



INDUSTRIAL BIOTECHNOLOGY IN GERMANY

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Released in January 2009

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INDUSTRIAL BIOTECHNOLOGY IN GERMANY

INTRODUCTION

Biotechnology will be an important pillar of Europe's economy by 2030, indispensable to sustainable economic growth, employment, energy supply and to maintaining a high standard of living. It will be increasingly used in labour-intensive sectors, e.g. industrial processing, pharmaceuticals, agriculture and food. By 2030, the products of white biotechnology and bioenergy will have an estimated one-third share, worth €300bn, of industrial production.

Biotechnology is expected to help meet the most urgent global challenges – growing and ageing populations, limited resources of raw materials, energy and water, the threat of global warming – by facilitating the development of a sustainable economy built on biobased industrial processes.

Germany, host to the headquarters of leading global corporations including BASF, Bayer, and Evonik, is one of Europe's most important players in the field of industrial biotechnology.

Germany is home to some 500 biotech companies. Eighty-three percent of them operate in the health/medicine fields ('red' biotechnology), 19 percent in the animal health field, ten percent in agriculture ('green' biotechnology) and 13 percent in the area of industrial applications ('white' biotechnology) (in these statistics, companies could be assigned to more than one category). The economic sectors where biotech processes and products are or could be of relevance accounted for some 14 percent of Germany's GDP and 17 percent of all jobs in 2003.

I. RESEARCH AND INNOVATION

Modern industrial biotechnology is a relatively new discipline, with major areas of knowledge still to be explored. Public support to research as well as the establishment of pilot and demonstration facilities to scale-up individual processes will therefore help in the development of a European bio-based economy.

A. Public research funding

The BMBF – Federal Ministry of Education² and Research and the FZJ - Forschungszentrum Juelich GmbH³ and Sächsisches - Staatsministerium für Umwelt und Landwirtschaft⁴, (SMUL) are members as partner of the European Network Area on Industrial biotechnology (ERA-net IB)⁵.

The FNR - Fachagentur Nachwachsende Rohstoffe e.V.⁶ and the DBU - Deutsche Bundesstiftung Umwelt⁷ are members of ERA-net IB as observer.

The Agency for Renewable Resources (FNR)⁸ runs a Renewable Resources programme which supports research in the field of renewable resources, bioenergy, renewable raw materials, bioproducts, industrial biotechnology and biofuels. Projects are selected via open calls. The overall yearly budget is €50 million, totally financed by the federal Government.

Major sources of funding for biotechnology research in Germany are⁹:

- German Federal Ministry of Education and Research (BMBF)
- German Federal Ministry of Economy and Technology (BMW)
- German Federal Ministry of Food, Agriculture, and Consumer Protection (BMELV)
- German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
- German Federal Trust Fund on Environment (DBU)
- German Research Foundation (DFG)
- German Academic Exchange Service (DAAD)
- Alexander von Humboldt Foundation
- Foundation for Industrial Research
- Trust Association for German Science
- Fritz Thyssen Foundation
- Robert Bosch Foundation
- Koerber Foundation
- Klaus Tschira Foundation (KTS)
- Schering Foundation
- Volkswagen Foundation
- Peter and Traudl Engelhorn Foundation
- German-Israeli Foundation of Scientific Research and Development (GIF)

B. Pilot and demonstration plants

i. pilot plants

² www.bmbf.de

³ www.fz-juelich.de

⁴ www.smul.sachsen.de

⁵ <http://www.era-ib.net>

⁶ www.fnr.de

⁷ www.dbu.de

⁸ www.fnr.de

⁹ <http://www.biotechnologie.de/bio/generator/Navigation/English/Funding-and-Grants/sources-of-funding.html>

Pilot plants are listed by alphabetical order of location

a) Open to all

Hamburg

Technische Universität Hamburg-Harburg, Hamburg	
General, products, feedstocks	Fibre-pulping process (pilot R&D)
Services	Feedstock pre-treatment, flax fibre
Financing	Public (federal funding)
Contact	Prof. Dr. Rudolf Müller, http://www.tu-harburg.de/itb/

Oberhausen

Fraunhofer Institute for Environmental, Safety and Energy Technology UMSICHT, Oberhausen, Branch Teterow	
General, products, feedstocks	Biopolymers Biodegradable plastics, polymers from renewable resources, nanocomposites, pilot and small-scale series production
Services	
Financing	Public (federal funding, State of North Rhine-Westphalia, FhG)
Contact	Dr.- Ing. Görgе Deerberg, http://www.umsicht.fraunhofer.de/englisch/

