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 Lithuania

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Sander van der Molen and Christien Enzing

Innovation Policy Group
TNO Quality of Life
The Netherlands

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Summary

Lithuania became independent in 1991 and joined the European Union in 2004. In 2005, GDP amounted to EUR 19 600M EUR, which is approximately 50% of the EU25 average. In 2000, R&D investments in Lithuania amounted to 0.68% of GDP, which is well below the EU25 average. The bulk of investment in R&D is by public authorities, private business only accounting for 21.5% of the total. .

73% of all Lithuanian industrial output is produced by low-technology organisations. The main existing high-technology industries are biotechnology, laser technology and information technology.

The main actors in the national science, technology and innovation system in Lithuania are the Ministry of Science and Education and the Ministry of Economy. The former is responsible for national R&D policy, while the latter is responsible for policies concerning innovation in business development. Moreover, the Science Council of Lithuania acts as a scientific advisor and consultant to the government. The Lithuanian State Science and Studies Foundation implements state policy in the fields of science and studies through a number of programmes.

Generally speaking, there is very little programme or project funding in Lithuania. Most governmental support of science and technology is by means of lump-sum budget allocations directly to universities or state research organisations.

In 2002, all political parties signed an agreement emphasising the goal that biotechnology in Lithuania should attain the general European level as quickly as possible. However, Lithuania actually lags behind the implementation of EU directives on biotechnology patenting and genetic engineering, while IPR protection is still regarded as insufficient.

The main actors in the field of biotechnology are the Institute of Biotechnology and three large biotechnology companies: Fermentas, Sicor Biotechnology and Biocentras. Several research institutes and universities also pursue research in the field of biotechnology, e.g. Vilnius University and the Technical University of Vilnius Gediminas. The Lithuanian Academy of Science has a biochemistry department.

In the period 2002-2005, the Ministry of Science and Education had two generic programmes that funded biotech projects with a total sum of 6M EUR. During the same period, the Lithuanian State Science and Studies Foundation supported projects in the field of biotechnology under the aegis of the ‘High Technology Development Programme’ and the ‘The Programme of Priority Trends of Lithuanian Research and Experimental Development’. Together these two programmes had a budget of 3M EUR for biotechnology designated mainly for research. Commercialisation activities are not funded through these programmes.

Both the knowledge base and availability of human resources are rather limited in Lithuania. This accounts for the small number of publications in the field of biotechnology per million capita and the share of biotechnology publications among the total number of publications: both are significantly lower than the USA level and the EU25 average. On the other hand, the citation rate per biotechnology publication is twice as high as the EU25 average and the USA level. Most of the publications are in the field of generic biotechnology, but plant biotechnology also has a higher share of biotechnology publications than the EU25 average

and the USA level. Plant biotechnology, animal biotechnology, food biotechnology and health biotechnology showed the highest growth rates in the ten years covered by this report. The number of patents per million capita and per biotechnology publication is much lower than the EU25 average and the USA level. There have not been any biotechnology IPOs nor any biomedicines developed and/or produced in Lithuania. There have also been no field trials in the period covered by the study.

Although the two policy-directed instruments of the Lithuanian State Science and Studies Foundation have in fact supported research, no actual data is available detailing the coverage of policy goals, biotechnology areas or activities. Ideas and plans for the establishment of a new biotechnology science park in Vilnius have been mooted for several years. After a five-year time lapse nothing has yet materialised. A representative of the Ministry of Economy confirmed that in 2005 these plans had been revived and that the science park will definitely be established in the future.

1. Introduction and background

1.1 General introduction

Lithuania gained its independence (from Russia) in 1991. The country's neighbours are Poland, Russia (Kaliningrad), Latvia and Belarus. It has approximately 3.5 million inhabitants. The country is a parliamentary democracy (Eurostat, 2005).

After an economic crisis in 1998, Lithuania's economic recovery began in 2000 and growth continued: in 2003, GDP grew by 9.7% and in 2004 by 6.7%. In 2005, Lithuania's GDP amounted to 19 600M EUR (Eurostat, 2005), which is 5 692 EUR per capita. This is approximately 50% of the EU25 average. Furthermore, Lithuanian exports increased by 21% in 2004, and cumulative Foreign Direct Investments rose by 18.2% (Daukšys, 2005).

Low-technology industry still predominates in Lithuania, producing 73% of all output, compared to 4.4% for high-technology industries. The main high-tech industries are biotechnology, laser technology and information technology (ADE, 2003; UN, 2003; Bumelis, 2005). One of the fastest-growing sectors in Lithuania is ICT, which in 2001 grew by 23%, and reached a 6.4% share of GDP (Infobalt, 2006). Nevertheless, Lithuania still lags behind the other member states of the European Union in ICT; the industrial infrastructure is outdated and high-tech production is minimal. Competitiveness in agriculture is low, business services are still in an infant stage, and manufacturing and social infrastructure in the countryside are still underdeveloped. The use of energy is inefficient and the country lacks experience and expertise in state-wide strategic management and economic development (Lithuanian Parliament, 2002).

In 2000, Lithuanian expenditures on R&D amounted to 0.68 % of GPD. Government invested 42% and business 21.5%. Lithuania has a well-developed R&D infrastructure, especially in the fields of natural, exact and technical science (Zurauskas, 2003). However, the R&D system is – compared to Western European countries – rather rigid. This is because most public resources (approx. 88%) are restricted to and allocated directly to public research organisations (European Commission, 2005).

In Central and Eastern Europe, Lithuania is regarded as one of the leaders in biotechnology. From the1990s onward, biotechnology in Lithuania began developing into a branch of industry in its own right. Biotechnology is considered a well-developed economic area with a promising future. Many employees in the biotechnology industry have a background in research, most in possession of an academic degree (Bumelis, 2005). Lithuania also apparently offers favourable conditions for biotechnology industry and biotech pharmaceuticals due to low tax rates on profits, low salaries and low energy costs (Bumelis, 2005). The availability of highly qualified specialists in biochemistry, microbiology and biological engineering is also regarded as an important potential success factor in the development of biotechnology in Lithuania (EKT, 2004). In general, the country has a strong academic reputation, which was developed during the Soviet era, as well as several growing high-technology private industries. UN data show that 27% of all PhD researchers in Lithuania have qualifications in biomedical sciences (UN, 2003).

Most of the modern biotechnological industry is concentrated in the city of Vilnius. There are three major companies: Fermentas, Sicor Biotechnology and Biocentras. Fermentas (founded in 1995) is one of the 10 largest producers of analogous biotechnological products in the world (Lithuanian Business Review, 2004). Sicor Biotechnology (established in 1994 as Biofa AB) produces recombinant biopharmaceutical products. The company was acquired in 2004 by Teva Pharmaceutical Industries Ltd. Biocentras (founded in 1988) produces specific microbial strains for remediation of soil polluted by oil and oil products. Six smaller companies are active in biofuel production (biodiesel and bioethanol): Telsiu, Rapsoila, Linas ir viza, Agrochema, Bioethanol distelery and Malsena (Abraitis, 2006). Biosinteze AB produces enzyme preparations and Biok produces natural cosmetics (EKT, 2004).

Investments in biotechnology industry during 2006 were estimated at 23-46M EUR, creating 100-200 new work sites and having an annual turnover of 29-58M EUR. It is projected that, by 2014, annual turnover in biotechnology industry should reach 145-290M EUR (EKT, 2004).

According to the Lithuanian Scientific Society, future radical innovations are expected in mechanics, electronics and biology. Lithuania has potential in all these fields. The country's main challenge will be the formation of networks and cooperation between the private and public sectors (LMS, 2005).

