

Practitioner's Section

A motor for future-proof jobs

The results of the study "Biotechnology in Germany - Employment Potential and Competitiveness".

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Several hundred thousand people are already employed in biotechnology and gene technology in Germany. In the future, this industry will continue to create jobs. By 2020, the biotechnology industry will generate work and wealth for more people than are currently employed in the entire chemical industry. The study "Biotechnology in Germany - Employment Potential and Competitiveness" confirms that this industry is capable of becoming an engine for future-proof jobs.

Biotechnology plays an important role as a leading-edge and cross-disciplinary technology for innovation and growth. A country like Germany, poorly endowed in natural resources yet with a highly-qualified workforce, must invest in this innovative future technology in order to ensure its long-term competitiveness. It is already hard to imagine a world without biotechnology and gene technology. They form the basis for medical and pharmaceutical products and for agricultural and environmental technology. They offer vast potential for optimising existing processes as well as for the development of new products and services.

In addition, biotechnology and gene technology are among the most important fields for investment in the 21st century. The German Miners', Chemical and Energy Workers' Union, IG BCE, does not emphasize this fact from an uncritical belief in progress, but from a familiarity with those who do research and work in these future-oriented fields.

IG BCE says "yes" to biotechnology and gene technology. We are committed to this sector and do not only strive to secure existing jobs, but seek the creation of others in Germany.

By stating our position so clearly, we do not only meet with approval. A common question posed refers to the actual job-creation potential of the biotechnology sector; for it is often assumed that

this technology will not make a considerable impact on the development of the job market.

As no comprehensive studies had been carried out in this field, IG BCE, together with the German Association of Biotechnology Industries, DIB, and financially aided by the foundation Hans-Böckler-Stiftung, commissioned a study in order to fill the research gap.

Two renowned research institutions, the Fraunhofer Institute for Systems and Innovation (Fraunhofer ISI) and the German Institute for Economic Research (DIW) started their research study entitled "Biotechnology in Germany – Employment Potential and Competitiveness".

The principal aim was to gain reliable figures and assessments on the current economic and political importance of biotechnology in Germany. For the first time, not only were the direct employment effects covered, but also the upstream and downstream economic sectors included. This comprised research institutions, small and medium-size enterprises, the chemical and pharmaceutical industries as well as foodstuffs.

Not only was the question of the current and future economic importance of the individual biotechnology areas in Germany placed at the forefront of the study, but also the role and function of biotechnologies for the entire value-added chain as well as possible future scenarios for the creation of value. Furthermore, production and

sector structures in the biotechnology areas were listed and analysed – also taking its interconnectedness with traditional sectors into account - in order to assess international competitiveness. With the aim of devising a concrete and recommended course of action, the critical constraints and the key success factors in research, development, production and the distribution of products and processes in biotechnology were identified. Additionally, the question to what degree biotechnology is accepted or rejected by German society, and to what extent this affects its chances for economic success was also incorporated into the study.

Design of the study

In order to analyse the employment potential of biotechnology, an investigative model consisting of three variables (“pillars”) was utilised which takes the different employment impacts into consideration. The calculation of the employment effects was carried out by means of the input-output model ISIS, developed at the Fraunhofer ISI. It is based on the up-to-date input-output

tables of the Federal Statistical Office for the year 2002. They divided the German economy into 71 production and service sectors and six end-user sectors (among others, private consumer demand and export). For certain elements, (the formation of “biotechnology micro-segments”, the updating of productivity indices) an adjustment was made for the years 2004 and 2020, using appropriate statistical sources.

By means of an elaborate “top-down/bottom-up” procedure, employment scenarios were developed. A variety of methods was applied, among others, written surveys, expert interviews as well as patent analysis and techno-economic studies.