Fraunhofer Institute for Environmental, Safety and Energy Technology UMSICHT, Oberhausen, Branch Willich	
General, products, feedstocks	Adsorbents made from renewable resources Rotary kiln pilot plant for the development and sample production of specific high-performance adsorbents and from renewable resources.
Services	
Financing	Public (federal funding, State of Mecklenburg- Western Pommerania, FhG)
Contact	Dr.- Ing. Görgе Deerberg, http://www.umsicht.fraunhofer.de/englisch/

Pfinztal

Fraunhofer Institute for Chemical Technology, Pfinztal	
General, products, feedstocks	Biopolymers, Biomaterials, Chemical Biomass Conversion
Services	Several units and arrays for polymer engineering & processing, Microwave arrays, units for membrane technology, units for processing in supercritical fluids
Financing	Public (federal funding, State of Baden- Württemberg, FhG) & private
Contact	http://www1.ict.fraunhofer.de/english/index.shtml

Postdam

Leibniz-Institute for Agricultural Engineering Potsdam-Bornim e.V., Dept. Bioengineering	
General, products, feedstocks	Pilot plant facility for the biotechnological manufacture of valuable products based on renewable resources (started operation in August 2006) <ul style="list-style-type: none"> - Lactic acid fermentation (continuous mode) 10 t/a - Processing of sugar and starchy (after enzymatic hydrolysis) materials - coarse-/microfiltration (pre-treatment of raw materials) - solid/fluid transport, mixing, heating/sterilization - down-stream processing (ultrafiltration, softening, electrodialysis, ion

	exchange)
Services	Feedstock pre-treatment, fermenter, nanofiltration, elektrolyse, product separation & refining
Financing	Public (mixed funding: State of Brandenburg, federal funding, EFRE)
Contact	Dr. Joachim Venus, http://www.atb-potsdam.de

Leibniz-Institute for Agricultural Engineering Potsdam-Bornim e.V., Dept. Bioengineering	
General, products, feedstocks	Fibre-pulping process 300 kg/h
Services	Feedstock pre-treatment, hemp fibre
Financing	Public (EU, State of Brandenburg, federal funding)
Contact	Prof. Dr. Christian Frl, http://www.atb-potsdam.de

ATB Potsdam-Bornim e.V, Germany	
General, products, feedstocks	Raw materials: starchy materials (e.g. cereals) Products: Lactates, lactic acid, starter cultures
Services	Stirred vessels (up to 1000 L), 450-L-fermentor, power, steam, water, compressed air
Financing	€3,2 million (75% funding by EU/ERDF; 12,5% Federal and 12,5% Regional Government respectively Investitions-Bank des Landes Brandenburg - ILB)
Contact	ATB Potsdam-Bornim e.V., www.potsdam.de

Ritschenhausen

Sauerkraut- und Gemseverarbeitungs-GmbH, Ritschenhausen	
General, products, feedstocks	Fatty acids, lipids, carotenoids, 6 t/a
Services	Photobioreactor to produce microalgal species
Financing	Public (federal funding) & private
Contact	Herr Winkel, Phone: (+49)(0)36949/21516

Schkopau

Fraunhofer Gesellschaft zur Frderung der angewandten Forschung e.V. (FhG), Pilot Plant Center (PAZ) for polymer synthesis and polymer processing at Schkopau ValuePark	
General, products, feedstocks	Biopolymers, Biomaterials
Services	Polymer synthesis & processing (about 330 main arrays with approx. 840 field instruments enable all the usual polymer synthesis processes to be carried out in the synthesis section, with the exception of ultra-high pressure polymerisation; pressures of up to 100 bars, temperatures over a range from - 25 to 50°C and working volumes of up to 650 litres can be achieved)
Financing	Public (federal funding, State of Saxony-Anhalt, EFRE, FhG) & private
Contact	Dr. Mathias Hahn, http://www.polymerpilotanlagen.de/

