areas promising to engender the technologies shaping tomorrow's economies, and are the recipients of support from the state's business community. This breadth and thrust of activity manifest the ability of Bavaria's post-secondary sector to respond to the challenges posed by ongoing developments. The list of the cross-university research consortia in Bavaria includes:

- ForCarbon—participating in it are the universities of Augsburg, Bayreuth, Erlangen-Nuremberg, Regensburg and Würzburg. Objective: to conduct research into carbon-based materials.
- ForOxid—the Center for the Application of Research into Materials and the Environment; the universities of Augsburg, Bayreuth and Würzburg; the Fraunhofer Institute for Research into Silicates. Objective of the consortium's research: the multiscale design of functional oxidic materials.
- ForNeI—the Fraunhofer Institute for Integrated Systems and Component Technology, Erlangen; the university of Erlangen-Nuremberg; the Technical University, Munich; the University of the Federal Armed Forces, Munich; and the University of Würzburg. Objective of the consortium's research: nano-scale electronics.
- ForIngen—the universities of Erlangen-Nuremberg, Munich, Regensburg and Würzburg. The objective of the consortium's research: to find how pathogens change their genetic information
- ForBias—the Technical University Munich; the University of Munich; the University of the Federal Armed Forces Munich. Objective: to create bioanalytical-based systems of sensory-directed assistance
- ForSip—the universities of Augsburg, Erlangen-Nuremberg and Passau, and the Technical University Munich. Objective: to conduct research into the situating and individualization of man-machine interactions
- ForWerkzeug—the university of Erlangen-Nuremberg; the Bavarian Center of Laser Research, Erlangen; and the Technical University Munich. Objective: to develop machine tooling systems enhancing the flexibility and efficiency of production operations
- ForLog—the universities of Erlangen-Nuremberg and of Regensburg, the Technical University Munich. Objective: to create supra-adaptive logistics systems

Applied research and development projects carried out by Bavaria's polytechnics**Operating objectives and responsibilities**

The applied research and development activities undertaken by Bavaria's polytechnics show a great breadth of subject matter. These activities are designed to transfer the expertise and technologies developed to the state's SMEs and to the rest of its business community. These transfers are carried out by the polytechnics' senior administrators and by a large numbers of professors.

Bavaria's technology transfer network

To be viable in today's highly competitive business world, a region has to institute and maintain a system capable of transferring the knowledge and technologies produced by its research institutes to its industrial community. The state of Bavaria's support for its technology transfer system is multifaceted. The guiding idea behind this support: "help the companies get what they need to get themselves growing."

Technology centers

Bavaria's high-tech incubation centers help their companies get through the start-up phase.

Bavaria's centers of high-tech incubation provide young companies' CEOs with direct access to scientists, technicians and managers.

The following high-tech incubation centers have been founded in Bavaria with public-sector support:

- Munich's technology center, maintained by Münchner-Gewerbehof- und Technologiezentrumsgesellschaft mbH (MTZ), Munich (incubation center)
- Innovations- und Gründerzentrum Nuremberg-Fürth-Erlangen GmbH (IGZ), Erlangen (incubation center)
- Technologie- und Gründerzentrum GmbH (TGZ), Würzburg (incubation center)
- Gründer-, Innovations- und Beratungszentrum Betriebsgesellschaft mbH (GRIBS), Schweinfurt (incubation center)
- Techno-Z Freilassing (the center works closely with the nearby Salzburg Technology Center, thus furthering the cross-border development of technologies by Bavaria and Austria)
- Innovations- und Gründerzentrum Biotechnologie (IZB), Martinsried, Munich (biotech-related incubation center)
- BioMed/ZmK Würzburg, Würzburg
- Innovations- und Gründerzentrum Biotechnologie (IZB), Weihenstephan (biotech-related incubation center)
- BioPark Regensburg, Regensburg
- Innovations- und Gründerzentrum Medizintechnik und Pharma (IZMP), Erlangen (incubation center for pharmaceutical and medical technologies)
- Energietechnologisches Zentrum (ETZ), Nuremberg (center for energy supply technologies)
- IT-Speicher Regensburg, Regensburg
- Logistik-Kompetenz-Zentrum (LKZ), Prien (center for the development of logistics-related expertises)
- Umwelttechnologisches Gründerzentrum (UTG), Augsburg (incubation center for environmental technologies)
- Innova-High-Tech-Park, Kaufbeuren (incubation center)
- Technologie Centrum Westbayern (TCW), Nördlingen
- Start Point Munich—the center for energy and communication, Brunnthal-Nord, Munich
- b-neun Media & Technology Center, Unterföhring, a northern suburb of Munich (innovation center for electronic media)
- AITI-Park, Augsburg (IT-related incubation center)
- Neue Materialien, Bayreuth (materials engineering incubation center)
- Innovations- und Technologie-Campus (ITC), Deggendorf
- GATE incubation center (GATE), Garching
- Anwendungszentrum Satellitennavigation, Oberpfaffenhofen (incubation center for satellite-based navigation systems).

