

# BioPolis - Inventory and analysis of national public policies that stimulate research in biotechnology, its exploitation and commercialisation by industry in Europe in the period 2002–2005

National Report of Poland

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## Summary

Poland joined the European Union in 2004. It has a history of poor innovation performance. According to the European Innovation Scoreboard (2004), Poland lagged behind other EU member states particularly in business R&D expenditures and in USPTO patents. Expenditure on ICT equipment is the only feature in which Poland performs above the EU average.

Regarding R&D efforts, Poland's gross domestic R&D expenditures (GERD) as a percentage of GDP declined between 1999 and 2003 (from 0.7 in 1999 to 0.56% by 2003). Business expenditure on R&D only contributed to about 31% of total GERD in 2002, with Government contributing 61%. Moreover, business R&D expenditure as a percentage of GDP has also shown a sharp decreasing trend in recent years, from 0.29% in 1999 to 0.15% in 2003.

The Polish Framework Programme for research was adopted in June 2005. This is now the main instrument of Poland's research policy. The Programme is based on a number of action plans. These include the National Development Plan (2007-2013) and the Strategy for the Development of Science in Poland along with a Prospective Forecast up to 2020. In particular, the aim of the Strategy is to define both the technical-scientific and innovation policies, which will correspond with the changes occurring in the legal, economic and organisational environment of Polish science.

The Polish biotechnology science base consists of more than 3000 scientists in universities and units of the Academy of Sciences specializing in biotechnology research. Biotechnology is a subfield of two of the research priority areas (health and nanomaterials and nanotechnologies) identified by the 2005 Polish Framework Programme for research. However, biotechnology in Poland is mainly considered as a scientific area, and while there is plenty of advanced research in the field, very little has been done in terms of effective and profitable exploitation. The Polish biotechnology industry is not yet in a position to perform independent research and an adequate system for linking science and industry does not yet exist. The most important limitations to the future development of Polish biotechnology include the fact that universities are insufficiently oriented towards the needs of the market, and there are very few technology transfer offices. This leads to very weak information flow between universities and industry.

The main biotechnology policy and research actors in Poland are The Ministry of Education and Science (MeiN), The Ministry of Economic Affairs and Labour, The Polish Agency for Enterprise Development (PAED), The Industrial Development Agency (IDA) and Foundation FIRE.

Finally, all Polish government support for biotechnology research over the period 2002-2005 was channelled entirely through the Committee for Scientific Research (KBN) and the Ministry for Science and Information Technology (MNiI). The Ministry allocated a total of 25.05M PLN (6M EUR) for both non-policy-directed and policy-directed funding of biotechnology related research projects, research-ordered projects granted to proposals submitted by research teams or individual researchers (mainly based at universities) and the co-financing of targeted projects.

## **1. Introduction and background**

### **1.1 General introduction**

Poland has a population of 38.2 million, and GDP per capita was 4,847 (current) EUR in 2003. Manufacturing production, with a 33% share of the total national value added, was slightly above the EU average. One of the main sources of Poland's international competitiveness are its low production costs, with unit labour costs at around 45% of the level in Austria (Walendowski, 2005). However, in 2004, Poland's labour productivity per person employed was 62% of the EU-25 average, even lower than other new Member States (Eurostat, 2005). During 2004 Polish exports grew by 25%, in particular machinery and transport equipment, together with exports of food and live animals (Walendowski, 2005).

In general, Poland's innovation performance continues to be poor. According to the European Innovation Scoreboard (2004), Poland lags behind other EU member states particularly in business R&D expenditures and in USPTO patents. Moreover, while Poland has been catching up in terms of the skills and qualifications of its workforce, it is still well below the EU-25 average in terms of, for instance, the proportion of the population with tertiary education (65% of EU-25 average). The only feature in which Poland scores above the EU average is for expenditure on ICT equipment.

Regarding R&D efforts, Poland's gross domestic R&D expenditures (GERD) as a percentage of GDP declined between 1999 and 2003. While the percentage was about 0.7 in 1999, it had fallen to 0.56% by 2003. Moreover, business expenditure on R&D only contributed to about 31% of total GERD in 2002, with Government contributing 61% (EU-25 percentages were 55% and 35%, respectively). Finally, business R&D expenditure as a percentage of GDP has also shown a sharp decreasing trend in recent years, from a 0.29% in 1999 to a 0.15% in 2003.

### **1.2 Characteristics of national S&T and innovation system**

Before World War II, scientific research in Poland was primarily concentrated in higher education institutes, though several state institutes also existed. Higher education institutes were given block grants and researchers had autonomy to choose research topics of interest. From the end of World War II, during the period of communist rule, the higher education institutions lost much of their autonomy. Research was concentrated into three sectors: R&D institutes and laboratories subordinate to various ministries, institutes of the Polish Academy of Sciences and the higher education institutes. Research was managed and financed by a system of central planning, the state was the sole source of finance for research and the main criterion for funding research, even basic research, was its economic and social utility. After the fall of the communist regime in 1989, a new system was set up for managing and financing scientific research. In 1991 the Committee for Scientific Research (KBN) was set up as the supreme authority regarding State policy for science and technology and as the major central government source of funds for research. Funds were awarded on the basis of direct competition between researchers from the Polish Academies of Science, higher education units and government units (Jablecka, 1995). In April 2003 KBN was transformed into the Ministry for Science and Information Technology (MniI). KBN

remained an independent entity until February 2005 and was mainly responsible for providing guidelines for the country's research policy and submitting the Government plans for budgetary expenditure in the areas of science and technology (S&T). As the consequence of the Act on Financing Science, KBN was replaced by the Council for Science in 2005. The Council for Science formally represents the research community and plays an advisory role to the Minister for scientific research and funding of R&D. In October 2005 MNiI was transformed into the Ministry of Education and Science (MEiN).

The Act for Financing Science encourages the concentration of public expenditures on development projects that could be applied by SMEs, and facilitates the consolidation of the R&D sector by promoting joint proposals. The Act on Science Financing introduced financial planning in which the Minister sets the levels of financing for specific areas of science; the introduction of new research projects, especially development projects; and the set-up of programmes and initiatives which are necessary to support structural changes, i.e. creation of science networks, consortiums and reorganization of the State Research Institutes (JBR).

The Polish Framework Programme for research, adopted in June 2005, is now the fundamental instrument of Poland's research policy. It is based on several government strategy documents including the National Development Plan (2007-2013) and the Strategy for the Development of Science in Poland along with a Prospective Forecast up to 2020. The Strategy for the Development of Science in Poland includes the following:

- The development of research priorities (in order to allow Polish science to compete internationally);
- Instruments fostering private investment in R&D activities;
- Funding specially allocated to science;
- Mechanisms to stimulate unforeseen investments in R&D activities (from tax mechanisms, venture capital, or public-private partnerships);
- Improving the effectiveness of using structural funds (through the creation of the Regional Innovation Strategy).