Stuttgart

Subitec GmbH, Stuttgart	
General,	Fatty acids, lipids, carotenoids, 1,5 t/a

products, feedstocks	
Services	Photobioreactor to produce microalgal species
Financing	Public (federal funding) & private
Contact	Prof. Walter Troesch, http://www.subitec.de

b) Partly restricted

Clausthal- Zellerfeld

CUTEC-Institut GmbH, Clausthal- Zellerfeld	
General, products, feedstocks	Plant for Biofuel production, 1 l/h
Services	Artfuel process, gasification, FTSynthesis, BtL
Financing	Public-private (State of Lower Saxonia, Hesse, Brandenburg, Volkswagen AG)
Contact	Dr.-Ing. Stefan Vodegel, http://www.cutec.de/impressum.php

Clausnitz

Agrargenossenschaft Bergland Clausnitz e.G.	
General, products, feedstocks	Biogas plant, solid state fermentation, 5.000 t/a, 175 kWel
Services	Solid state fermentation, slurry free, tub reactor, bioleaching
Financing	Public (federal funding) & private
Contact	Lothar Eckardt or Prof. Dr. Bernd Linke (ATB), http://www.atb-potsdam.de

Karlsruhe

Forschungszentrum Karlsruhe, Karlsruhe	
General, products, feedstocks	Plant for Biofuel production, 500 kg/day
Services	Bioliq-process, feedstock pretreatment via fast pyrolysis, gasification, Methanolsynthesis, BtL
Financing	Public-private (federal, State of Baden-Württemberg, Industry)
Contact	Dr. Nicolaus Dahmen, http://www.fzk.de/fzk/idcplg?IdcService=FZK&node=0427

Oberhausen

Fraunhofer-Institute for Environmental, Safety and Energy Technology (UMSICHT), Oberhausen	
General, products, feedstocks	CHP-unit with gasification of biomass/ 500 kW: 150 kW electricity, 250 KW heat
Services	Gasification, circulating fluidised bed gasifier for wood chips, gas motor generator plant, biomass feedstock pre-treatment
Financing	Public (federal funding)
Contact	Dr. Thomas Marzi, http://www.umsicht.fraunhofer.de

Sulzbach- Rosenberg

ATZ Entwicklungszentrum, Sulzbach- Rosenberg

General, products, feedstocks	Biofuels, pre-treatment for fermentation, ethanol, 60 kg/d Thermo pressure hydrolysis (TDH) for feedstock pre-treatment
Services	
Financing	Public (federal funding)
Contact	Dr. Matthias Franke, http://www.atz.de

c) Restricted

Berlin

Uhde Inventa-Fischer GmbH, Berlin	
General, products, feedstocks	Biopolymers, PLA, 50 kg/d
Services	Miniplant, polymerisation of lactic acid to PLA, downstream operations
Financing	Private
Contact	Dr. Rainer Schaller, http://www.uhde-inventafischer.com

Karlsruhe

Pilot-plant VERENA, Karlsruhe	
General, products, feedstocks	Raw materials: solid biomass, mud (incl. sewage sludge), liquid educts Product: Synthetic fuel (Syngas, Synfuel)
Services	Bioliq-process: Feed system, reaction system (fast pyrolysis), separation system Gasification of biomass in super-critical water
Financing	
Contact	FZ Karlsruhe, Germany, http://www.fzk.de/fzk/groups/itc-cpv/documents/internetdokument/id_033613.pdf

ii. demonstration plants

Demonstration plants are listed by alphabetical order of location

a) Open to all

Klötze

Bioprodukte Prof. Steinberg GmbH, Klötze	
General, products, feedstocks	Fatty acids, lipids, carotenoids, 130 t/a Photobioreaktor to produce microalgal species
Services	
Financing	Public (federal funding) & private
Contact	Prof. Steinberg, http://www.bioproduktesteinberg.de

Wolgast

Kreiskrankenhaus Wolgast, Wolgast	
General, products, feedstocks	CHP Unit with alternative fuel – rapeseed oil/ 240 kW electricity, 310 KW heat, 258 kW for cooling gas motor with alternative fuel generator plant, co-generation heat/power and cooling energy
Services	

Financing	Public (State of Mecklenburg-Pomerania, federal funding)
Contact	www.kreiskrankenhauswolgast.de

b) Partly restricted

Bad Hersfeld

Landwirtschaftszentrum Eichhof, Landesbetrieb Landwirtschaft Hessen, Bad Hersfeld	
General, products, feedstocks	Biogas plant with microgasturbine, 35 kWel Use of biogas in a microgasturbine
Services	
Financing	Public (State of Hesse) & private
Contact	Jan Müller (ISET), http://www.mikrogasturbine.de