The transferring of technologies in Bavaria

There are now more than 100 institutions in Bavaria providing links to R & D bodies and to local experts, or supplying consulting or problem-solving services in various technical areas.

To handle these responsibilities, the institutions also carry out a range of related activities, and hold ancillary events, including:

- the staging of specialized events and seminars centered around technologies, and of further occupational training courses for companies
- the organization of congresses and exhibitions presenting and pertaining to research findings and other technological subjects
- the coordination of high-tech companies' participation in trade fairs
- the state-wide dissemination of information.

Technologies transferred through "Bayern Innovativ"

The ability to incorporate innovations into products and services remains the prime determinant of a company's ability to compete successfully on international markets. To enhance this ability on the part of Bavaria's SMEs, the state government founded Bayern Innovativ in 1995. Headquartered in Nuremberg, the agency handles its brief by intensifying the transfer of technologies.

To do such, the agency helps state scientific institutes and companies forge and maintain links among each other. From the resulting matches of technologies and sectors ensue the quick and efficient development of advanced products.

As the following figures detail, the agency has masterfully handled its responsibility. To date, Bayern Innovativ has brought together 75,000 experts and potential partners. In doing such, the agency has forged a network of some 40,000 companies and of some 400 scientific institutes. Up to 10,000 participants (from 40 countries) attend the topic-specific events held every year in Bavaria by the agency.

The technology transfer platforms developed by Bayern Innovativ GmbH have become major venues for the initiating of new technology-related partnerships.

Activities include:

- the creation of platforms of joint development, the planning and organizing of congresses, symposia, one-on-one-meetings and cooperation forums
- the organization of stands shared by companies and scientific institutes at international-level high-tech trade fairs
- the creation and maintenance of media (an E-letter, newsletter, Internet portal, Internet-based videoconferences disseminating knowhow, the publishing of special reports and studies), in German and in English
- the planning and organization of the following joint initiatives and networks
 - BAIKA—the platform set up to foster innovation and cooperation among Bavaria's automotive suppliers
 - BAIKUM—Bavaria's initiative for innovation in environmental technologies
 - BAIKEM—Bavaria's initiative for innovation and cooperation in the electronics and microtechnologies sectors
 - Life Science Bavaria international network
 - Bavarian Energy Forum
 - Textile Innovation
- Forum Medizintechnik & Pharma e. V. sector of activities
- Innovation Relay Center sector of activities
- BayTech sector of activities: the securing, brokering and management of projects jointly undertaken by companies and universities.

Bayern Innovativ GmbH identifies advances needed by and forthcoming from the business and technology communities. The agency then gets scientific institutes and companies involved in the advances' development. This process is carried out by a team of some 50 staff members—engineers, physics, chemists, ICT experts, economists and marketing specialists. This team also works with experts hailing from the business and scientific communities.