Employment potentials

With the study of relatively new technology fields, the actual market penetration contains a number of uncertainties. Employment effects are therefore given with lower and upper limits, which can be considered as pessimistic and optimistic market share estimates, respectively. The lower and upper limits for the year 2020 can be interpreted as resulting from slow or rapid market

Figure 1 “Three Pillar Concept” for the Analysis of the Employment Effects of New Technologies, Applied to Biotechnology

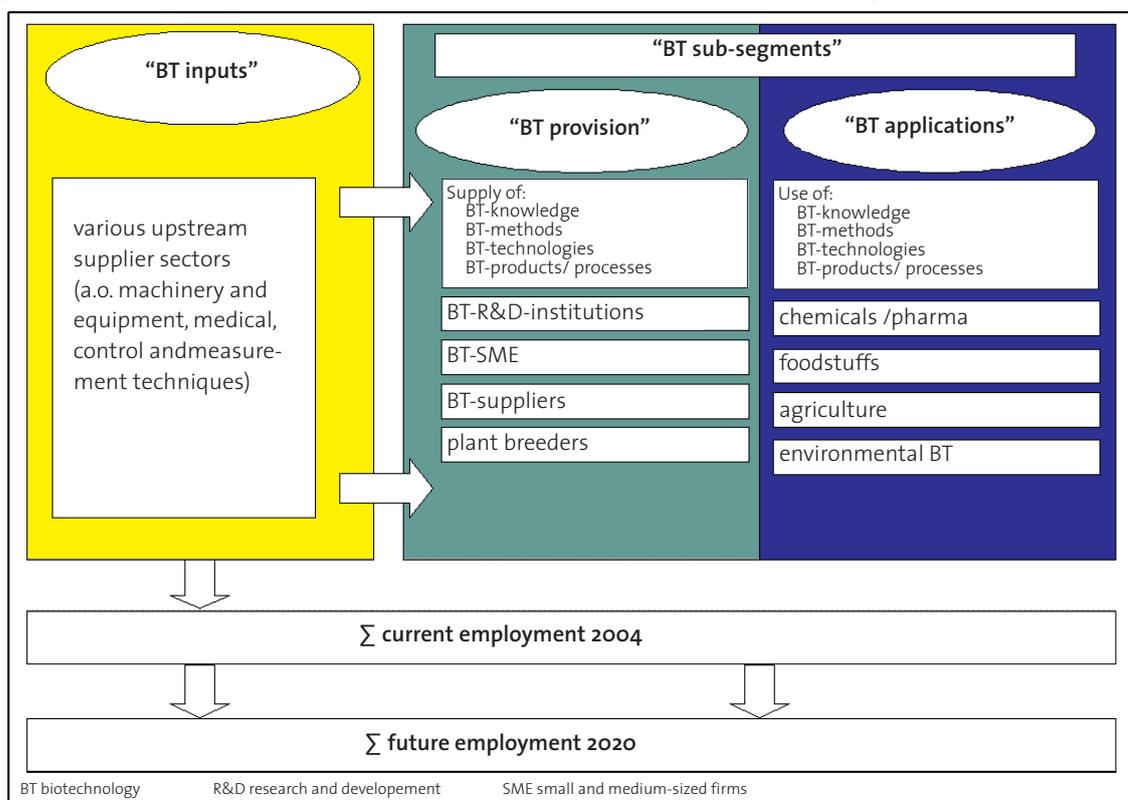
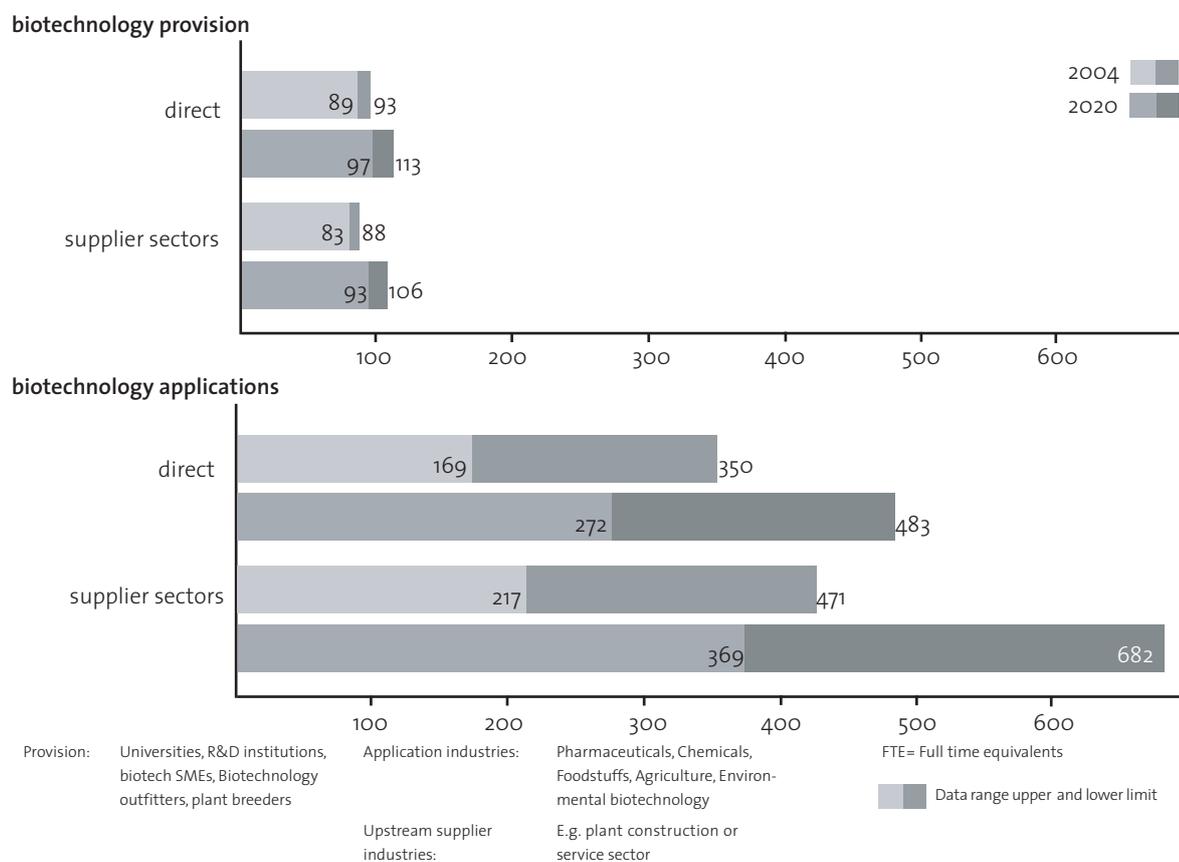