Euskirchen

Schornbuscher Biogas GmbH & Co KG, Euskirchen	
General, products, feedstocks	Biogas plant, slurry free fermentation, 500 kWel Slurry free fermentation of energy plants
Services	
Financing	Public (federal funding) & private
Contact	Rainer von Meer or Prof. Dr. Peter Weiland (FAL), http://www.fal.de

Leonberg

Biogas-Brennstoffzellen GmbH, Leonberg	
General, products, feedstocks	Biogas plant with fuel cell (250 kWel) Fermentation of biowaste, conditioning and use of biogas in fuel cell "hot module"
Services	
Financing	Public (federal funding) & private
Contact	Wolfgang Bagin, http://www.lra-bb.kdrs.de

Lüneburg

PYTEC GmbH Thermochemische Anlagen, Lüneburg	
General, products, feedstocks	Plant for Biofuel production, 6 t/day
Services	Ablative flash pyrolysis
Financing	Private
Contact	Stefan Schöll, Managing Director, http://www.pytecsite.de/impressum.htm

München

Aufwind Schmack Betriebs-GmbH & Co; RES projects GmbH, München	
General, products, feedstocks	Biogas plant with Conditioning and injection of biogas into the gas distribution system, 920 Nm ³ /h Conditioning and injection of biogas into the gas distribution system
Services	
Financing	Private
Contact	Dr. Andreas Seebach (RES Renewable Energy Systems GmbH)

<http://www.resprojects.de>

c) Restricted

Brensbach

Gras refinery, Brensbach	
General, products, feedstocks	Raw material: gras Products: cellulose-based insulation material, Composite plastic material from cellulose / PP, Gras protein, Fertilizer from press juice
Services	
Financing	Cost: €2.9 million
Contact	Biowert IndustrieGmbH, www.biowert.de

Freiberg

Demonstration Plant Carbo-V®, Freiberg	
General, products, feedstocks	Raw materials: 68000 t biomass (wood, straw, whole plant biomass) per year Product: 13000 t SunDiesel fuel per year
Services	Three-stage gasification: 1) low temperature gasification 2) high temperature gasification 3) endothermic entrained gasification
Financing	
Contact	Choren Industries, www.choren.com

CHOREN Industries GmbH, Freiberg	
General, products, feedstocks	Gasification/FT-synthesis, BtL-biofuels, 15.000 t/a
Services	Carbo-V process, feedstock pretreatment, gasification, FTsynthesis, BtL (sundiesel)
Financing	Public (EU, State of Saxony, federal funding) & private
Contact	Olaf Schulze (CTO), http://www.choren.com/en/

Rosenow

Nordhanf GmbH, Rosenow	
General, products, feedstocks	Fibre-pulping process 10.000 t/a
Services	Feedstock pre-treatment, hemp fibre
Financing	Private
Contact	Mr Tornow

Sellessen

Vattenfall Europe AG, Biomasse- HKW Sellessen	
General, products, feedstocks	CHP Unit Sellessen (State of Brandenburg), 2,5 MW electricity and 3,5 MW heat, biomass-fuels, woody-feedstocks
Services	Steam generator plant, biomass firing, feedstock pre-treatment
Financing	Private
Contact	Ms Katharina Bloemer, www.vattenfall.com

Teltow-Seehof

Green Biorefinery Demonstration Plant (Planned), Teltow-Seehof	
General, products, feedstocks	Raw material: Green biomass (24 000 t/a) Products: Proteins for Industry and Cosmetics, Press cake for fodder and fuel, Heat and electricity from biogas
Services	Press-out technology, fermentation
Financing & contact	Research Institute Biopos e.V., Teltow-Seehof, Germany www.biopos.de FMS Futter-mittel GmbH, Selbelang, Germany Cost: €5 million

Wildshausen

Stadtwerke Düsseldorf AG, Holzvergaseranlage Arnsberg- Wildshausen	
General, products, feedstocks	CHP Unit gasification of biomass / 270 kW electricity, 410 KW heat
Services	Gasification, gas motor generator plant, biomass feedstock pretreatment
Financing	Private
Contact	http://www.swdag.de/unternehmen/erzeugungsanlagen/holzvergaseranlage.php

Iceland (EU-CRAFT-Project, FP 5 and FP6)