1.2 Characteristics of national S&T and innovation system

In Lithuania, the greatest share (approx. 88%) of public resources are allocated directly, by means of lump-sum budgets, to universities and state research institutes. This makes the system rather inflexible. Cooperation and interaction between companies and research institutes or universities is modest and occasional. The remaining portion of public resources for R&D (12%) is channelled to the Lithuanian State Science and Studies Foundation for the funding of a number of programmes (European Commission, 2005). On the whole, public support for R&D is rather low, and mechanisms for funding of innovation are lacking. (UN, 2003).

In 2001, the Ministry of Science and Education published the document 'Lithuanian Science and Technology White Book'. The White Book was prepared by a group of scientists and experts and argues that the development of science and technologies is the most important element in the country's development strategy. The importance of an increase of state and business investments in R&D was mentioned and several possibilities for the stimulation of science and technology were presented. Public-private partnerships and competition programmes were put forward, while the provision of tax incentives to encourage businesses to invest in R&D were considered to be essential. (Ministry of Science and Education, 2001).

Based on the 'Long-term Development Strategy of the Lithuanian State', approved by the Lithuanian parliament on November 12, 2002 (decision No.IX-1187) and the 'White Paper on Lithuanian R&D and Technology', the government approved the following R&D priorities (Alipro, 2005):

1. Research to ensure personal quality of life:
   - Genomics and biotechnology for health and agriculture,
   - Qualitative, safe and ecological food technologies,
   - Changes of ecosystems and climate.
2. Research to promote a knowledge-based society
3. Research to create nanotechnologies
4. R&D activities on nuclear safety

5. R&D to increase international competitiveness of Lithuanian industries:
   - Development of biotechnologies,
   - Mechatronics,
   - Lasers,
   - Information and other high technologies.

Policy-making actors
The main actors in the field of R&D and innovation policy making in Lithuania are the Ministry of Science and Education and the Ministry of Economy.

The Ministry of Science and Education is responsible for preparing and executing government R&D policy. The purpose of the Department of Science and Studies is to formulate the national strategy for science and technology. Furthermore, this department promotes the development of innovation potential, including human resources, research and development activities and to some extent commercialisation of results (ADE, 2003).

The Ministry of Economy is in charge of governmental policy for industry, energy, foreign and internal trade, ecology and waste management. This ministry is the major policy actor concerning innovation in business development (Cordis, 2005).

The Ministries of Science and Education and that of Economy lack coordination (ADE, 2003). In 2002 the Science and Technology Commission was created in order to coordinate the various actors in science, technology and innovation policy and especially the two ministries. In spring 2005, the commission was transformed into the Science, Technology and Innovation Commission with the task of coordinating the activities of the institutions involved in the development and implementation of science, technology, and innovation policy and to create optimal conditions for improving the country's science potential and its economic competitiveness (Cordis, 2005).

The Science Council of Lithuania acts as an advisory body to the parliament and government in general. It is regarded as one of the major science and technology policy actors in Lithuania. Its activities include preparing proposals and draft decrees for the Ministry of Higher Education and Science, making proposals about the right of institutions to confer doctoral degrees, supervising the award of research degrees and academic titles, and providing notification of doctoral degrees issued for Lithuanian citizens abroad. The Science Council is also responsible for the development of Lithuania's R&D policies. In 2004, it published proposals for the implementation of the recommendations made by the World Bank in its 2003 report 'Lithuania. Aiming for the knowledge economy'. The council consists of 24 persons; two-thirds being elected by scientists and one-third appointed by the parliament (Erawatch, 2006).

The Lithuanian State Science and Studies Foundation (LSS) was created in 1993 and allocates funds to support research in Lithuania. In 2003, the activities of the foundation were expanded and now it funds 'researchers selected by competition who address fundamental scientific problems that will be of practical application in high technology spheres approved by the government' (Kaunas University of Technology, 2005). In 2005, the foundation allocated 0.6M EUR to individual researchers and research groups.

In March 2005, a new Science, Technology and Innovation Commission was established, as a merger of two high-level policy advisory commissions: the Science and Technology

Commission and the Education and Science Commission to the Government of Lithuania. The new commission is chaired by the Prime Minister and is the highest-level policy coordination body, representing science, education and business communities, as well as the government. The commission meets on a regular basis and has a permanently operative secretariat (Erawatch, 2006).

1.3 National support and framework conditions for biotechnology

Biotechnology is a priority in national R&D and innovation policy in Lithuania. In 2002, all political parties signed an agreement which established the goal that biotechnology in Lithuania should strive to attain the general European level as quickly as possible. It was also agreed that biotechnology should play an important role in the industrial development of Lithuania by increasing competitiveness in the high-tech sector and improving the country's health system (Bumelis, 2005).

Regulation
According to a UNEP project, in 2002 there was no particular single national policy on biosafety established in Lithuania (UNEP, 2002). The ADE Report (2003) concluded that IPR protection was insufficient. In December 2004, Lithuania (together with Latvia) had neither approved nor implemented the EU Directive 98/44/EC on patenting of biotechnology and genetic engineering (European Commission, 2005).

Nevertheless, according to the Lithuanian Scientific Society, the Lithuanian R&D legislation is, like all the main instruments of reform, in a continual process of improvement.

Regulations in Lithuania related to biotechnology are: the Law on Health Protection; the Law on Environmental Protection; the Law of the Republic of Lithuania on Biochemical Research Ethics; the Law on Genetically Modified Organisms; the 'Procedure for registration, use, storage, introduction and transportation of micro-organisms and other sources of biological pollution'; the 'Procedure to register means for chemical and biological protection of plants'; and the 'Rules for chemical commission for state protection of plants' (UN, 2002).

Public perception
A Eurobarometer (2005) survey showed that on several ethical issues concerning the application of biotechnology technologies, Lithuanians responded in a similar manner to the EU25 average. Table 1.1 shows the responses to a variety of questions in Lithuania and the corresponding averages for EU25.

Table 1.1 Responses of the Lithuanian public, expressed in percentages, on the application of new technologies and the corresponding EU25 averages

Topics for consideration	Never	Only in exceptional circumstances	Only if highly regulated and controlled	In all circumstances	Dnk*
Animal cloning for research in human diseases	26 31	17 22	36 35	9 8	2 4
Human cloning so couples can have a baby despite genetic disorder	57 59	15 16	12 15	15 4	15 5
Cloning human stem cells from embryos for organ transplant	22 22	24 20	34 41	6 11	15 5
Growing meat from cell cultures to avoid slaughter of animals	55 54	9 12	14 18	7 6	16 9
Developing GM crops to increase variety of regionally grown food	41 37	15 17	22 31	6 8	17 7
Developing GM bacteria for cleaning up environmental catastrophes	20 19	13 16	28 37	21 20	19 8

* DNK: do not know
Source: Eurobarometer, 2005

1.3 The main biotech policy and research actors

In Lithuania, 21 universities, 27 colleges and 43 state research organisations perform research. In addition, 100 companies also carry out R&D. There are six operational science and technology parks situated in Lithuania (Cordis, 2005).

Historically, the Academy of Science is the most important actor in the field of research in Lithuania (EKT, 2004). The Academy has several institutes that are active in biotechnology. The department of Biochemistry of the Lithuanian Academy of Science was created in 1967. Approximately 68 researchers are working in the fields of gene structure and expression in micro-organisms, as well as in other areas outside the field of biotechnology. The departments of medical sciences and the department of biology are also active in biotechnology research.

The state-owned Institute of Biotechnology (IBT) was founded in 1975. It specialises in genetic and molecular studies, and the study and development of recombinant biomedical proteins. It is the most important research organisation in the field of biotechnology in Lithuania and is located in Vilnius. The institute is considered to be an EU Centre of Excellence and employs 2 000 persons, approximately 400 of which are scientific personnel. It is renowned for its high level of scientific research and close scientific cooperation with biotechnology companies (Vilnius, 2005).

The institute has created several spin-off companies, which are now leading biotechnology firms in Lithuania. Together, these companies (Fermentas, Sicor Biotech and Biocentras) are responsible for 80% of the Lithuanian biotechnology industry's income (Vilnius, 2001). Biok is also a spin-off company of the Institute of Biotechnology.