Bayern Innovativ GmbH also devotes itself to the development of ten cutting edge technologies, with these ranging from biotech and microsystems technologies to materials engineering. These technologies are deployed by the ten most important sectors in Bavaria's economy, with these including the automotive, electronics, chemical, construction, textile and ceramics industries. Their breadth of activities has secured the agency's projects a large number of participants. Many of these participants do not normally form part of value added chains. Through their participation, the projects often feature new-look nexuses of activity.

Technologies transferred by local chambers of commerce and by the state's office of commerce (Landesgewerbeanstalt Bayern)

The state's chambers of commerce and the contact offices maintained at the headquarters and branches (of which the bulk are located in northern Bavaria) of Landesgewerbeanstalt Bayern (LGA) also facilitate the transfer of technologies in Bavaria. These bodies engage in

- the analysis of areas of weakness and of motivation to undertake structural transformations
- the promotion of knowledge transfer between those possessing it and those requiring it, and the supplying of experts capable of addressing individual problems
- the initiation of dialogues helping answer questions and solving problems arising in individual areas of technology.

Technologies transferred through OTTI

Serving SMEs and other members of the local business community, Regensburg's Ostbayerisches Technologie-Transfer-Institut e.V. (OTTI) acts as a consultant, offers further occupational education courses, dispenses information, and conducts public relations campaigns. OTTI also serves as a technology broker.

Technologies transferred by Kompetenzzentrum Umwelt Augsburg-Schwaben e.V., (KUMAS)

This center of technical expertise forms the nexus of the Augsburg-Swabia's network of providers of environmental technologies. KUMAS works to promote the flow of innovation among dedicated companies, scientists, political bodies and public authorities.

In doing such, the center augments the region's stock of knowhow and utilizable developments in the field of environmental technologies. The center's brief comprises the

- increasing of the sales abroad made by Swabian environmental technology companies
- the inculcating of environmental principles
- the setting up and operation of environmental management systems
- development of environment-related medicine technologies
- development of energy supply systems
- the furthering of the precepts of sustainable development
- the development of environment-related information systems.

BfA—Bavaria's Institute for Applied Environmental Research—and Augsburg's Center for the Incubation of Environment Technological Companies form the hearts of KUMAS' network. The institute and the center are located in the immediate vicinity of KUMAS.

Technologies transferred by BayernDesign

Design plays a key role in shaping a personal environment which is attractive, safe, functional and healthful. Headquartered in Nuremberg, BayernDesign began operations in May 2001. Its brief is to spearhead the transformation of Bavaria from a manufacturer of high-tech products into one in which technology and design further each other. To accomplish this goal, BayernDesign raises the public's awareness of the importance of design. It does this by disseminating information via www.bayern-design.de, by staging events, by forging networks, by holding competitions and by putting together exhibitions.

Technologies transferred through Bavaria's institutions of higher education

Bavaria's universities and polytechnics maintain offices of outreach and technology transfer. They also employ technology consultants. Responsible for the compiling and dissemination of catalogues listing technologies available, these offices and consultants serve as the interface to Bavaria's business community. They have also been charged with the solving of problems facing Bavaria's small and medium-sized companies, through the analyzing and defining of problems and through the selecting of consultants recruited from the state's academic community.

The following universities have such offices and employ such consultants:

- University of Augsburg: Center for Knowledge and Technology Transfer—ZWW
- University of Bamberg: Research Promotion and Knowledge Transfer
- University of Bayreuth: Knowledge and Technology Transfer
- University of Erlangen-Nuremberg: Contact Agency for Knowledge and Technology Transfer
- University of the Federal Armed Forces Munich: ITIS e.V.—Knowledge and Technology Transfer
- University of Passau: Knowledge and Technology Transfer
- University of Regensburg: FUTUR—Research and Technology Transfer
- University of Würzburg: Research Promotion and Technology and Knowledge Transfer
- University of Munich: KFT Contact Agency for Research and Technology Transfer
- Technical University Munich
 - WIMES—Agency for Knowledge Transfer and Trade Fairs
 - TUMTech GmbH—Technology Transfer and Management

Visit www.tbu-online.de to find out how to get in touch with the agencies, and to learn more about them. The Website is maintained by the Working Circle of the Technology Transfer Agencies of Bavaria's universities.