Lignocellulosic Feedstock Biorefinery, Iceland	
General, products, feedstocks	Raw material: Lignocellulose biomass (20 000 t/a) Product: Ethanol for E10 fuel (Ethyl-lactate production under development) Geothermic steam Acid hydrolysis, sugar fermentation (modified "Bergius/Rheingau"-process)
Services	
Financing	€10 million
Contact	The Icelandic Biomass Company, tetra Ingenieure, Germany, Biopos, Germany, www.biopos.de

II. POLICY

Public authorities can promote the quick take-up of industrial biotechnology innovations by implementing a number of “instruments” or policy initiatives. This can be the improvement of the regulatory framework; the integration of specification for bio-based products in public procurement; the establishment of standardisation, labelling and certification schemes to overcome perceived uncertainty about product properties and weak market transparency; the development of financial instruments and supports to increase investments into research, technology development and innovation as well as the elaboration of communication and information campaign to communicate the benefits of bio-based products to users.

A. Policies and regulations

The High-Tech Strategy for Germany¹⁰ was developed in 2007 through a joint effort by all federal government departments. The strategy aims to create a climate where ideas can be “ignited” and where research results can be translated into products, processes and services. The High-Tech Strategy defines 17 fields with the objective of improving the cooperation between science and industry as well as accelerating direct application of research findings. Biotechnology has been identified as one of the 17 key sectors where Germany wants to create lead markets.

The German government aims to put Germany as a biotech location at the top of the European rankings not only in terms of the number of biotech firms but also when measured by turnover and jobs. Thus, the German Government has identified industrial biotechnology¹¹ as an opportunity in the field of biotechnology.

In order for biotechnology policies to succeed, it is necessary to discuss the opportunities that biotechnology has to offer. To help, in 2007 the German government published a brochure on white biotech - **Weißer Biotechnologie**¹². The brochure shows concrete examples of white biotech applications (enzymes, nutraceuticals, textile industry...).

B. Public procurement

Green procurement exclusively applies to public authorities.

The establishment of a specific national action plan regarding public procurement programmes for bio-based products is currently not an issue in the Government administration.

Industry associations cannot submit plans to propose the establishment of green procurement for public authorities.

C. Standardisation, labelling and certification

Der blaue Engel¹³ was created in 1978 on the initiative of the Federal Minister of the Interior and approved by the Ministers of the Environment of the national government and the federal states. It was designed as an instrument of environmental policy which would harmonise with the market and enable the positive features of products and services to be labelled on a voluntary basis. It set the standard for eco-friendly products and services selected by an independent jury in line with defined criteria.

¹⁰ http://www.bmbf.de/pub/bmbf_hts_lang_eng.pdf

¹¹ <http://www.hightech-strategie.de/en/238.php>

¹² http://www.bmbf.de/pub/weisse_biotechnologie.pdf

¹³ <http://www.blauer-engel.de/en/index.php>

The label does not communicate specific biobased properties / qualities or eco-friendliness of a product. It is just the “lesser evil” – meaning its properties are less pollutive than the properties of comparable products.

The spectrum of the Blue Angel’s activities is continuously extended and new products and services are eco-labelled. Today, about 10.000 products and services in 80 product categories carry the Blue Angel eco-label.

D. Access to finance

The most prominent current funding program in the field of IB is called “BioIndustrie 2021”. **BioIndustrie 2021**¹⁴ runs from 2006 to 2011 and has a budget of €60 million. Additional funding from industrial partners will supplement the total funding volume for research and development projects to more than €150 million. The objective is to bring ideas and research results in the field of white biotechnology faster from universities and research institutes to the market. These funds will be channelled mainly through the new BioIndustrie 2021 cluster competition

Biodindustrie 2021 cluster competition¹⁵: In order to better advance this field of research and business in Germany, the Federal Ministry of Research and Education (BMBF) began the BioIndustrie 2021 cluster competition in the autumn of 2006. €60 million of funding - to be spread over five years - has been made available for this initiative (see above).

The definitive goal of the BioIndustrie 2021 competition is to consolidate essential institutions and disciplines (e.g. Process engineering, machine and equipment construction, process and control engineering, analytics) into interdisciplinary project teams, both efficiently and at an early stage. Strategic clusters that integrate all parties in a network structure are anticipated to emerge within the framework of the competition. Included in this vision are research institutions, private companies, venture capitalists and banks, which will be cooperating to define their core competencies, develop forms of financing and strategies for future markets, and implement appropriate projects in their common interests.