Research institutes involved in plant research and the use of renewal resources are (Abraitis, 2006):

- Institute of Biochemistry,
- Institute of Chemistry,
- Lithuanian Institute of Horticulture,
- Lithuanian Forest Research Institute,
- Lithuanian Institute of Agriculture,
- Kaunus Technology University, Department of Chemical Technology,
- Lithuanian University of Agriculture, Department of Agronomy, and
- Vilnius University, Chemistry and Natural Sciences departments.

The Institute of Immunology at Vilnius University was founded in 1990 and is associated with the Academy of Science. The institute employs approximately 80 people, including 30 doctors and six post-graduates. The institute is associated with the Lithuanian Academy of Sciences and Vilnius University and has a number of laboratories active in biotechnology, specifically in: molecular immunology, immunotechnology, biomodels, immunopharmacology and immunoanalysis, and nanotechnologies. The Department of Biochemistry and Biophysics at Vilnius University is also involved in biotechnology research.

Finally, it is important to mention that biotechnology activities are also being conducted at the Institute for Chemistry and Bioengineering (Department of Fundamental Sciences) at the Technical University of Vilnius Gediminas and the Lithuanian Veterinary Academy.

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 directed by explicit policy decisions about specific instruments, such as R&D programmes, programmes encouraging collaboration, industrial research grants, support for centres of excellence, support for commercialisation 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, including biotechnology. The BioPolis project considers only those generic instruments that make a reference made to (the stimulation of) biotechnology activities in the policy of the funding organisation running the programme or that of the ministry/government itself.

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

In this chapter, funding of biotechnology research through policy- and non-policy-directed instruments and of biotechnology commercialisation through policy-directed instruments are presented. Data were collected through desk research (publications, documents, websites of national and regional public funding organisations and/or governmental departments), a survey conducted by representatives of funding organisations that manage the generic and biotech-specific programmes, interviews with representatives of organisations that are involved in non-policy-directed and policy-directed funding. The website of the funding organisations and their programmes and the names of contact persons that participated in the survey and/or who were interviewed can be found in Annex 3 (List of contact persons) and Annex 4 (References). Section 2.2 presents the non-policy-directed funding and Section 2.3 the policy-directed funding. Charities also play an important role in the funding of biotechnology research in some countries; they will be addressed in Section 2.4. The final section provides a short overview of European funding of biotechnology research in the Netherlands through the 6th Framework Programme.

2.2 Non-policy-directed funding of biotechnology research

There are two non-policy-directed instruments under the responsibility of the Ministry of Economy (interview with Keraminas Arunas, 2005):

– A response mode programme to which companies can apply for research grants. There is no focus on any specific technology and any firm can apply;
– A fund for non-profit intermediaries that provides advice, information and other services in the field of technology transfer, IPR and innovation management.

No detailed information or budget information are available for either programme.

The Lithuanian State Science and Studies Foundation manages a response mode programme (and also several biotech-specific programmes, which are presented in the next section). In the period 2002-2005, the foundation supported one biotechnology project through the response mode programme, with a funding of slightly below 10 000 EUR.

Table 0.1 Non-policy-directed funding of biotechnology research in the period 2002-2005 (M EUR)

Funding organisation	Public research institutions / Response mode programmes	Funds
Ministry of Economy	R&D in companies	NA
Ministry of Economy	Support for non-profit intermediaries	NA
Lithuanian State Science and Studies Foundation	Individual researchers or research groups	< 0.01

NA: Not available
Source: BioPolis Research

2.3 Policy-directed instruments

In the period 2002-2005, the Lithuanian State Science and Studies Foundation managed two biotech-specific programmes with a total budget of 3M EUR. The Ministry of Science and Education had two generic programmes that funded biotech projects with a sum of 6M EUR (see

Table 0.2). These programmes will be presented in more detail in the rest of this section.

Table 0.2 Lithuanian public policy-directed biotechnology-stimulating instruments in the period 2002-2005 (in M EUR)

Instrument	Funding organisation	Budget	% of total	*Use of DF/SF*
National				
Biotech-specific				
Supporting Lithuanian priority areas: genomics and biotechnology for health and agriculture	Lithuanian State Science and Studies Foundation	0.68	7.6%	
Development of high technologies and biotechnologies	Lithuanian State Science and Studies Foundation	2.32	25.8%	
Generic				
Development of social and economic infrastructure	Ministry of Education and Science	4.27	47.4%	SF
Development of human Resources	Ministry of Education and Science	1.73	19.2%	SF
Total		9.00	100 %	

Source: BioPolis Research

Genomics and biotechnology for health and agriculture
The programme 'Genomics and Biotechnology for Health and Agriculture' of the Lithuanian State Science and Studies Foundation is part of the overall programme 'Support to Lithuanian Priority Research and Experimental Development Trends'.

This programme supports research in eight priority areas:
- Genomics and biotechnologies for health and agriculture,
- High-quality, safe and ecologically clean food technologies,
- Changes in ecosystems and climate,
- Information society technologies,
- Citizens and management in the knowledge society,
- Maintaining national identity in a global environment,
- Scientific research aimed at nanotechnology design,
- Scientific research and experimental development aimed at solving nuclear security and radioactive garbage management problems.

Biotechnology
The High Technology Development Programme has set five priority areas, and biotechnology is one of them. The other areas are: mechatronics, laser technology, information technology and nanotechnology and electronics. These areas have been chosen because of the existence of scientific expertise. They correspond with EU priorities and also cover the most potentially successful parts of the country's economy and encourage the creation of knowledge-based science and technology parks or clusters (Alipro, 2005).

The High Technology Development programme was initiated by the Ministry of Economy and is coordinated by the Lithuanian State and Study Foundation. The programme is financed jointly from national budgetary sources and by the Ministry of Science and Education (special allocation for the implementation of the Lithuanian Single Programming Document Measures for 2004-2006).

Development of social and economic infrastructure
One of the projects outlined in the programme 'Development of social and economic infrastructure' is: 'Development of labour market, education, professional education, science and studies institutions and social services infrastructure'. It is a Ministry of Science and Education programme with biotechnology as one of its priority areas. In fact, two biotechnology projects were funded under this measure with a total budget of 4.27M EUR (100% funding from the European Structural Funds: Development of Human Resources).

Development of human resources
The programme 'Development of Human Resources' includes the project 'Improvement of the quality of human resources in the area of scientific research and innovation'. It is linked to biotechnology at several levels. This is sponsored by the Ministry of Science and Education and received funding of 1.73M EUR in the period 2004-2005.
Abraitis (2006) mentions a 'Programme on Promotion of Production and use of Biofuel in 2004-2010'. Information on this programme's budget, funding organisations, etc. could not be found.

2.4 Charities

There are no charity organisations in Lithuania that fund research in the field of biotechnology. The Lithuanian Oncological Society is not involved in funding research; however, raising funds for cancer research (including biotechnology) is among this society's goals for the future (interview Valuckas, 2005).

2.5 Participation in 6th Framework Programme

Table 0.3 shows Lithuanian involvement in the 6th Framework Programmes that address biotechnology/life sciences research. Lithuania has been active in all three parts. It participated in 16 (of the 8 537) Thematic Priority 1 projects: 'Life sciences, genomics and biotechnology for Health', in 1 (of the 106) projects in the field of bionanotechnology (Thematic Priority 2) and in 11 (of the 1 599) 'Food Quality and Safety' projects (Thematic Priority 5). It did not coordinate any programmes.