The core areas of expertise of the polytechnics—and hence the bulk of the technologies which they transfer—are in the fields of electronic, industrial, and other forms of engineering, ICT (information and communication technologies) and business administration.

A number of the state's polytechnics have areas of individual specialization. These include the facilities in Rosenheim (wood processing technologies) and Weihenstephan (agriculture, food processing, environmental protection, biotechnologies, forestry, horticulture and landscape architecture).

The transferring of technologies by non-university facilities

The following non-university facilities serve as technology transfer offices:

- The Munich-based Max Planck Institute's Garching Innovation
- Ascenion GmbH Munich, serving GSF (Oberschleißheim), and numerous other life sciences companies
- The Munich-based Fraunhofer Society's Patents Center
- Oberpfaffenhofen's Deutsches Zentrum für Luft- und Raumfahrt e.V.
- Kompetenzzentrum Neue Materialien Nordbayern (NMB, materials engineering), Bayreuth
- Süddeutsches Kunststoff-Zentrum SKZ-KFE gGmbH (research into and development of plastics production technologies), Würzburg

Centers of application and utilization

Operating objectives and responsibilities

A number of Bavaria's universities, non-university research institutions and dedicated sponsoring and supporting organizations maintain centers of application and utilization. These centers are found throughout the state, providing their users, primarily SMEs, with direct access to leading edge technologies. In addition to disseminating information and providing further occupational training for young staff members, the centers maintain facilities demonstrating solutions to all of the problems arising in the course of developing key technologies.

Among them:

IWB Center for the utilization of product technologies, Augsburg

maintained by Munich's University of Technology

The center for the testing of fiber-reinforced materials

at the University of Erlangen-Nuremberg

Bavarian Laser Center (BLZ), Erlangen

Center for the application of coating technologies at the Fraunhofer Institute for Research into Silicates (ISC), Würzburg

Zentrum für Neue Ingenieur- und Software-Technologien GmbH (ZNT)

(Center for new engineering-based and software technologies), Burghausen

ATZ Center of Development of Processes and Materials Used in and by the Energy Supply Trade

Sulzbach-Rosenberg

Bayerisches Zentrum für Angewandte Energieforschung e.V. (ZAE)

the Universities of Würzburg and of Erlangen-Nuremberg, Munich's University of Technology

Center of competence in New Materials North Bavaria (NMB)

Bayreuth, Fürth and Würzburg

Center for the application of research into materials and into the environment (AMU)

University of Augsburg

KFB Center for Fluorescent Bioanalytics (KFB) at the University of Regensburg

The Bayreuth Center for Colloids and for Interfaces (BZKG), University of Bayreuth

The Center for Regenerative Materials, Straubing

Center for Environment Sciences (WZU), University of Augsburg

Center for Applied Computer Sciences, Passau

Campus Center for IT Services and Start-ups, Passau

Institute for Capital Goods and Operating Systems (iwb)

Munich's University of Technology

Bavarian Network of Expertise in Mechatronics (BKM), Augsburg

Bavarian Institute of Applied Environmental Research and Technologies (BIFA)

Augsburg

South German Plastic Processing Center (SKZ), Würzburg

pro-micron, Kaufbeuren

The assessment and monitoring of technologies

Operating objectives and responsibilities

In Bavaria, testing offices, agencies and facilities conducting pilot projects also transfer research findings from the state's universities, of which they form part, or with which they are affiliated, to its business community. Their daily work—assessing the effects and effectiveness of technologies—mandates that these bodies take a highly practical approach when carrying out the commissions entrusted to them.