Winners of this competition are:

Cluster	Coordination	Funding
CLIB 2021 ¹⁶ - Cluster Industrial Biotechnology	A cluster with more than 60 members linking Germany's household names in the chemical industry, small and mid-sized enterprises (SME), academia, investors and infrastructure	€20 million
BioKatalysis 2021 ¹⁷ - New Forms of Sustainable Biocatalysis	TUTech Innovation GmbH, Hamburg	€20 million
Biopolymers/Biomaterials ¹⁸	BIOPRO Baden-Württemberg GmbH, Stuttgart	€10 million
Industrial Processes with Biogenous Building Blocks and Performance Proteins (IBP) ¹⁹	BioM Biotech Cluster Development GmbH, Martinsried	€5 million
Integrated BioIndustry: Implementation	Frankfurt Bio Tech Alliance e.V.,	€5 million

¹⁴ <http://www.bmbf.de/de/6955.php>

¹⁵ <http://www.biotechnologie.de/bio/generator/Navigation/English/funding-and-grants.did=71310.html>

¹⁶ <http://www.clib2021.com/>

¹⁷ <http://www.biokatalyse2021.de>

¹⁸ <http://www.biotechnologie.de/bio/generator/Navigation/English/funding-and-grants.did=71314.html>

¹⁹ <http://www.bio-m.org/>

Concept for the Creation of an Industrial Biotechnology Cluster ²⁰	Frankfurt am Main	
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BioChancePlus²¹ is a financial instrument through which the German Federal Ministry for Education and Research (BMBF) is supporting the high-risk development of young biotech companies. The BMBF programme makes available €100 million in project funds. Together with a further €150 million in private capital, this is to encourage in particular cooperation and networking between companies. The aid is specifically aimed at helping spin-offs and start-ups establish themselves for the purpose of bringing new biotechnology products to market.

GO-Bio²². With this programme, biotech research teams with a good business plan can qualify for support from the BMBF's GO-Bio fund. The fund is making €150 million available over the next ten years and should help researchers to take their brainstorming from the laboratory to the marketplace.

The High-Tech Strategy for Germany allocates €430 million²³ to biotechnology for the period 2006-2009. The Biotechnologie 2021 cluster competition was one of the initiatives initiated in the framework of the strategy. Moreover, due to the strong response, additional funding has been provided for the BioChancePlus funding initiative since 2007.

In addition to the Government funding, BASF, Deutsche Telekom, Siemens, DaimlerChrysler, Carl Zeiss and Robert Bosch have formed a partnership with the federal government and the KfW development bank to provide venture capital funding for tech-sector start ups. **The High-Tech Gründerfonds**²⁴ is directed at “young high-opportunity technological companies implementing promising research results in an entrepreneurial manner” – including biotech companies. In addition to providing €272 million in venture capital funding, the program provides young start-ups with managerial supervision.

SusChem-D is working on such projects – German Industry Associations like DECHEMA/VBU and VCI/DIB are involved: SusChem D focussed this year on nine subjects:

1. energy efficient life and living
2. Efficient use of heat from industrial processes
3. Energy for mobility
4. Sustainable mobility
5. resource efficient chemical production
6. environmental friendly production processes
7. use of renewable raw materials for materials
8. material use of renewable raw materials for the chemical industry
9. protection of climate

German Industry Associations like VCI/dib, BIO Deutschland, and DECHEMA/VBU are in negotiations with different government departments regarding bio-based products research, investment, etc. Many political debates and public discussions focus currently on which business environment and which corporate tax structure could foster investment in research and innovation best.

E. Communication

There is a common initiative from the chemical industry together with their trade associations VCI/DIB, DECHEMA/VBU, BIO Deutschland, research institutions and the chemical union, called

²⁰ <http://www.biotech-alliance.de/bioindustry/de/index.htm>

²¹ <http://www.bmbf.de/en/986.php>

²² <http://www.go-bio.de/>

²³ <http://www.hightech-strategie.de/en/36.php>

²⁴ www.high-tech-gruenderfonds.de

German Platform for White Biotechnology²⁵ (Deutsche Plattform Weiße Biotechnologie – DPWB) who communicates general benefits of biotech product groups and improvements regarding regulation, market incentives, research, etc. to the general public and the politicians.

²⁵ <http://www.weisse-biotechnologie.de/>