Table 0.3 Involvement of Lithuania in biotechnology/life sciences programmes of the 6th Framework Programme

6th Framework Programme	Participation as project manager in # of projects	Participation as member of the project team
1. Life sciences, genomics and biotechnology for health	0	16 (0.2%)
2. Nanotechnologies, section bionanotechnology	0	1 (0.9%)
5. Food quality and safety	0	11 (0.7%)

[1] First and second call, all types of projects.
[2] Persons/groups can participate in more projects, resulting in more participations.
Source: BioPolis Research

Lithuania also participated in several international programmes. In the period 2002-2005, these included 14 projects in the field of biotechnology under the aegis of EUREKA and COST. They received funding up to 0.1M EUR (Lithuanian State Science and Studies Foundation, 2005).

3. Performance of the national biotechnology innovation system

3.1 Introduction

This chapter analyses the performance of the Lithuanian biotechnology innovation system for two or three time periods (depending on data availability) as shown by a range of indicators for scientific and commercialisation performance. Each time period includes several years, to avoid capturing erratic trends. National trends are benchmarked against the performance of the EU25 member states and the USA.

The presentation of the performance is structured along four main areas of the innovation system: the knowledge base, processes of knowledge transmission and application, industrial development and markets for biotechnology-based products. For each area, data of a number of different indicators for Lithuania, the USA and EU25 are shown. The values of EU25 have been chosen as a 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

Although the number of publications in the field of biotechnology almost doubled between 1994-2004, Lithuania had considerably fewer biotechnology publications per million capita than EU25 countries, and lags significantly behind the USA. The index figure for the number of publications in the field of biotechnology per million capita was nine in the period 1994-1996, 11 in the period 1998-2000 and 16 in the period 2002-2004. EU25 is indexed at 100 (see Chart 3.1).

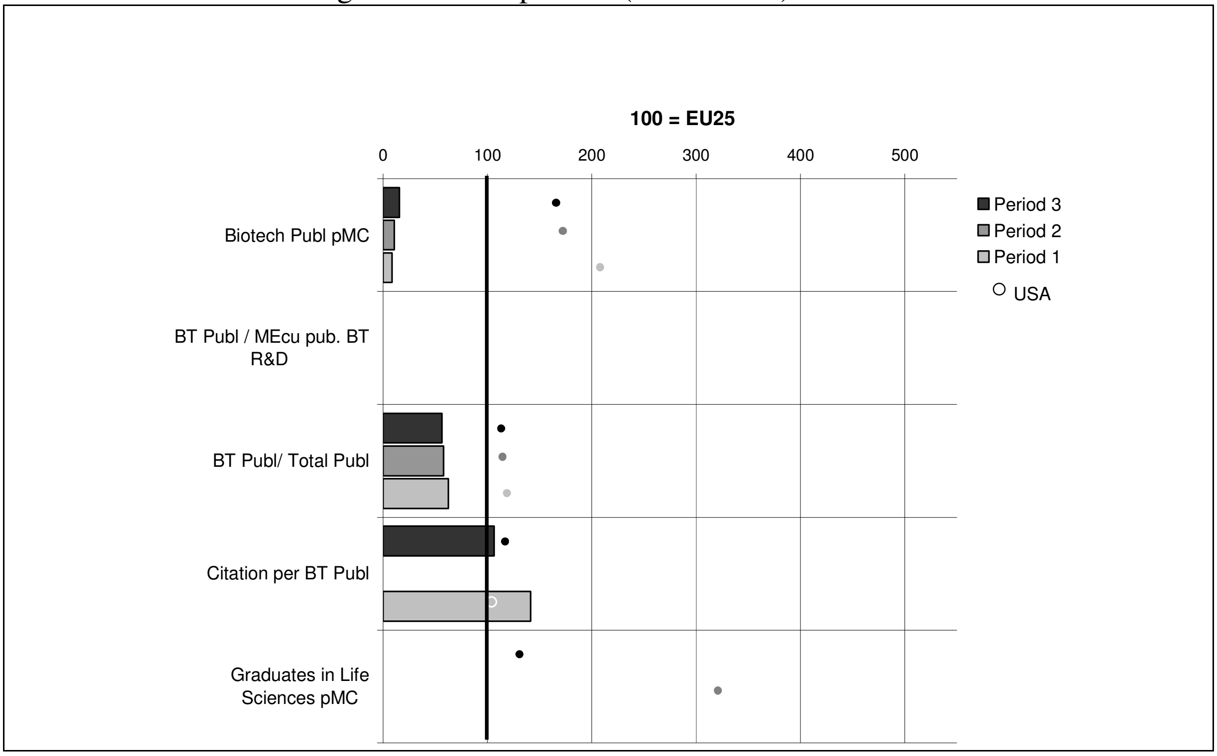
The share of biotechnology publications of the total number of publications in Lithuania is also lower than the EU25 average or the USA level. It remained at 7% during the periods 1994-1996, 1998-2000 and 2002-2004. Since the share of biotechnology publications for the EU25 and USA gradually increased over these periods, the index figures for Lithuania actually reflected a decreasing trend (from index 63 in 1994-1998 to 58 in 1998-2000 and 56 in 2002-2004).

Most remarkable were the high citation rates per biotechnology publication. Lithuanian biotechnology publications were cited more than EU25 biotechnology publications. This high citation rate might be explained by the small country effect[1]. Between the periods 1994-1998

p[1] Small countries show a relatively large citation rate. A possible explanation might be that, in terms of number of publications, usually large countries have a larger "middle quality" share of research results (in terms of impacts), leading to a "dilution" of papers with outstanding impact from these countries in a large number of medium-impact publications, while smaller countries have usually "low in the number, but good in quality" publications. This could be explained by a certain concentration of resources in small countries towards selected research groups. In other words, small countries may concentrate their resources in outstanding research units, which would lead to the effect that a lower number of publications may have greater impact. It should be noted, that we did not explore this "small-country" bias in detail during the BioPolis project. Additional research would be required to confirm this explanation.

and 2000-2004 the citation rate in Lithuania showed a decrease (from index 142 to 107). The absolute number of citations of biotechnology publications declined from 8.69 to 7.77. There is no data available on the number of graduates in the field of life sciences in Lithuania.

Chart 3.1 Lithuanian biotechnology knowledge base indicators: comparison with EU25 and USA figures in three periods (index value)



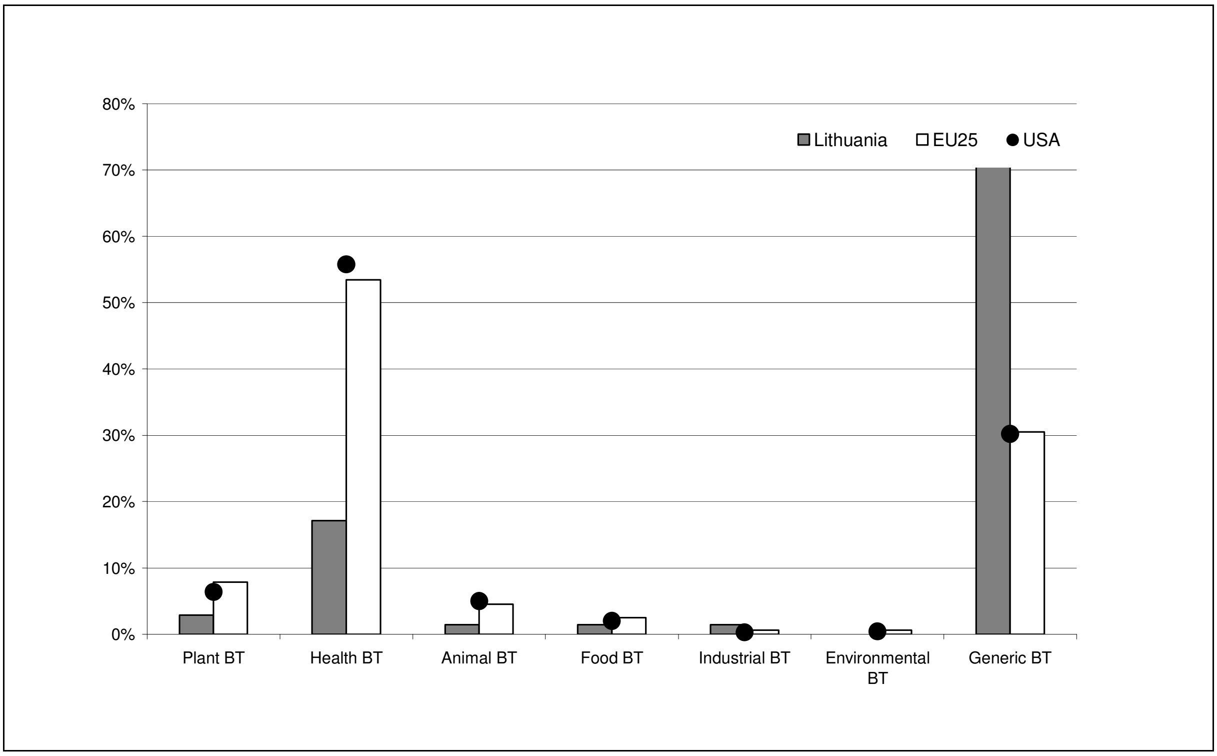
Source: BioPolis Research
Data: Science Citation Index