Figure 2 Biotechnology Direct employees and Employees in supplier industries (Provision and Application industries, in thousand FTEs)



Source: Calculations Fraunhofer ISI 206 (Errors possible in rounding up)

penetration.

Generally, an increase in employment can be expected in all three sub-segments: provision, application and input. For the provision of biotechnology know-how by universities, R&D institutions, biotech outfitters, small and medium-sized enterprises as well as plant breeders, an employment potential of 89,000 to 93,000 direct employees was shown. About 97,000 to 113,000 direct employees can be expected for the year 2020, thus an increase of 10 – 20%.

In the field of application, a considerably greater employment potential has been identified. The biotech application industries comprise pharmaceuticals, chemicals and foodstuffs industries as well as agriculture and environmental biotechnology. These industries apply biotechnological methods, processes and products. The sum of direct employment effects in these industries amounts to 169,000 to 350,000 jobs in 2004. In

2020, this figure may rise to 272,000 to 483,000 employees.

Biotechnology application industries have a considerable impact on employment in the supplier industries, such as, for example, mechanical engineering and plant construction. In 2004 and 2020, these indirect employment effects were greater than direct employment impacts. The data range shows employment figures of 217,000 to 471,000 in 2004 and even 369,000 to 682,000 in 2020. Besides positive gross employment effects, we also have to consider negative employment impacts. They arise, for example, due to the substitution of traditional processes and products (e.g. chemical-based pharmaceuticals, fossil-based energy sources) and the expenditures and investments thereby forgone. In addition, compensatory and budget effects arise, as e.g., extra costs (among others for research funding, subsidies and tax exemptions for biofuels) must be

compensated in the entire economy by reducing expenditures in other places. These negative effects were not calculated within the framework of this study. A calculation of such effects would be very time and cost intensive.

An evaluation of Germany as a location for biotechnology – SWOT analysis

As well as site conditions, the international competitiveness of the stakeholders in the sub-segments of biotechnology represents another important factor for the realization of employment potentials. Therefore, strengths and opportunities, as well as weaknesses and threats for Germany as a location for biotechnology were examined by the study.