The Strategy will be reassessed every 3 years, when new priorities may appear and be implemented. Strategy definition and implementation involved participation from the Ministry of Science and Information Society Technologies, the Ministry of Economic Affairs and Labour, local government and the social partners. It is supposed to both support the development of science (which is intended to be closely linked to demands from enterprises) and actively affect an increase in Polish innovation.

The aim of the Strategy is to define state scientific, technical-scientific and innovation policies, which will correspond with the changes occurring in the legal, economic and organisational environment of Polish science. On this basis, it aims to allow the implementation of an effective system for supporting innovation in the regions, building a partnership between science and industry, and the strengthening and application of the potential of the regional, academic and R&D sector for supporting entrepreneurship. The Strategy took into account some decisions from the National Development Plan 2004-2006 adopted by the Council of Ministers in February 2003, which gave priority to the development of entrepreneurship and an increase in innovation, along with the

strengthening of institutions to support enterprise activities (i.e. technology parks) or fostering cooperation between research and development.

Policy makers in Poland are increasingly aware of the importance of innovation for the economic development of the country, shown by the frequent policy documents concerning innovation in recent years, summarised below.

In December 1999 the Council of Ministers approved a document Guidelines for the State Innovation Policy until 2002, which aims to prepare the legal framework for restructuring and privatising scientific institutes, and increasing the GERD/GDP ratio. Regarding the first issue, it is important to note that in 2002 39.5% of the 257 active R&D organisations (including R&D institutes, central laboratories and research centres and units) recorded negative financial results, and the government encouraged them to undergo a process of merger and privatisation.

In July 2000, the Ministry of Economy adopted a far-reaching government programme Increasing Innovativeness of the Polish Economy until the Year 2006, to intensify strategic actions to increase the innovativeness of the Polish economy. The programme outlined four main priority areas:

- Creating mechanisms and structures conducive to innovation
- Shaping innovation attitudes
- Supporting the development of the ICT infrastructure
- Changing consumption and production patterns to make them more favourable to long-term sustainable development

While the 1999 policy document was oriented towards the development of science and technology policies, the 2000 policy document was more oriented towards increasing the development of innovation throughout the economy. Two other policy documents, issued between 2000 and 2001, focused on building an information society in Poland.

The European Commission's 2003 Action Plan aimed to increase investment in research and technological development in Europe. Aiming to change the low R&D investment trend, it set Poland the target of increasing its GERD/GDP ratio to 1.5% by 2006, with business expenditure on R&D accounting for 0.9% of this. The targets set for Poland were in line with the objectives set for Europe as a whole in this regard, which were to increase the average research investment level from 1.9% of GDP in 2003 to 3% of GDP by 2010 (with two-thirds being funded by the private sector) (Commission of the European Communities, 2003).

Until 2000 financing of innovation from the state budget was very weak and limited to public sector R&D institutes. However, companies could apply for preferential loans to invest in innovative activities. The lack of development of the financial system in Poland and the specific difficulties for SMEs in finding access to funds for innovation, has been considered as one of the weaknesses of the Polish innovation system. In 2002 a new law on Financial Support for New Instruments entered into force. The law defines the principles of granting state financial support to entrepreneurs making new investments, especially investments in technological innovation. The law provides various types of assistance, ranging from investment grants for a percentage of the investment outlay to training grants.

The Government has also launched a number of specific initiatives to support innovation. The Polish Agency for Enterprise Development (PAED) promotes advisory services for business. In 1996 it set up a national network of organisations to provide advisory, training, information and financial services to SMEs. Its programme, Fund for Counselling, supported by PHARE 2002 as part of the Economic and Social Cohesion Programme, provides financial support to SMEs for a wide variety of consultancy services. The aim is to promote the development and modernisation of SMEs as well as innovation. Under PHARE 2002 PAED also promotes the financing of innovation by SMEs through its Investment Grants programme. The programme provides co-finance for investment projects aimed at the implementation of new technologies or innovations.

The Ministry of Economy has also taken steps to support innovation. It has coordinated activities to improve and simplify the legal and regulatory environment for innovation. The improvement of the regulatory environment aims to reduce red tape, for instance there is new legislation that has substantially reduced the time required to register a new company (Walendowski, 2003). It is also working to bring Polish legislation on intellectual and property rights (IPR) into line with international standards although further efforts are needed to improve the implementation of IPRs, such as dealing with the comparatively lengthier procedures that inventors face in obtaining a patent in Poland.

Innovation policy is also supported at the regional level through the National Strategy of Regional Development 2001, which established procedures for financing regional development programmes. The Ministry of Economy is responsible for the management of the Structural Funds allocated to these programmes, but the regional authorities are responsible for implementing the programmes.

### **1.3 National support and framework conditions for biotechnology**

The Polish biotechnology science base is strong, with over 3000 scientists in universities and units of the Academy of Sciences specializing in biotech research. As Kucinski (2005) reports, biotechnology is a subfield of two of the research priority areas (health and nanomaterials and nanotechnologies) identified by the 2005 Polish Framework Programme for research. However, biotechnology in Poland is mainly considered as a scientific area (Sobiepanek, 2003), and while there is plenty of advanced research in the field, very little has been done in terms of effective and profitable exploitation. Thus, the biotechnology industry in Poland is a sector in evolution, in the sense that commercialisation of biotechnology is still limited. Conventional biotechnology, such as antibiotics and fermentation, is well established in Poland. However industry is not yet in a position to perform independent research and an adequate system for linking science and industry does not yet exist.

Poland's biotechnology industry is in the very early stages of development. The sector consists of approximately 30 companies. Most revenues are generated by the healthcare biotech sector, followed by industrial biotech, agricultural biotech and environmental bio-remediation. The large majority of companies are small business firms (up to 10 employees), very often established at universities or research labs. Among the major Polish biotech companies is Bioton, which is a company specialized in drugs, particularly in recombinant human insulin, with around 466 employees. Some of the

other important Polish companies in biotechnology include: Biomed, DNA II Gdansk, BTL Zaklad, Akwawit, Biowet Pulawy, Bio-Gen, Polfa, and Jelfa Jelenia Gora (Sobiepanek, 2003). Since the biotechnology industry has a long development cycle and does not generate sales in the early stages, the Polish biotechnology industry is in need of financial support, expertise for clinical testing, and specialized marketing tools. Government initiatives described in Section 1.2 aim to tackle these constraints.