As can be concluded from Chart 3.2.1, over 70% of all biotechnology publications in the period 1994-1996 can be characterised as generic biotechnology. In the period 2002-2004 (Chart 3.2.3) this share of generic biotechnology in the total number of biotechnology publications declined to less then 50%.

The share of health biotechnology publications grew from 17% in the period 1994-1996 to 33% in the period 2002-2004, which is still a much lower share than EU25 (58 %) and USA (59%).

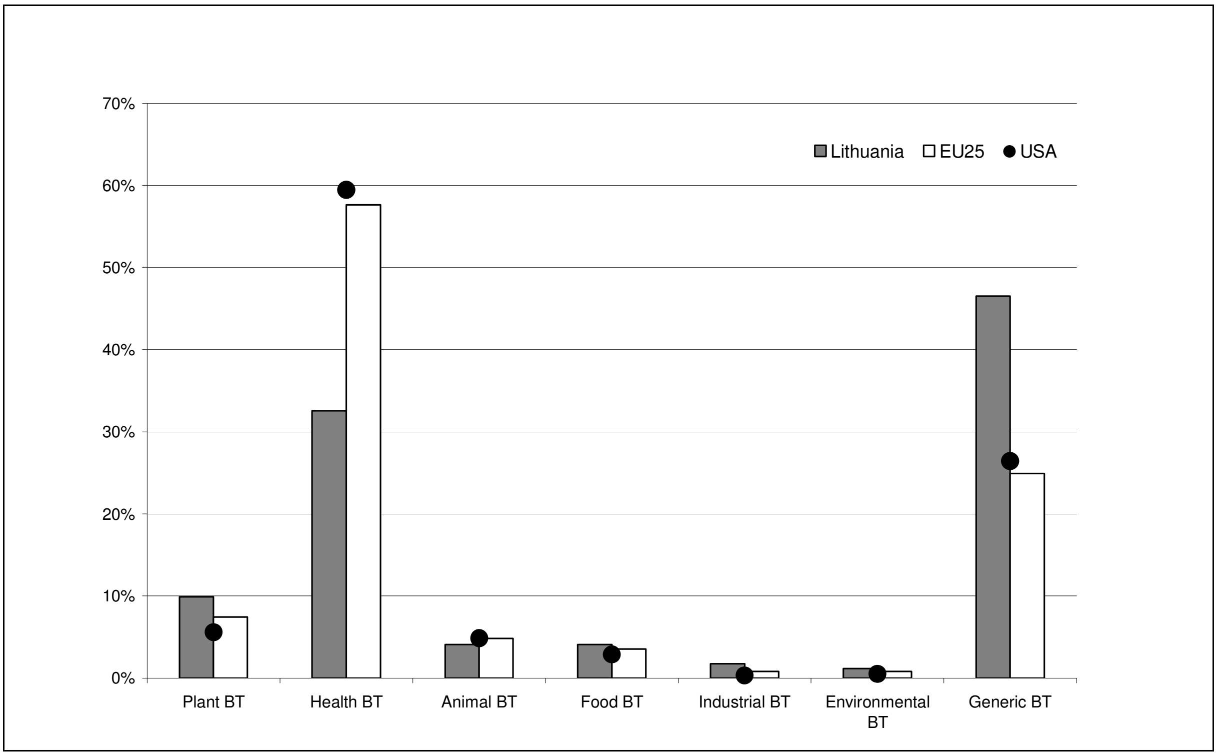
The relative share of plant biotechnology grew from approximately 3% in the period 1994-1996 to 10% in the second period. In this second period this share was above that of the EU25 average and the USA level. The same situation resulted for food publications and environmental biotechnology publications. In the industrial biotech field, Lithuania published relatively more than both the EU25 and USA, in both periods. In the animal biotech field, the backlog compared to EU25 and the USA decreased between 1994-1996 and 2002-2004.

Chart 3.2.1 Share of biotechnology subfields, as a percentage of total biotechnology publications, for Lithuania: comparison with EU25 and USA figures (1994-1996)



Source: BioPolis Research
Data: Science Citation Index

Chart 3.2.2 Share of biotechnology (BT) subfields, as a percentage of total biotechnology publications, for Lithuania: comparison with EU25 and USA figures (2002-2004).



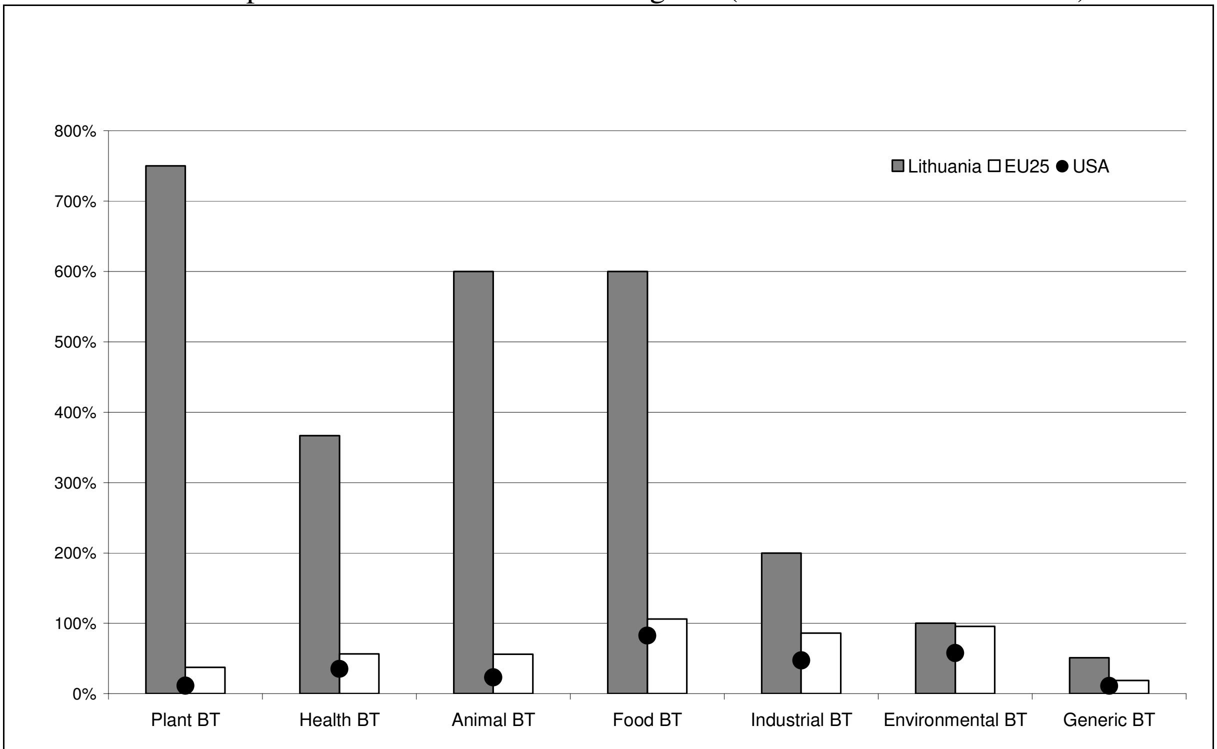
Source: BioPolis Research
Data: Science Citation Index

Although the growth rates of the number of biotechnology publications of Lithuanian researchers in the plant, animal and food biotechnology subfields between 1994-1996 and 2002-2004 grew substantially (far more than the USA and EU25) (Chart 3.3), it must be pointed out that the absolute number of publications for these subfields in the period 1996-1998 was only 1 or 2.