Some of the testing bodies affiliated with Munich's University of Technology are:

- the state office for the testing of technical physics
- the laboratory for structural chemistry
- the institute for the testing of hydraulics and hydrology
- the state agency for the testing of materials used in industrial engineering
- the association of offices for the testing of construction sites
- the agency for the testing of foundations, soils and boulders
- the state agency for the testing and development of construction technologies

A similar range of responsibilities is handled by Münchberg's State Agency for the Testing of Textiles, which is affiliated with Hof's Polytechnic.

Complementing Bavaria's range of institutes evaluating and testing technologies is a network of special-purpose institutions. They also provide information and consulting services.

- Bavarian Energy Forum, maintained by Bayern Innovativ, Nuremberg
- the center for information on energy conservation and on renewable sources of energy, Lindau
- the center for information on and the demonstrating of sources of renewable energy (and especially photovoltaics), Fürth
- the testing agency of the South German Center of Plastics Processing, SKZ-TeConA GmbH (Testing, Consulting, Approval), Würzburg
- the LGA Landesgewerbeanstalt Bayern (Nuremberg) and its branch offices in Augsburg, Bayreuth, Hof, Munich, Regensburg and Würzburg
- the energy conservation consulting services provided by Munich's Bauzentrum (center of building materials and procedures)
- the "Regional Development and Energy" specialized association, Regensburg.

Patenting and licensing institutions

Patents constitute an important source of valuable technical information for companies. As compared to other sources of information, the patents exhibit a greater comprehensiveness and precision of content. These patents thus serve as a source of inspiration for corporate research, development, production and strategy-formulating departments.

The fact that several national and international-level patent offices are headquartered in Bavaria provides the state's business community with an edge over its counterparts.

European Patent Office

Headquartered in Munich, the European Patent Office (EPO) (www.epo.org) maintains official units in Berlin, Vienna and The Hague. The EPO grants patents valid in the countries forming party to the European Patent Agreement (EPA). The EPO is the executive arm of the European Patent Organization, an international body founded on the basis of the EPA.

As of June 2006, the parties to the EPA were Austria, Belgium, Switzerland, Cyprus, Denmark, Germany, Spain, Finland, France, Turkey, UK, Greece, Iceland, Ireland, Italy, Latvia, Liechtenstein, Lithuania, Luxembourg, Monaco, the Netherlands, Poland, Portugal, Sweden, Bulgaria, Czech Republic, Estonia, Romania, Slovak Republic, Slovenia and Hungary. Patent applications submitted to the EPO are initially considered to be for all of the above. The applicant's selection of countries of validity occurs later on in the patent granting process.

The responsibility of the EPA is to ensure that the citizens of Europe get full use of innovations and of the economic growth and viability these innovations facilitate. To do such, the EPA conducts all-encompassing investigations. Once completed, these result in the granting of patents valid in several or all of the 31 parties. Patent applications can be submitted in German, French or English.

The European Patent Office's dedicated services are accessible at:
www.european-patent-office.org/espacenet

German Patent Office

Responsibilities and facilities

The German Office of Patents and Trademarks (GOPT) is an agency forming part of the Federal Ministry of Justice. The GOPT is the authority responsible in Germany for the granting, protection and administration of commercial rights to intellectual property. Another of the GOPT's main responsibilities is the broad-scale public dissemination of information on commercial rights to intellectual property.

Headquartered in Munich, with offices in Jena and Berlin, the GOPT is responsible for

- patents, trademarks and patterns
- conducting of dedicated research
- informing the general public about commercial rights to intellectual property.

GOPT (www.dpma.de) maintains Websites providing information on patents (www.depatistnet.de) and on patent applications and on holders willing to grant licenses to their patents (<https://dpinfo.dpma.de>).

The Fraunhofer Society's Patent Office for the German Research Community

This office is one of the ten institutes maintained in Bavaria by the Fraunhofer-Gesellschaft zur Förderung der angewandten Forschung e.V. The office provides the services turning research findings—created by its associated institutes and companies—into successful products.