For all companies involved in biotechnology, legal regulations and intellectual property rights are fundamental. Poland's laws have been undergoing significant changes to harmonise with those of the European Union. Intellectual property rights in Poland are now fully compatible with those of the European Union. The most important legal act is the Act of June 2000, on Industrial Property Law.

The most important limitations to the future development of Polish biotechnology are as follows. First, universities are insufficiently oriented towards the needs of the market, there are too few science parks and incubators, and a limited number of technology transfer offices. This leads to very weak information flow between universities and industry. Second, industry is not familiar with the innovation potential of university research. For this reason, authors such as Twardowski (2005) argue that Poland urgently needs to build platforms for closer contact between industry and academia, together with investment in science parks.

In January 2002, the Act on Genetically Modified Organisms (GMO) was introduced in Poland, the first act in Polish legislation that regulates GMOs in a comprehensive way. Polish legislation in biotechnology is based on EU standards, but is more restrictive in the approval of GM crop varieties. As an example, although Monsanto's 810-corn variety has been approved for planting in the EU, none can be planted in Poland until there are regulations in place governing coexistence (Twardowski, 2005). Poland currently does not produce or import any GM crops nor are any under development; however, there are valid import permits for protein concentrates based on GM soybeans for feed production (GAIN Report, 2005).

In January 2005, the Ministry of the Environment presented for public discussion a proposed new Act on GMOs. The proposed Act covers several new aspects including the precautionary principle, labelling, coexistence of different agricultural traditions, etc (Twardowski, 2005). With regard to coexistence, in July 2003 the European Commission (EC) published guidelines outlining strategies and best practices for allowing genetically modified crops to grow alongside conventional and organic crops. These guidelines suggest that a general EU-wide approach is not workable and allows individual countries to set their own policy. Polish authorities have stated on several occasions that they are unable to establish and maintain regulatory control of coexistence due to budget constraints. In 2004 Parliament rejected legislation, prepared by the Ministry of Agriculture, that specified the requirements to be met for coexistence of GM cultivation with conventional and organic crops. Generally, farm groups fear that coexistence will jeopardize profitable sales to Western Europe, specifically the European Union. In addition, farm organizations, of which many represent small-scale farmers, stated that due to prohibitively high costs they could not adopt GM crops and thus fear the competition posed by larger farmers who could benefit from the technology (GAIN Report, 2005).

With regard to public attitudes to new technologies in Europe, a public survey Eurobarometer (2005) found that Poland is close to the EU-25 average when asked whether biotechnology and genetic engineering would have a positive effect on our way of life in the next 20 years (63% compared with an EU-25 average of 65%). Poland is also close to the EU average in its attitudes toward various applications of animal and human cloning, such as approval of animal cloning that is highly regulated and controlled for research into human diseases (36% in Poland, 35% in EU-25 average of 35%); and disapproval of cloning of human being so that couples could have a baby even when one partner has a genetic disease (61% in Poland and 59% in EU-25). With the exception of the use of genetic testing to produce a child that could act as a bone-marrow donor for a brother or sister who has a life threatening disease, where Poland has a higher disapproval rate (36%) than the EU-25 average (31%), Poland is slightly more receptive to various applications of genetics than the EU-25 average. The survey also examined public attitudes to genetic modification. Poland follows the European path of approval with regard to several applications of genetically modified crops but has higher acceptance (28%) than the EU-25 average (20%) with regard to the approval of developing genetically modified bacteria to clean up after environmental catastrophes.

#### **1.4 The main biotech policy and research actors**

Two ministries are involved in policy for biotech research and commercialisation. The Ministry of Education and Science (MeiN) has the main responsibility for research and the Ministry of Economic Affairs and Labour is mainly concerned with commercialisation issues.

##### *The Ministry of Education and Science (MeiN)*

The Ministry of Education and Science (MEiN) is in charge of developing the scientific-technical policy of the state, including proposals for legal instruments, allocating funds for R&D, and evaluating the progress of sponsored research. It was formed in October 2005 as a merger of the Ministry of Science & Information Technology (MniL) and the Ministry of National Education & Sport. Formerly, in 2003, MniL had taken over state policy for science and technology from the State Committee for Scientific Research (KBN) (see section 1.2 above). KBN remained as an independent entity responsible for providing advice on national research policy for a short while, but was replaced by The Council for Science in February 2005. The Council for Science formally represents the research community and plays an advisory role in matters related to scientific research and funding of R&D.

##### *The Ministry of Economic Affairs and Labour*

The Ministry of Economic Affairs and Labour is the managing authority of the Sectoral Operational Programme - Improvement of the Competitiveness of Enterprises, which is the flagship programme for increasing the competitiveness of Polish companies in years 2004-2006. In March 2003, the Ministry created a Department of Innovation that has subsequently been in charge of developing and implementing innovation policy, mainly identifying the barriers to innovation and supporting infrastructure favourable to the uptake of innovation. Other relevant Departments of the Ministry include the

Department for Competitiveness, the Department of Industrial Policy, the Department of Entrepreneurship Development, and the Department of Regional Policy.

Coordination of government policy for science and technology is supported by The Council for Science and Technology Development (Rada Rozwoju Naukii Technologii), established on January 2005 by Decree of the Prime Minister. It is an advisory/consultative board on strategies for science and new technology development. The Council is formed by ministers concerned with science, the economy, public finance, labour and the high schools and is responsible for presenting opinion and evaluations to the Council of Ministers and the Prime Minister on the system that supports the use of R&D to increase innovation and the quality of life. Its remit includes the following areas:

- a) Development of the information society and knowledge-based economy;
- b) Law and organizational regulations concerning science and technology development;
- c) Amount of funds granted for science in the State budget;
- d) EU funds for infrastructure development, especially for research, informatics technologies and high schools;
- e) Mechanisms for cooperation between government and non-government organisations to develop strategies for science and technology.

Two other actors have responsibility for the management and implementation of innovation activities. They are the Polish Agency for Enterprise Development and the Industrial Development Agency.

#### *The Polish Agency for Enterprise Development (PAED)*

PAED is a government agency reporting to the Ministry of Economic Affairs and Labour. The agency was established by 2001, and it is tasked with managing the EU and State budgetary funds earmarked for enterprise and human resource development, in particular SMEs. The agency's main activities include: granting subsidies for SMEs to support enterprise development, as well as providing loans for innovative activities; provision of consulting and expert services; provision of training for entrepreneurs and employees of SMEs.

#### *The Industrial Development Agency (IDA) and Foundation FIRE*

The Industrial Development Agency (IDA) is a joint stock company, wholly owned by the State Treasury. IDA participates in the process of structural change, including sectoral programmes. Recently the role of IDA has been strengthened and it has been given new responsibility for the establishment of industrial parks and to support technology incubators that favour the establishment of innovative enterprises.