In addition, health biotechnology and industrial biotechnology both showed higher growth figures in terms of the number of publications than the EU25 average and the USA level, though here the absolute number of publications was somewhat higher, actually increasing from 12 to 56.

The number of publications per million capita in Lithuania was much lower than the EU25 average and USA level. Nevertheless, the relatively high growth rates in several biotechnology subfields indicates that Lithuania is starting to reap the benefits of increased efforts in biotechnology research – and is beginning to 'catch up'.

Chart 3.3 Growth rates of biotechnology (BT) subfield publications in Lithuania: comparison with EU 25 and USA figures (1994-1996 and 2002-2004)

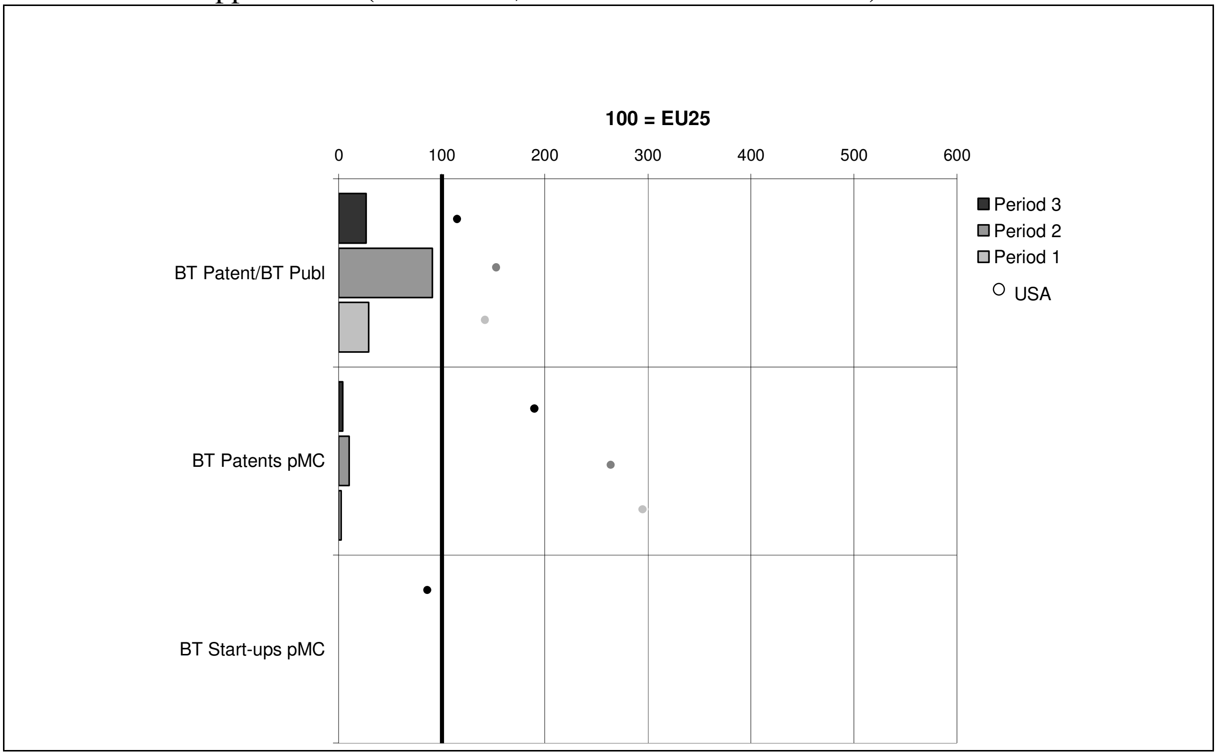


Source: BioPolis Research
Data: Science Citation Index

3.3 Performance in knowledge transmission and application

In Lithuania, the number of biotechnology patents per biotechnology publication was much lower than in the EU25 in period 1 (see Chart 3.4). In period 2, the number of biotechnology patents per biotechnology publication was close to the EU25 average. This substantial change is partly due to the low number of biotechnology patents. In the period 1994-1996, there was one biotechnology patent, while eight patents were issued in the next period (1998-2000). In the period 2001-2003, this figure had declined to three patents. Consequently, the number of biotechnology patents per million capita is much lower than the EU25 average. The indexed figure for the number of biotechnology patents per million capita varied (from three in 1994-1998 to 10 in 1998-2000 and to four in 2001-2003). There was no data for the number of start-up companies in the field of biotechnology in Lithuania.

Chart 3.4 Performance indicators for Lithuania's biotechnology knowledge transmission and applications (1994-1996, 1998-2000 and 2002-2004).



Source: BioPolis Research
Data: Science Citation Index

3.3 Industrial development

In the BioPolis project, three indicators are used for performance in industrial development: number of biotechnology companies pMC, number of Biotech IPOs pMC; and venture capital in EUR pC.

Lithuania has zero biotechnology IPOs pMC, while there are no data available in the sources used for the performance analysis for Lithuania's number of biotechnology companies pMC and venture capital in EUR pC. On the basis of a number of other sources, at least 11 biotech-active companies have been identified (see Section 1.1).

3.5 Market conditions

In the BioPolis project, two indicators are used for the performance in market conditions: approved biomedicines (1995-2002) and field trials (1996-2002). Lithuania did not have any records for either indicator.

4. Conclusions

4.1 Introduction

In this chapter, conclusions are drawn about the availability and characteristics of the generic and biotechnology-specific instruments through which the Lithuanian government has funded biotechnology research, technology transfer and commercialisation.

4.2 Public funding of biotechnology through policy instruments

Biotechnology research in Lithuania is funded through non-policy-directed and policy-directed instruments. Data on the amount of expenditures on biotechnology research through non-policy-directed mechanisms could not be retrieved.

Four policy-directed instruments that support biotechnology research in Lithuania have been identified: two generic and two biotech-specific. Biotechnology research was funded through these four instruments with a total budget of 9M EUR. There are no policy-directed instruments supporting commercialisation of biotechnology in Lithuania (see Table 4.1).

Table 0.1 Public funding of biotechnology, by non-directed, generic and specific instruments, in the period 2002-2005 (in M EUR)

	2002	2003	2004	2005	Total
RESEARCH					
1. *Non-policy-directed*					
Public research institutions		-	-	-	-
Response mode	NA	NA	NA	NA	-
Total	-	-	-	-	-
2a. *Policy-directed, Generic*					
National					
Development of social and economic infrastructure	NA	NA	NA	NA	4.27
Development of human resources	NA	NA	NA	NA	1.73
Regional	-	-	-	-	
Total	NA	NA	NA	NA	6.00
2b. Policy-directed, Biotech-specific					
National					
Supporting Lithuanian priority areas: genomics and biotechnology for health and agriculture	NA	0.23	0.23	0.23	0.68
Development of high technologies and biotechnologies	NA	0.77	0.77	0.77	2.32
Regional	-	-	-	-	-
Total	NA	1.00	1.00	1.00	3.00
COMMERCIALISATION					
1a. Policy-directed, Generic					
National	-	-	-	-	-
Regional	-	-	-	-	-
Total	-	-	-	-	-
1b. *Policy-directed, Biotech-specific*					
National	-	-	-	-	-
Regional	-	-	-	-	-
Total	-	-	-	-	-
OTHER					

	2002	2003	2004	2005	Total
1a. *Policy-directed, Generic*					
National	-	-	-	-	-
Regional	-	-	-	-	-
Total	-	-	-	-	-
1b. *Policy-directed, Biotech-specific*					
National	-	-	-	-	-
Regional	-	-	-	-	-
Total	-	-	-	-	-
GRAND TOTALS	NA	1.00	1.00	1.00	9.00

NA: Not available
Source: BioPolis Research

4.3 Specific features of the instruments

Table 0.2 gives an overview of the recipients of the four policy instruments in Lithuania in the period 2002-2005. All types of recipients mentioned – public research organisations (PRO), small- and medium-sized companies (SME) and large firms (LF) – are eligible to apply for each of the four instruments.