These findings stem from institutes (either forming part of universities or maintained on an independent basis), from small-sized companies and from inventors. The office seeks out these inventions and furthers their development. This primarily occurs through the granting of licenses on same to companies and through the development of startup projects. The patent office provides inventors with financial support. The agency also compiles for them patenting and licensing strategies, and assists them in the exploitation of their intellectual property (IP).

The patent office assists companies in the assessment and valuation of their inventions, patents and technologies. The office also compiles studies on the rights enjoyed by IP and evaluates the same. Further, the office also carries out patent-related research, and assists research institutes, inventors, and institutions of higher education in the securing and exploiting of rights to IP. The office also brokers technologies and R & D products to the business community.

Working on a commission from the community of institutions of higher education in Bavaria, the office manages Bayern Patent. This initiative was set up to market the patents forthcoming from these institutions.

The LGA's center of patents and norms in Nuremberg and Hof

The name "LGA" stands for a group of companies providing advanced testing and other services. With more than 30 offices in Germany and in other countries, the group (www.lga.de) is comprised of a publicly-owned corporation and several other companies.

The LGA provides testing, counseling, monitoring and certification services. The agency also supplies a large variety of information on patents, trademarks, pattern and norms. This information is publicly accessible via www.patente.lga.de and www.normen.lga.de.

With an office in Hof and its headquarters in Nuremberg, the LGA's center of patents and norms provides SMEs and inventors with the following facilities and services:

- It maintains a public-access reading area and document supply service.
Provided at and by them are German and non-German patents, patterns, trademarks and samples, norms, a selection of national-level directives, laws, regulations, association-level guidelines, the EU's gazette and the documents issued by the EU Commission. LGA is the only facility in Germany to offer direct access to the research system maintained by Germany's Office of Patents and Trademarks (DEPATIS) for its customers.
- It accepts applications for the granting of patents, patterns, trademarks and samples. The center also maintains a "mailbox" that allows applicants to hand in their applications during the night time.
- It conducts research into all areas of the protection of commercial rights to intellectual property. The office also compiles analyses of patents statistics and monitors trends in the area.
- It shares premises and content with the Euro Info Center (www.eic.lga.de)
- It stages seminars on and offers training in commercial rights to intellectual property, norms and other subjects.
- It conducts on-line research into patents. To this end, the center employs www.vituelles-supportzentrum.de, which features a 24/7 system of interaction with dedicated experts.
- Working with local patent attorneys, the centers counsels, on a free-of-charge, weekly basis, inventors seeking an initial briefing.
- The center provides financial support to SMEs applying for initial patents (INSTI). This forms part of a program designed to stimulate the flow of innovation.

Public sector support provided to private-sector R & D projects

Bavaria is proud of its range of large-sized companies and the world-famous products emerging from their R & D departments. It is equally proud of its small and medium-sized companies, which continue to develop path-breaking technologies. While doing so, these companies have displayed a great store of innovation, the willingness to take risks and a high degree of adaptability. Key fact: small and medium-sized companies and individual inventors are responsible for some 85% of all patents applied for in the Federal Republic of Germany. The wide, highly diverse range of programs instituted by the state government augments these smaller-sized companies' ability to innovate.

Forms of financial assistance supplied by Bavaria to research and other sources of technical development

The programs of financial assistance set up by the state of Bavaria give a large number of companies incentives to investigate and utilize advanced technologies. The programs thus foster the proliferation of these technologies throughout the state's business community.

Bavarian program for the introduction of technologies (BayTP)

By supporting everything from the design of the initial concept to the serial manufacturing and marketing of the final product, this program promotes the development of new technologies into fully-functional prototypes.

This support is not restricted to or geared towards any particular sectors. Projects not involving software and undertaken by individual companies—of small or medium size—are eligible for support, which takes the form of loans and subsidies.