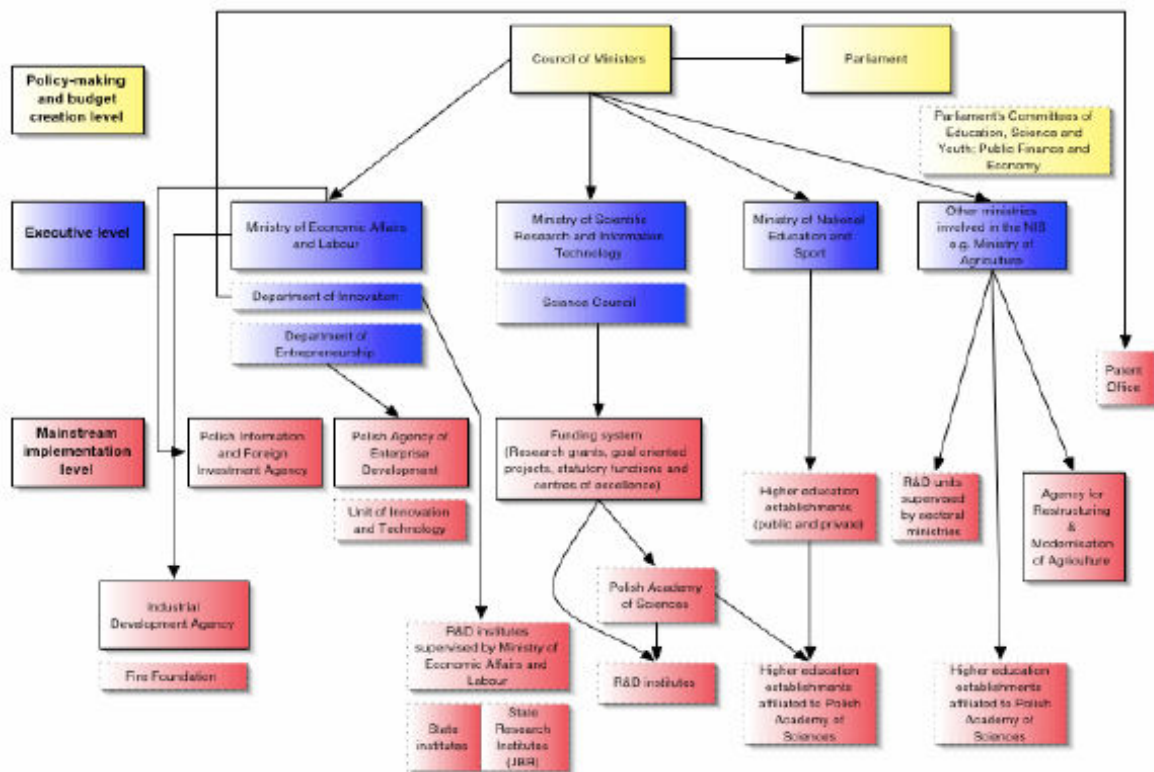
At the beginning of 2002 IDA, supported by the Ministry of Economic Affairs and Labour, established the Foundation FIRE. The Foundation's main task is to break down barriers that hold back the commercialisation and adoption of new technologies, and to support innovative start-ups.

Biotechnology research is performed by 21 universities with biotechnology faculties and 10 scientific units of the Polish Academy of Science, representing profiles as varied as: medical/pharmaceutical, environmental, agricultural, plant-related, food-related and bio-processing. In 1999, the European Commission selected research centres in candidate Member States with the potential to play a key role in the Sixth Framework Programme's Networks of Excellence programme. Of the 30 centres identified, there were four Polish centres conducting research in biotech:

- Institute of Biochemistry and Biophysics, Polish Academy of Sciences (IBB PAS)
- Centre of Molecular and Macromolecular Studies, Polish Academy of Sciences
- Institute of Fundamental Technological research (IFTR), Polish Academy of Sciences
- Jagiellonian University, Institute of Molecular Biology

Figure 1.1 provides an overview of Poland's policy and research actors in biotechnology prior to the merger in 2005 of the Ministries of Science & Information Technology (MniL) and the Ministry of National Education & Sport, to form the Ministry of Education and Science.

Figure 1.1 Poland's policy and research actors in biotechnology



Source: Trend Chart, Report on Poland (2005).

## **2. Funding of biotechnology R&D, transfer and commercialisation**

### **2.1 Introduction**

This chapter reviews the funding of biotechnology research and commercialisation. In the report we make a distinction between policy-directed funding and non-policy-directed funding of biotechnology.

Policy-directed funding includes funding which was directed by explicit policy decision making about installing a specific instrument, such as specific R&D programmes, programmes encouraging collaboration, industrial research grants, support for centres of excellence, support for commercialization of research, support for start-ups, programmes encouraging mobility of researchers, programmes with open calls, etc. This policy-directed funding can include biotechnology specific policy instruments and generic policy instruments. Biotechnology specific policy instruments are instruments that have been specifically set up to stimulate biotechnology. Generic policy instruments are instruments that are not dedicated to a specific technology, but which in principle stimulate all technologies, also including biotechnology. In the BioPolis project, only those generic instruments are included if a reference is made to (the stimulation of) biotechnology activities in the policy of the funding organisation that runs the program, or of the ministry / government department that funds the funding organisations or that runs the program itself.

Non-policy-directed funding of research includes funding which is part of the structural governmental support for scientific education, research and research infrastructure. This type of funding is mainly given through block grants to universities and (government) research institutes, the open-call system of research councils *et cetera*. Research councils, research institutes and government research institutes develop their own programmes through which biotechnology may be supported. In the BioPolis project only the funds for block grants to (government) research institutes and through the open-call system of research councils are included.

In this chapter the funding of biotechnology research through policy and non-policy-directed instruments and of biotechnology commercialisation through policy-directed instruments is presented. Data were collected through desk research (publications, documents, websites of national public funding organisations and/or governmental departments) and interviews with representatives of organisations that are involved in non-policy-directed and policy-directed funding. The names of contact people that have been interviewed can be found in Annex 3 (List of Contact Persons). Section 2.2 presents the non-policy-directed funding and section 2.3 the policy-directed funding. The final section provides a short overview of the European funding of biotechnology research in Poland through the 6<sup>th</sup> Framework Program.

All government support for biotechnology research over the period 2002-2005 was channelled through KBN (until April 2003) and MNiI (from April 2003 until October 2005). Grants from both these organisations are presented together, as if from MNiI. The Ministry allocated a total of 25.05M Polish zlotys (PLN) (about 6M EUR) for both non-policy-directed and policy-directed funding of biotechnology related research projects, research-ordered projects granted to proposals submitted by research teams or individual researchers (mainly based at universities) and co-financing of targeted

projects where the subject matter is defined by the applicant. The policy goal covered by these research grants is mainly to support a high level of biotechnology research, and the projects cover almost all the areas of application defined by BIOPOLIS, with the exception of ethical, legal, and social aspects of biotechnology.