Table 0.2 Participants/recipients and co-financing requirements of policy-directed programmes that funded biotech activities in the period 2002-2005

Instrument	Funding agency	Participants/ Recipients			Financial contribution required (%)	
		PROs	SMEs	LFs	Recipients	Other public authorities
Generic						
Development of Human Resources	Ministry of Science and Education	√	√	√	NA	NA
Development of Social and Economic Infrastructure	Ministry of Science and Education	√	√	√	NA	NA
Biotech-specific	*Generic*					
Supporting Lithuanian priority areas: genomics and biotechnology for health and agriculture	Lithuanian State Science and Studies Foundation	√	√	√	NA	NA
Development of high technologies and biotechnologies	Lithuanian State Science and Studies Foundation	√	√	√	NA	NA

NA: Not Available
Source: BioPolis Research

4.4 Policy goals

Error! Reference source not found. shows the coverage of policy goals of three of the four instruments. For the fourth programme, data about the coverage of goals are not available.

The biotechnology-specific instruments cover the goal 'Stimulation of high level of biotechnology research'. The Development of Human Resources programme covers the policy goal 'Support the availability of human resources'.

Table 0.3 Coverage of policy goals and funding, by national policy-directed instruments, in the period 2002-2005 (M EUR)

	Policy goals									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Generic										
Development of Human Resources				√						
Development of Social and Economic Infrastructure	NA	NA	NA		NA	NA	NA	NA	NA	NA
Biotech-specific										
Genomics and Biotechnology for Health and Agriculture	√									
High Technology Development Programme - Biotechnology	√									
Total	3.00			1.73						

1 = High level of biotechnology research
2 = High level of industry-oriented (and applied) research
3 = Knowledge flow and collaboration among scientific disciplines
4 = Availability of human resources
5 = Transmission of knowledge from academia to industry and its application to industrial resources
6 = The adoption of biotechnology for new industrial applications
7 = Firm creation
8 = Social acceptance of biotechnology
9 = Business investment in R&D
10= Bio-safety, risk assessment
Source: BioPolis Research

4.5 Biotech research application areas

No data are available about the coverage of biotech research application areas by the four instruments.

4.6 Stimulation of biotech activities through the instruments

No data are available about the coverage of biotech activities by the four instruments.

5. Future developments

In 2000, a new Biotechnology Science Park was planned to be established in the Paneriu District in Vilnius, where the majority of Lithuania's biotechnological research institutions and industrial companies are located (the Institute of Biotechnology, Fermentas; the central offices and research centres of Biotechna, Biocentras, Biosinteze and Biok). This Biotechnology Science Park was scheduled to occupy an old building, with over 5 000 m^2 of floor space, previously belonging to the Institute of Biotechnology.

The aims of the Biotechnology Science Park included (EKT, 2004):

- To stimulate the exchange of information between universities and lend support and management expertise to research organisations and businesses;
- To stimulate innovations through business incubation and support;
- Toe establish and rent laboratories and research-related buildings.

Public support was expected to come from the Ministry of Economy and the government of the city Vilnius (Vilnius, 2005).

However, after five years these plans for the establishment of the biotechnology science park were still not implemented. According to a representative of the Ministry of Economy, the project has been recently revived and the park is now scheduled to be set up and operating sometime in 2007 (interview with Arunas Keraminas, 2006).

On the basis of the outcomes of the so-called 'National Potential Study' – a strategic analysis of the development of the biotechnology industry in Lithuania commissioned by the Ministry of Economy – the 'Programme on Development of Industrial Biotechnology in Lithuania in 2006-2010' was prepared. The Programme will deal with development of bio-resources for industrial biotechnology, biotechnological processes and potential products (Abraitis, 2006).

In March 2005, a new Science, Technology and Innovation Commission was established, created by merging two high-level policy advisory commissions: the Science and Technology Commission and the Education and the Science Commission to the Government of Lithuania. The new commission is chaired by the Prime Minister and is the highest-level policy coordination body, representing the science, education and business communities, as well as the government. The commission works on a regular basis and has a permanently functioning secretariat (Erawatch, 2006).

Annex 1 List of tables

Annex 2 List of figures and charts

Annex 3 List of contact persons

Violeta Vaiciuniene	Lithuanian State Science and Studies Foundation
Konstantinas Povilas	Valuckas Vilnius University
Algis Pauliukonis	Institute of Biotechnology
Arunas Keraminas	Ministry of Economy
Karina Firkaviciute	Ministry of Science and Education

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Annex 5 Performance

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

	Indicator	Chart	Comments	Time periods
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	BT 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 comparison	(2) 1998 (3) 2002

	Indicator	Chart	Comments	Time periods
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	2002
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[2]	2005
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 US data for comparison	1996-2001

[2] http://europa.eu.int/comm/public_opinion/archives/ebs/ebs_225_report_en.pdf

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 Charts in chapter 3

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
Lithuania	68	111	173	4	4	3
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
Lithuania	19	32	50	9	11	16
USA	454	492	529	208	172	166

* data for 2003 is used
Source: BioPolis Research
Publications: SCI
Population: EUROSTAT and OECD

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

	BT Publi-cations	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	na	na	na	na	na	na
Lithuania	173	na	na	na	na	na	na
USA	154402	na	na	na	na	na	na

Source: BioPolis Research
Publications: SCI
BT public expenditures in research: Inventory Project, Table 3.4 Executive Summary

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
Lithuania	68	111	173	957	1519	2351
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
Lithuania	7%	7%	7%	63	58	56

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
Lithuania	8.69	7.77	142	107
USA	6.39	8.54	104	117

Source: BioPolis Research
Citation: 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**	81316	552**	431
Lithuania	n.a.	n.a.	4*	3
USA	75253*	70950	276*	288
	Graduates pMC		**Index EU17=100**	
	1998 / 1999	**2002**	**1998**	**2002**
EU17	91**	189	100	100
Lithuania	n.a.	n.a.	n.a.	n.a.
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 3.2.1. Share of BT publications in subfields of total number of BT publications for the period 1994-1996

	1994-1996							
	Total	Plant	Health	Animal	Food	Indus-trial	Environ-mental	Generic
EU25	100%	8%	53%	5%	3%	1%	1%	30%
Lithuania	100%	3%	17%	1%	1%	1%	0%	76%
USA	100%	6%	56%	5%	2%	0%	0%	30%

Source: BioPolis Research
Publications: SCI

Raw data for Chart 3.2.2. Share of BT publications in subfields of total number of BT publications for the period 2002-2004

	2002-2004							
	Total	**Plant**	**Health**	**Animal**	**Food**	**Indus-trial**	**Environ-mental**	**Generic**
EU25	100%	7%	58%	5%	4%	1%	1%	25%
Lithuania	100%	10%	33%	4%	4%	2%	1%	47%

Source: BioPolis Research
Publications: SCI

Raw data for Chart 3.2.1 BT publications in subfields for the period 1994-1996

	1994-1996							
	Total	**Plant**	**Health**	**Animal**	**Food**	**Indus-trial**	**Environ-mental**	**Generic**
EU25	97217	7629	51944	4375	2434	624	576	29635
Lithuania	70	2	12	1	1	1	0	53
USA	111686	7118	62274	5580	2230	296	459	33729