We can summarize the findings as follows:

Strengths and opportunities are mainly:

- The availability of highly-qualified personnel (among others scientists, engineers, technicians)
- A broad knowledge-base in all biotechnology areas – primary and applied research
- A large stock of technological assets (many patents)
- Dynamic, high-quality and highly regarded scientific publications
- A good research infrastructure with a differentiated research landscape
- A broad and competitive industrial basis – in both application as well as supply industries
- Large domestic markets and a well-established access to major export markets
- A good infrastructure (among others energy, transport/logistics, IT)
- Germany's central geographical location within the EU
- Public acceptance of biotechnology in the field of health and medicine as well as in industrial production

Weaknesses and threats are among others:

- An unwillingness of industry stakeholders to take risks and to invest compared to international competitors
- A paucity of venture capital in gestation periods despite existing private capital
- Relatively low R&D expenditures in German biotech enterprises compared to international competitors
- A lack in labour mobility between science and industry – especially from industry to science
- Future bottlenecks for (highly) qualified personnel (among others scientists, engineers, technicians)
- Increasing competition in the production area

mainly, especially from Asia

- A highly complex structure of national and international laws lacking in complementarity, related elevated bureaucratic costs and frequent poor service orientation of public authorities
- Low levels of public acceptance for biotechnological products in agriculture and food
- Strong overseas orientation of leading enterprises in the area of green biotechnology

Conclusions

Today, a high-performance society is based on a highly complex and interdependent economy. We have to embrace this complexity to be able to assess, for example, the likely impact of job losses in one sector of the German economy on other industries and sectors.

The results of the study show that several hundred thousand people are already employed in biotechnology and gene technology. Furthermore, the study confirms that this sector possesses enormous powers of innovation capable of generating enormous employment potential, in particular in the applied (manufacturing and production) industries. For example, by 2020, more people will work in biotechnology-related fields than are currently employed in the entire chemical industry.

It was found that biotechnology has to be understood and appreciated as a cross-sectional technology. The progress made in biotechnology and gene technology plays an important role in many core industries. Biotechnology has implications via the chemical and pharmaceutical industries for the environment, agriculture and food production. Despite market penetration developing at different pace in individual industries, penetration is set to increase.

The SWOT analysis illustrates the areas for action that need to be addressed by politicians, entrepreneurs and scientists. Nothing less than a concerted effort by all stakeholders is required if the full potential of biotechnology for innovation, growth and employment is to be realised.

In order to sustain and strengthen the performance of the German economy amidst international competition, we need to accelerate the application of the full spectrum of biotechnology. The upsurge in innovation triggered by this cross-sectional technology creates new products and markets, but not only that. Innovation in biotechnology and gene technology safeguards, at the same time, the future of research-intensive and export-oriented industries. They form the basis for the cutting-edge role of chemical and

pharmaceutical production.

The result: biotechnology sustains and creates hundreds of thousands of jobs, many of which in the future-proof research and service sectors. Biotechnology and gene technology are indispensable if we want to remain competitive at an international level.

If Germany as an industrial location wants to benefit from this opportunity, research and production need to be both welcomed and nurtured and - needless to say - German safety and environmental standards must be applied.

Biotechnology and gene technology are difficult issues. The complex interconnections are not always easy to understand and objections dominate the public mood. We need to deal with these ethical issues and the fears they engender in the population at large. Enterprises need to communicate openly about their work and especially about their products. We need an open and fair dialogue about the opportunities and risks. Only if we succeed in convincing people of the benefits of these products, we will manage to create acceptance for biotechnology in Germany in the long term.

As a country poor in natural resources, we need to focus on know-how and technology in Germany. Innovation can act as a driving force for our economy. We can thus ensure prosperity and create urgently-needed employment. The trend towards losing jobs, especially in traditional production sectors will probably continue over the coming years. In order to remain competitive, we need innovation, new products and new markets. The growth in the industry of biotechnology is therefore likely to play an even greater role here. The results of the study presented thus serve to both encourage and confirm the views held by IG BCE. We have always emphasized that biotechnology and gene technology offer great opportunities for German know-how and technology, and that investment in this technology is worthwhile. We will continue to commit our resources to this end.

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