## 2.2 Non-policy-directed funding of biotechnology research

Non-policy-directed funding is provided by a sub-programme of the Peer-Reviewed Research Grants Programme (PRRGP). This sub-programme, Grants for Own and Promoted Research, is for projects by small research teams or individual researchers, where the researchers propose the topic of the research. The sub-programme receives about 95% of the budget for PRRGP, about 112M EUR per annum. In the period 2002-2005 biotechnology research projects were allocated 11.33 PLN million (2.7M EUR).

## 2.3 Policy-directed funding of biotechnology research and commercialisation

There are two generic instruments for policy-directed funding of biotechnology research in Poland: a sub-programme of the PRRGP for commissioned research and goal-oriented projects.

The commissioned research sub-programme, where the topic of research is identified by the Minister, receives approximately 5% of the total annual budget of the Peer-Reviewed Research Grants Programme (112M EUR), and allocated a budget of 10.2 PLN millions (2.4M EUR) for biotechnology research in the period 2003 to 2005.

Goal-oriented projects must be carried out within an appointed period of time and there are specific conditions for entrepreneurs (the recipient is required to contribute 50% of the costs). In the period 2002-2005 the Ministry (KBN or MNiI) allocated 3.53 million PLN (0.8M EUR) to biotechnology projects.

Table 2.1 provides an overview of policy-directed instruments supporting biotechnology research in Poland.

Table 2.1 National public policy-directed biotechnology stimulating instruments during the period 2002 – 2005

Instrument	Funding organisation	Budget PLN (M EUR)	% of total	Use of DF/SF*
<b>National</b>				
PRRGP commissioned research	MniL and KBN	10.19 (2.4)	74	
PRRGP goal-oriented projects	MniL and KBN	3.53 (0.8)	26	
<b>Total</b>		<b>13.72 (3.2)</b>	<b>100</b>	

\*DF/SF = Development Funds/Structural Funds

Source: BioPolis Research

## **2.4 Participation in 6<sup>th</sup> FP and use of development funds**

Poland acted as the coordinator of 7 European Commission 6<sup>th</sup> Framework Programme projects: it was coordinator of 2 projects in the Life Sciences for Health thematic priority and 5 projects in the Food Quality and Safety thematic priority. It provided one partner to a project under the Nanobio thematic priority, 144 partners to Life Sciences for Health and 51 partners to Food Quality and Safety.

### **3. Performance of the national biotechnology innovation system**

#### **3.1 Introduction**

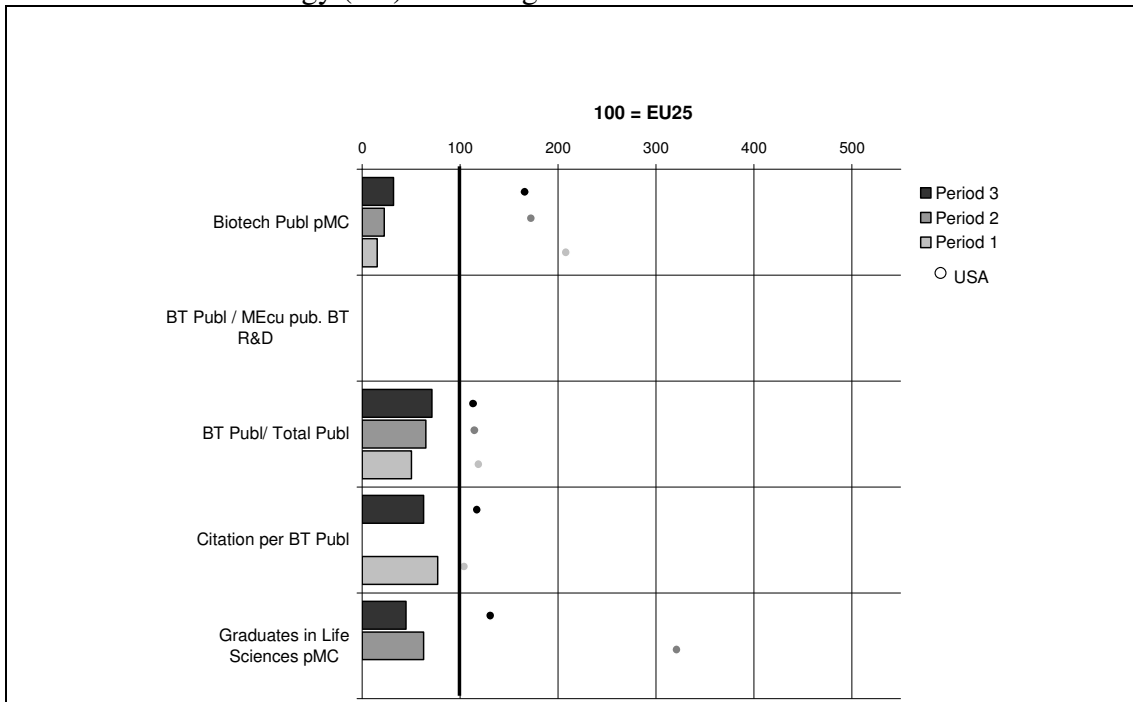
This chapter analyses the performance of the Poland biotechnology innovation system for two or three time periods as shown by a range of indicators for scientific and commercialisation performance, to the extent that data is available. Each time period includes several years, to avoid capturing erratic trends. National trends are benchmarked against the performance of the EU-25 Member States and the US. This performance data should be treated with caution. An important indicator for scientific performance is the publications data in the Science Citation Index (SCI). However, the SCI's bias towards English-language journals could distort country comparisons if Polish scientists have a tendency to publish in journals in other languages that are not covered by the SCI. Lack of patent data may reflect failure by the national patent system or its implementation to meet international standards.

The presentation of the performance is structured along the four main areas of the Innovation System: the knowledge base, processes of knowledge transmission and application, biotechnology commercialisation or markets for biotechnology based products but, because of lack of data, mainly focuses on the knowledge base. A number of different indicators present the performance of the knowledge base for Poland, the USA and EU25. The values of EU25 have been chosen as reference in each indicator. The absolute figures that are used to calculate the values for the indicators presented and the sources for the data can be found in Annex 5. In principle, for each indicator data are presented for three periods. The periods chosen can vary considerably between the indicators; table A.5.1 presents for each indicator the specific years for each period.