Source: BioPolis Research
Publications: SCI

Raw data for Chart 3.2.2 BT publications in subfields for the period 2002-2004

	2002-2004							
	Total	**Plant**	**Health**	**Animal**	**Food**	**Indus-trial**	**Environ-mental**	**Generic**
EU25	140984	10494	81220	6821	5017	1162	1126	35144
Lithuania	172	17	56	7	7	3	2	80
USA	141680	7910	84234	6872	4070	436	724	37434

Source: BioPolis Research
Publications: SCI

Raw data for Chart 3.3. Growth rate of BT publications in subfields between 1994-96 and 2002-04

	1994-1996/2002-2004						
	Plant	**Health**	**Animal**	**Food**	**Industrial**	**Environ-mental**	**Generic**
EU25	38%	56%	56%	106%	86%	95%	19%
Lithuania	750%	367%	600%	600%	200%	100%*	51%
USA	11%	35%	23%	83%	47%	58%	11%

* The starting for Environmental in Lithuania was 0 in period 94/96; the growth rate was set to 100% independent from the number in period 2002/2004.
Source: BIOPOLIS Research
Publications: SCI

Raw data for Chart 3.4. BT Patents pMC: absolute and indexed values

	BT patents			Population (million)		
	94-96	**98-00**	**01-03**	**1996**	**2000**	**2003**
EU25	4924	8921	10119	447	451	455
Lithuania	1	7	3	4	4	3
USA	8590	14396	12348	264	276	292*
	BT patents/pMC			**Index**		
	94-96	**98-00**	**01-03**	**94-96**	**98-00**	**01-03**
EU25	11	20	22	100	100	100
Lithuania	0	2	1	3	10	4
USA	33	52	42	295	264	190

Source: BioPolis S Research
Publications: SCI
Patents: Questel Orbit

Raw data for Chart 3.4. BT Patents per BT publications: absolute and indexed values

	BT patents			BT publications		
	94-96	**98-00**	**01-03**	**94-96**	**98-00**	**01-03**
EU25	4924	8921	10119	97521	128716	140219
Lithuania	1	7	3	68	111	157
USA	8590	14396	12348	119802	135508	148853
	BT patents/ BT publications			**Index EU25=100**		
	94-96	**98-00**	**01-03**	**94-96**	**98-00**	**01-03**
EU25	0,05	0,07	0,07	100	100	100
Lithuania	0,01	0,06	0,02	29	91	26
USA	0,07	0,11	0,08	142	153	115

Source: BIOPOLIS research
Publications SCI
Patents Questel Orbit

Raw data for Chart 3.5. Number of BT companies pMC for the period 2001-2004: absolute and indexed values

	BT companies				Population in T			
	2001	**2002**	**2003**	**2004**	**2001**	**2002**	**2003**	**2004**
Europe	1879	1878	1861	1815	452016	452641	454580	456863
EU Available	1643	1650	1782	1605	319337	319484	408602	322210
Lithuania	n.a.	n.a.	n.a.	n.a.		3476	3463	3446
USA	1457	1472	1473	1444	285102	287941	290789	291685
	BT companies pMC				**Index**			
	2001	**2002**	**2003**	**2004**	**2001**	**2002**	**2003**	**2004**
Europe								
EU Available	5	5	4	5	100	100	100	100
Lithuania	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
USA	5,11045	5,1121 58	5,065 53	4,95 054	99	99	116	99

Note: EU Available is the result of the sum of available EU member states

Source: BioPolis Research
Biotech companies: E&Y Beyond Borders 2002, 2003, 2004, 2005, EuropaBio

Raw data for Chart 3.5. BT start-ups pMC for period 2001-2003 and year 2003: absolute and indexed values

	BT start-ups		Population in T	
	2001-2003	2003	2003	
Europe (EU 15 - Cyprus - Greece + Norway + Switzerland)	523	132	367051	
Lithuania	n.a.	n.a.	3463	
USA	355	83	290789	
	Biotech start-up/pMC	Index	Biotech start-up/pMC	Index
	2001-2003	2001-2003	2003	2003
Europe (EU 15 - Cyprus - Greece + Norway + Switzerland)	1,4	100	0,36	100
Lithuania	n.a.	n.a.	n.a.	n.a.
USA	1,2	86	0,29	79

Source: BIOPOLIS Research
Start-ups: EuropaBio

Raw data for Chart 3.5. Number of BT IPO's pMC: absolute and indexed values

	BT IPO	Population T				
	2002-2005	2002	2003	2004	2005	2002-2005
EU Available	29	452927	454869	457154	461593	456636
Lithuania	0	3476	3463	3446	3425	3452
USA	52	287941	290789	291685		290138

	IPO /pMC	Index
	2002-2005	2002-2005
EU Available	0,00	100
Lithuania	0,00	0
USA	0,00	282

Note: EU Available is the result of the sum of available EU member states
Source: BioPolis Research
IPO data: E&Y 2002-2005, London Stock Exchange, Frankfurt Stock Exchange, Euronext, Nasdaq, Burril & Company

Raw data for Chart 3.5. Venture capital pC: absolute and indexed values

	Venture capital in biotechnology companies M€			Population in T		
	2002	2002	2002	2002	2003	2004
Europe	1100	920	2800			
EU Available	890	883	1111	315584	319663	325131
Lithuania	n.a.	n.a.	n.a.	3476	3463	3446

USA	2288	2498	2855	287941	290789	291685
	Venture capital in €/pC			**Index**		
	2002	**2003**	**2004**	**2002**	**2003**	**2004**
Europe						
EU Available	2,8	2,8	3,4	100	100	100
Lithuania	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
USA	8	9	10	282	311	286

Source: BioPolis Research
VC data: E&Y Beyond Borders 2002, 2003, 2004, 2005

Raw data for Chart 3.6. Number of Biomedicines pMC

	Biomedicines	**Population (Million)**	**Biomedicines / pMC**	**Index**
	1995-2002	**2002**		**1995-2002**
EU15	39	378	0,10	100
Lithuania	na	3.4	na	na
USA	115	289	0,40	387

Note: EU 15 is the result of the sum of the 15 old EU member states
Source: BioPolis Research
Number of biomedicines: Benchmarking of public biotechnology policy 2005

Raw data for Chart 3.6. Number of field trials pMC

	Field trials	**Population in M**	**Field trials pMC**	**Index**
	1996-2001	**2001**	**1996-2001**	**1996-2001**
EU15	1334	379	4	100
Lithuania	na	3.5	na	na
USA	6745	278	24	688

Note: EU 15 is the result of the sum of the 15 old EU member states
Source: BioPolis Research
Field trials: Biotechnology Innovation Scoreboard 2002

Raw data for biotechnology acceptance. Data are mentioned in the text of Chapter 3.

BT Acceptance Index 2002		
	Index Average	**N (sample size)**
EU - 15*	100,29	16828
Lithuania	na	na

*Weighted Average according to the weight "W13" of the Eurobarometer 58.2, which considers population differences among countries and corrects for inconsistencies in the national samples
Source: BioPolis Research
BT acceptance index: Benchmarking of public biotechnology policy 2005

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EUROSTAT: http://epp.eurostat.cec.eu.int/

OECD Education Database: http://www.oecd.org/

OECD Statistics: http://www.oecd.org/

STN International: http://www.stn-international.de/

Questel Orbit: http://www.questel.orbit.com/index.htm

Annex 6 Abbreviations

LMS	Lietuvos Mokslininkų Laikraš Lithuanian Scientific Society
LSS	Lietuvos Valstybinis Mokslo ir Studijų Fondas Lithuanian State Science and Studies Foundation
IBT	Biotechnologijos Institutas Institute of Biotechnology