Bavaria's program to foster the starting up of high-tech companies (BayTOU)

This program provides subsidies to start-ups and to recently founded companies launching new strategies of technological implementation and developing new products, with this including software processes, technical services and high-potential ways of doing business featuring unproven technologies.

"New materials" program of development

This program provides support to projects jointly carried out by companies and research institutes. Its objective is to step up the pace of development of new materials, and of their incorporation into products. This program is centered around the metals, polymers, ceramics/glass and fiber composites sectors.

Microsystem technologies in Bavaria

This program provides support to R & D projects carried out by companies and institutes jointly striving to find applications for micro-sized components, and for devices and systems incorporating them.

Information and communication technologies in Bavaria

Promoting the research into and development of information and communication technologies by companies and institutes. These technologies are to be incorporated into advanced products and services, and to go to increase the efficiency of business processes.

Further information on the above-mentioned technology promotion programs is available at www.stmwivt.bayern.de/technologie/technologief.html

Program for the fostering of efficient ways of producing and using energy

This public-sector program provides support to the development and demonstration of new energy production and conservation technologies.

For further information:

www.stmwivt.bayern.de/energie/foerderprogramme.html

Bavaria's regional promotion programs

Applying to those regions designated eligible for such support, this program supplies subsidies and loans to those parties making investments leading to the introduction of new technologies and to the creating or securing of jobs.

For further information:

www.stmwivt.bayern.de/foerderprogramme/inhalt.html

Bavaria's Research Foundation

The state of Bavaria founded this body in 1990. The foundation's main activity is to foster the rapid and multifaceted application of the findings compiled by the cutting edge research projects jointly conducted by the state's scientific and business communities.

These projects were primarily in the following sectors

- life sciences
- information and communication technologies
- microsystem technologies
- material supply systems
- energy and environmental technologies
- mechatronics
- nanotechnologies
- processing and production technologies

Provision of venture capital

Fulfilling a commission given to it by the state government of Bavaria, LfA—Förderbank Bayern, founded in 1995 a subsidiary—Bayern Kapital.

Bayern Kapital provides Bavaria-based, high-tech start-ups with participatory capital. These funds, in turn, finance the development and deployment of innovations. The provision of these funds generally occurs on a matching basis.

Bavaria's high-tech campaign

The world economy is continuing to gallop down the paths of globalization. Knowledge has become the key factor of production. Like the technologies they're creating, the sectors furthering these trends are fast-growing.

To ensure that the state stays at the forefront of technological progress, the government of Bavaria promulgated in 2000 a large-scope program—"Bavaria's campaign for advanced technologies." It is financed from the proceeds of the state's privatization activities, and goes to foster the development of innovations and of the cutting edge sectors in which they are found. This development work is carried out by scientific bodies and by corporations.

To date, € 1.69 billion has been disbursed by the campaign. This is to be followed by the provision of a further € 1.35 billion, forthcoming from privatization proceeds.

This campaign is being implemented to augment the stocks of know-how possessed by Bavaria in the sectors set to be of cardinal importance in this century:

- life sciences (gene-based and other kinds of biotechnologies, including those used in the processing of food, and medical technologies)
- information and communication technologies
- advanced materials
- environmental technologies
- mechatronics (the melding of industrial and communication technologies).

The carrying out of this campaign will impart further impetus to the growth being recorded by Bavaria's high-tech centers, and will thus keep them in the international-level race to secure investment.

All sectors of Bavaria's economy, even those not generally considered to be high-tech in nature, will profit, be it indirectly, from the high-tech campaign and the growth it is producing. The creation and expansion of regional-level centers of expertise are being undertaken to ensure that all of the state's many regions profit from and partake of this growth by developing their—highly individual—business assets. This diversity of assets constitutes a major advantage in the securing of inward investment on the national and international levels. The development of these assets will increase the numbers of local start-ups, business expansions or corporate arrivals.

For the above reasons, each of the state's seven regions has formulated its own strategy of development. The implementation of their constituent projects is being funded by € 176 million.