#### **3.2 Performance in creating a knowledge base and supporting the availability of human resources**

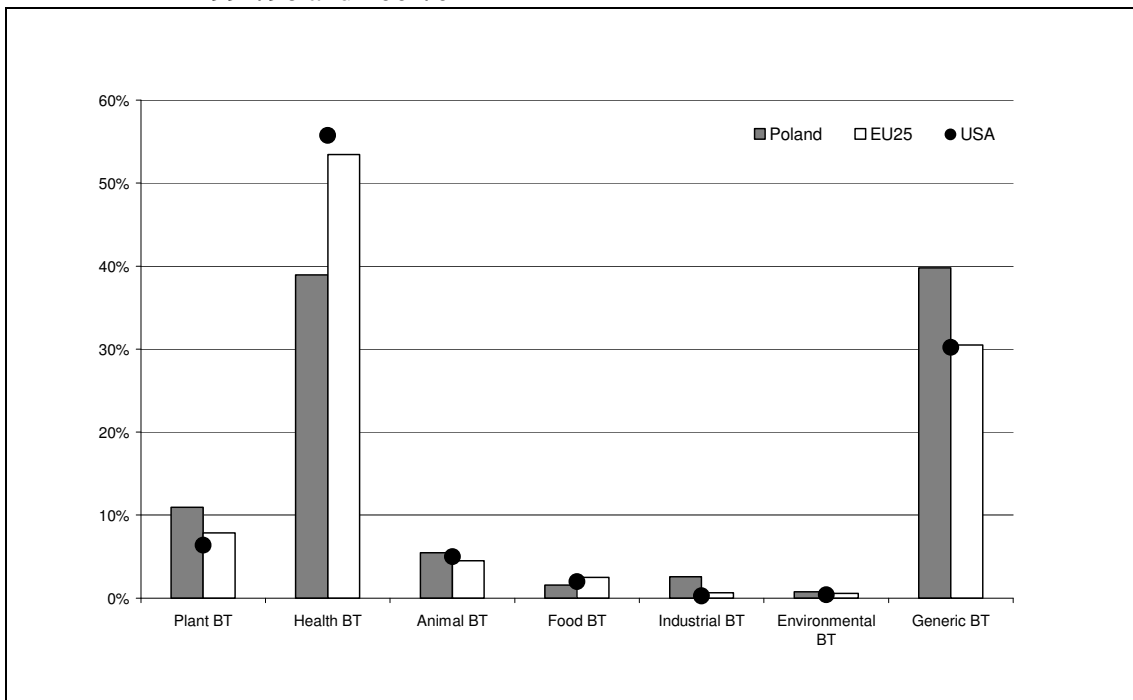
As Chart 3.1 shows, Poland is well below the EU-25 average for biotech publications per million capita or in terms of graduates in life sciences. In addition, the proportion of biotech publications relative to total publications is lower than the European average, indicating that biotech research is not a key component of Poland's overall research activities, and that the scale of the research undertaken in this area is still too small.

Chart 3.1 Biotechnology (BT) knowledge base indicators for Poland



Source: BioPolis Research

Chart 3.2 Biotechnology subfields: growth rates of Poland's publications between 1994/96 and 2002/04



Source: BioPolis Research

Chart 3.2 shows that Polish biotechnology publications have higher growth rates than that of EU-25 or US in almost all biotechnology application areas, except for industrial biotech where there has been no growth. The fact that environmental biotech and food

biotech publications have grown so much is consistent with the perception of policy makers that the food-industry, agriculture and the environment are the most promising areas for biotechnology application in Poland. Though not shown in this figure (see indicators provided in Annex 5) the two application areas where 79% of all publications concentrate are health and generic.

### **3.3 Performance in knowledge transmission and application**

The limited knowledge transmission and applications performance indicators that exist<sup>1</sup> suggest that Poland has not yet reached a substantial scale of industrial activity in biotech. The overall number of patents applied for in the area of biotech over the period 2001-2003 was 41, a ratio of 1.1 per million capita (EU-25 average 22.2 per million capita. Compared with an index of 100 to represent the EU-25 average ratio of biotech patents to biotech publications, Poland's index stood at 12 (1994-96), with a slight improvement shown by the rise to 16 for the period 2001-2003. The absence of an indicator based on biotech companies in Poland is caused by lack of comparable official biotechnology statistics, based on a common definition, for European countries. The only comparative data on biotech firms in Europe is provided by Ernst & Young reports which do not cover Poland. Some reviews have identified approximately 30 biotech companies in Poland, but these reviews do not say how they have defined the biotech companies included in their reviews. In any event, there is general consensus that biotech commercialisation is still rather weak in Poland. This lack, and absence of data for Poland on biotech Initial Public Offerings pMC, or venture capital € per capita allocated to biotech firms makes it impossible to measure biotechnology commercialisation or market conditions. Similar lack of data for Polish field trials of GM crops or approved biomedicines makes it impossible to measure market conditions.

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<sup>1</sup> Performance is measured by biotech patents/biotech publications, biotech patents and biotech companies per million capita (pMC).

## 4. Conclusions

### 4.1 Introduction

The chapter contains tables that summarise information about Poland's funding of biotechnology and the policy instruments used. Due to very limited information about these instruments, it is not possible to provide any information about the policy goals addressed, the applications areas funded or the activities stimulated.

### 4.2 Public funding of biotechnology through policy instruments

Table 4.1 Public funding of biotechnology through non-policy-directed and policy-directed instruments for the period 2002-2005 (in M EUR)

	2002	2003	2004	2005	Total
<b>RESEARCH</b>					
<i>1. Non-policy-directed</i>					
Response Mode	0.95	0.7	0.45	0.6	2.7
Total	0.95	0.7	0.45	0.6	2.7
<i>2a. Policy-directed Generic</i>					
National					3.2
Total	---	---	---	---	3.2
<b>GRAND TOTALS</b>	---	---	---	---	5.9

Source: BioPolis Research

### 4.3 Specific features of the instruments

Table 4.2 Participants/recipients and co-financing requirements of policy-directed programs that fund biotech activities in the period 2002-2005

Instrument	Funding agency	Participants/Recipients			Financial contribution required (%)	
		PRO's	SME's	LFs	Recipients	Other Public authorities
<b>National</b>						
<i>Generic</i>						
PRRGP commissioned research	MniL and KBN	√				
PRRGP goal-oriented projects	MniL and KBN	√	√		√	

Source: BioPolis Research

## **5. Future Developments**

Developments in 2005 may have a significant impact on biotechnology research and its commercialisation. Future funding of biotechnology research will be affected by the National Framework Programme for research announced in 2005. Innovation and commercialisation could be fostered by the new legal framework for innovation created by the Act on Financing Science and the Act for Supporting Innovation Activities.