A way to increase the number of gainfully employed in Bavaria is offered by the attracting of further foreign high-techs to the state. To achieve this, the state government is enhancing its outreach to the business communities in the USA, Japan and other European countries. The state's USPs ("unique selling points") are its trove of advanced technologies and companies possessing it. To activate these assets, the state government assists in the forging of technology partnerships.

Germany's research community produces a great number of marketable innovations. These, however, are not being properly exploited. That's the message being reported by rankings of countries by the numbers of technology-driven companies founded in them. As opposed to the situation for Germany as a whole, Bavaria's rate of self-employment is above the OECD-wide average. Bavaria's high-tech campaign is implementing programs designed to increase the number of high-tech companies and practices founded in Bavaria—and for a good reason. Twelve jobs created during its first five years of existence—that's the track record of the average high-tech. The corresponding figure for all newly-founded companies: 4 jobs after five years.

Businessplan competitions were staged in Munich and in northern Bavaria. These were successful and will be staged again. Company founders have a great need for business coaching. The provision of these services will therefore be expanded, as will the technology and incubation centers housing many of these newly-founded companies.

This set of measures will serve to strengthen Bavaria's research and business communities and all of the regions in which they are located. The measures will thus enable the state to remain one of the most potent competitors for investment in Europe and in the world as a whole. The deregulation of energy markets robbed the public sector's ownership of a stake in its energy suppliers of any strategic importance it might have had. Aware of that, the state of Bavaria sold its holdings in these suppliers. The funds issuing from this have been used to finance the state's campaign for high-tech and preceding programs. These expenditures have been made to implement Bavaria's policy of investing in the research capable of yielding innovative technologies, ones capable of keeping the state at the forefront of technological change.

Alliance Bavaria Innovative

Bavaria's cluster-building campaign

There's one very good way for Bavaria's business community and its staff members to counter the ever-higher level of competition prevailing on international markets: to incorporate link-building innovations into each and every one of the chains of value added. To assist the state's companies in doing such, and to promote such holistic approaches, the state government created the Alliance Bavaria Innovative.

The first thrust of the Alliance is the promotion of the forging of clusters by companies, universities, research institutes and other players in the Bavarian economy's 19 technological sectors and fields of joint operation.

The Alliance Bavaria Innovative's cluster-building has the following **objectives**:

- to **enhance the state's capacity to innovate** by easing and expediting the transformation of research findings into market-making products
- to **increase productivity** by optimizing working relationships and promoting competition. Both purposes are served by the creation of intra-cluster platforms of innovation, which allow erstwhile competitors to pursue joint programs of development.
- to **enhance companies' sense affiliation** with Bavaria by recruiting them into networks. These, in turn, are charged with the developing themselves into **trademarks** for technological excellence known the whole world over.

Intra-cluster platforms have been created for the following 19 technological sectors and areas of joint operation. Each is now engaged in the process of network-building:

High-tech clusters

- Biotechnologies
- Aerospace
- Satellite-based navigation
- Information and communication technologies
- Environmental technologies
- Medical technologies

Clusters of production

- Automotive
- Chemicals
- Sensorics and high-performance electronics
- Food processing
- Forestry and wood
- Financial services
- Media
- Energy technologies
- Rail technologies
- Logistics

Cross-disciplinary technologies

- Nanotechnologies
- Mechatronics and Automation
- Advanced materials

Highly-regarded businesspersons and scientists have agreed to serve as the clusters' "pitchmen". Entailed in this position is the deploying of their know-how, prestige and contacts in the clusters' recruiting and marketing efforts. Managing directors handle the day-to-day work of cluster-building by pursuing a broad variety of measures. Alliance Bavaria Innovative's second thrust is the unleashing of intra-regional synergies by the encouraging of cross-disciplinary networking on the local scale.

In addition to supportive services, the government of Bavaria is providing the Alliance with € 50 million over a five-year period. By doing so, the government has set in motion an open-ended process of network-building.

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