The Act for Financing Science aims to encourage the concentration of public expenditure on development projects that could be applied by SMEs, and to facilitate the consolidation of the R&D sector by promoting joint proposals. It also introduced financial planning, enabling the Minister to set the level of financing for specific areas of science; the introduction of new research projects, especially development projects, and the formation of programmes and initiatives to support structural changes, i.e. creation of science networks, consortiums and reorganization of the State Research Institutes.

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## **Annex 4   References**

Commission of the European Communities (2003). Investing in Research – An Action Plan for Europe, COM(2003) 226 final/2, Brussels.

Eurobarometer (2005). Social values, Science and Technology, Special Edition No. 225/Wave 63.1, European Commission accessed 29 March 2006 at:  
[http://europa.eu.int/comm/public\\_opinion/archives/ebs/ebs\\_225\\_report\\_en.pdf](http://europa.eu.int/comm/public_opinion/archives/ebs/ebs_225_report_en.pdf)

Eurostat (2005). Structural Indicators, accessed 2 May 2006 at  
<http://epp.eurostat.cec.eu.int/pls/portal/#>

GAIN Report, 2005. Global Agriculture Information Network. USDA Foreign Agricultural Service. Poland , Biotechnology, Annual.

Jablecka, J. (1995). Changes in the Management and Finance of the Research System in Poland, Social Studies of Science, Vol. 25, pp. 727-53.

Kucinski, J. (2005). Contribution to the expansion of the ERAWATCH knowledge base towards EU-25. Report on Poland. November 2005

Sobiepanek, Z. (2003). STAT Market Research Report. Poland. Accessed 3 May 2003 at the Industry Canada website:  
<http://strategis.ic.gc.ca/epic/internet/inimr-ri.nsf/en/gr109808e.html>

Twardowski, T and Bielecki, S. (2005). Red and White Based on Green. In Euro Biotech News. No. 8-9, Volume 4, 2005.

Walendowski, J. (2005). Annual Innovation Policy Trends and Appraisal Report Poland 2004-2005. European Trend Chart on Innovation, European Commission.

## Annex 5 Performance data

### Introduction

This Annex includes the data that was used to develop the indicators discussed in Chapter 3. Chapter 3 describes four sets of indicators used to measure the performance of the national biotechnology system of innovation, in terms of:

1. Creating a knowledge base and supporting the availability of human resources: Charts 3.1, 3.2.1, 3.2.2 and 3.3
2. Knowledge transmission and application: Chart 3.4
3. Industrial development: Chart 3.5
4. Market conditions: Chart 3.6

The indicators aim to capture trends in performance and compare the national situation with that of a reference region. To present trends in performance, most indicators are provided for three or two different time periods, depending on data availability. To avoid capturing erratic trends, each time period includes several years, again depending on data availability. Information on which years have been captured for each period and comments concerning the index used can be found in the last two columns of Table A5.1.

Table A5.1. Performance indicators, charts, comments and time periods

	<b>Indicator</b>	<b>Chart</b>	<b>Comments</b>	<b>Time periods</b>
Ind. 1	Biotech publications per million capita (pMC)	3.1	Index: Reference Region EU25 =100 and US data for comparison	1) 1994-1996, (2) 1998-2000, (3) 2002-2004
Ind. 2	Biotech publications per BT public R&D expenditure	3.1	Only for those countries included in the inventory Index: Reference Region EU25 =100	T Pub. 2002-2004 / Total Pub. Expenditure 1994-1998 M Ecu
Ind. 3	BT patents / BT publications	3.4	Index: Reference Region EU25 =100 and US data for comparison	1) 1994-1996 (2) 1998-2000 (3) 2001-2003
Ind. 4	BT publications / Total pub.	3.1	Index: Reference Region EU25 =100 and US data for comparison	1) 1994-1996 (2) 1998-2000 (3) 2002-2004
Ind. 5	Citations to BT publications	3.1	Index: Reference Region EU25 =100 and US data for comparison Small country effect	1) 1994-1998 (3) 2000-2004
Ind. 6	Graduates in life sciences pMC	3.1	Index: Reference Region EU17 =100 and US data for	2) 1998 (3) 2002

	<b>Indicator</b>	<b>Chart</b>	<b>Comments</b>	<b>Time periods</b>
			comparison	
Ind. 7	BT publications in subfields, as % of total BT publications	3.2.1	Data in % EU25 and US data for comparison	1994-1996
		3.2.2		2002-2004
Ind. 8	Growth rate of BT publications in subfields	3.3	EU25 and US data for comparison Small field effect	growth rate between 1994-96 (period 1) and 2002-04 (period 3)
Ind. 9	Biotech patent applications pMC	3.4	EU25 and US data for comparison	(1) 1994-1996 (2) 1998-2000 (3) 2001-2003
Ind. 10	Number of biotechnology companies pMC	3.5	European (data available) and US data for comparison	(2) 2001 (3) 2004
Ind. 11	Number of biotech start-ups pMC	3.4	European (data available) and US data for comparison	(3) 2001-2003 (only one period)
Ind. 12	Number of biotech IPOs pMC	3.5	European (data available) and US data for comparison	(3) 2002-2005
Ind. 13	Venture capital in € pC	3.5	European (data available) and US data for comparison	(2) 2002 (3) 2004
Ind. 14	BT acceptance index	No Chart - Discussed in text of chapter 3	Source: BT Policy Benchmarking 2005. The biotechnology acceptance index is a composite index and draws on questions Q.12, Q.13.1 and Q14.01 and Q14.09 of the Eurobarometer 58.0	002
Ind. 15	Eurobarometer 225	No Chart - discussed in text of chapter 3	See section 3.3 and sections 3.4.1, 3.4.2, and 3.4.3 of the Special Eurobarometer 225 <sup>2</sup>	005
Ind. 16	Biomedicines	3.6	Source: BT Policy Benchmarking 2005 Index: Reference Region EU15 =100 US data for comparison	1995-2002
Ind. 17	Field trials	3.6	Source: Biotechnology Innovation Scoreboard 2002 Index: Reference Region EU15 =100	1996-2001

<sup>2</sup> [http://europa.eu.int/comm/public\\_opinion/archives/ebs/ebs\\_225\\_report\\_en.pdf](http://europa.eu.int/comm/public_opinion/archives/ebs/ebs_225_report_en.pdf)

	Indicator	Chart	Comments	Time periods
			US data for comparison	

The following methodological issues are related to some of the indicators:

- Indicator 3 (Patent BT / Publications BT) replaces the indicator *BT publications basic research/ BT publications applied research*. Results of the EPOHITE project have shown that the original indicator does not differ significantly in the case of old EU member states. This might be the result of methodological problems associated with the indicator, since the definition of basic and applied research is based on a journal classification made by SCI. The explanatory power of this indicator is therefore questionable.
- To calculate the citation rate first the publications for the period 1994-1996 (set 1) were searched and all the publications in 1994-1998 that cited any publications in set 1 (set 2). Citation rate has been calculated by (number of publications in set 2) / (number of publications in set 1). However, many of the articles in set 2 cited not only one article in set 1 and these duplicated citations are not taken into account in our calculation. For example, if there are 2 articles in set 1 and they each has one citation but cited by the same article, there is only 1 article in set 2. The citation rate for the 2 articles in set 1 is 0.5 instead of 1. This depreciation is more obvious in countries with more publications such as USA and EU25 since the possibility to cite multiple articles in set 1 is large. Accordingly the citation rates of USA and EU25 are a bit underestimated.
- The indicator ‘Citations to BT publications’ seems to have a ‘small country effect’ bias. Small countries show a relatively large citation rate. A possible explanation might be that, as far as number of publications is concerned, larger countries usually have a larger ‘middle quality’ share of research results (in terms of impact) while smaller countries usually have a ‘low in number but good in quality’ publications impact. This can be explained by the concentration of resources allocated to selected research groups in small countries. Small countries may concentrate resources in outstanding research units. Accordingly, fewer publications may have greater impact.
- The EU25=100 index is applicable in the indicator ‘Graduates in life sciences pMC’ since data was only available for 17 member states.
- For those countries starting from zero in period 1 (1994/1996), the growth rate of BT publications in subfields was set to 100% if the number of publications in period 3 (2002-2004) was larger than zero. On the other hand, if the country reduced the number of publications to zero in the period 2002-2004, the growth rate was -100%. Given that a relative growth rate was used, small fields tended to have relatively larger growth rates.
- To benchmark each country we chose EU25 (or EU15 if data was not fully available) as the reference region. In those cases where data for EU25 or EU15 were not available, the reference corresponds to the sum of national data available. Moreover, to ease the presentation of indicators with different scales in a given chart, an index value was used.

### Raw data for the charts in Chapter 3

Only the data for the tables included in Chapter 3 in this report are presented here.

Raw data for Chart 3.1 BT publications per million capita (pMC): absolute and indexed values

	BT publications			Population (million)		
	94-96	98-00	02-04	1996	2000	2004
EU25	97521	128716	145646	447	451	457
Poland	1299	2481	3921	39	39	38
USA	119802	135508	154402	264	276	292
	BT publications/pMC			Index EU25=100		
	94-96	98-00	02-04	94-96	98-00	02-04
EU25	218	285	319	100	100	100
Poland	34	64	103	15	22	32
USA	454	492	529	208	172	166

Source: BioPolis Research

Publications: Science Citation Index (SCI) (through online database vendor STN International)

Population: EUROSTAT and OECD

Raw data for Chart 3.1 BT publications, as share of total publications: absolute and indexed values

	BT publications			Total publications		
	94-96	98-00	02-04	94-96	98-00	02-04
EU25	97521	128716	145646	860652	1024327	1117392
Poland	1299	2481	3921	22874	30280	42239
USA	119802	135508	154402	889506	941191	1045894
	Share of BT publication			Index EU25=100		
	94-96	98-00	02-04	94-96	98-00	02-04
EU25	11%	13%	13%	100	100	100
Poland	6%	8%	9%	50	65	71
USA	13%	14%	15%	119	115	113

Source: BioPolis Research

Publications: SCI

Raw data for Chart 3.1 Citations to BT publications: absolute and indexed values

	Citations to BT publications		Index EU25=100	
	94-98	00-04	94-98	00-04
EU25	6.14	7.28	100	100
Poland	4.74	4.58	77	63
USA	6.39	8.54	104	117

Source: BioPolis Research

Citations: SCI

Raw data for Chart 3.1 Graduates in life sciences pMC: absolute and indexed values

	Graduates in Life Sciences		Population (million)	
	1998 / 1999	2002	1998 / 1999	2002
EU17	46859**	81,316	552**	431
Poland	2066	3228	39	38
USA	75253*	70,950	276*	288
	Graduates pMC		Index EU17=100	
	1998 / 1999	2002	1998 / 1999	2002
EU17	85**	189	100	100
Poland	53	84	63	45
USA	273*	246	321	131

Index EU17=100 for 1998 is EU-16, because for Portugal no data available

\* data for 1998; \*\* data for 1999

Source: BioPolis Research

OECD Education Database

Population source for US OECD

Raw data for Chart 3.1. BT publications per BT public R&D expenditure

	BT Publications	Non-policy-directed funding	Policy-directed funding		Total public spending on BT (Mecu)	BT Publications/ Mecu BT public expenditure	Index
			Biotech Specific	Generic			
	2002-2004	1994-1998	1994-1998	1994-1998	1994-1998	2002-2004/1994-1998	
EU25	145646				n.a.		
Poland	3921	-	-	-	n.a.		n.a.
USA	154402				n.a.		n.a.

Source: BioPolis Research

Publications: SCI

BT public expenditures in research: Inventory Project, Table 3.4 Executive Summary

Raw data for Chart 3.2 Growth rate of BT publications in subfields between 1994-96 and 2002-04

	1994-1996/2002-2004						
	Plant	Health	Animal	Food	Industrial	Environmental	Generic
EU25	38%	56%	56%	106%	86%	95%	19%
Poland	149%	273%	218%	462%	0%	500%	99%
USA	11%	35%	23%	83%	47%	58%	11%

Source: BioPolis Research

Publications: SCI

**References:**

Enzing, C.M. et al. (1999): Inventory of Public Biotechnology R&D Programmes in Europe, Luxembourg: Office for Official Publications of the European Communities.

**Websites:**

EUROSTAT	<a href="http://epp.eurostat.cec.eu.int/">http://epp.eurostat.cec.eu.int/</a>
OECD Education Database	<a href="http://www.oecd.org/">http://www.oecd.org/</a>
OECD Statistics	<a href="http://www.oecd.org/">http://www.oecd.org/</a>
STN International	<a href="http://www.stn-international.de/">http://www.stn-international.de/</a>

## **Annex 6    Abbreviations**

GMO	Genetic Modified Organisms
IBB	PAS Institute of Biochemistry and Biophysics, Polish Academy of Sciences
IDA	Industrial Development Agency
IFTR	Institute of Fundamental Technological research
IPR	Intellectual and Property Rights
JBR	State Research Institutes
KBN	Committee for Scientific Research
MEiN	Ministry of Education and Science
MniI	Ministry for Science and Information Technology
PAED	Polish Agency for Enterprise Development
PRRGP	Peer-Reviewed Research Grants Programme
USPTO	United States Patent and Trademark Office

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