

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 Slovenia

BioPolis has been funded under FP6 funded, Priority 5: Food Quality and Safety
Contract No. 514174

Ralf Lindner
Fraunhofer Institute for Systems and Innovation Research (Fraunhofer ISI)
Karlsruhe, Germany

March 2007

Table of contents

Summary	3
1. Introduction and background	5
1.1 General introduction	5
1.2 Characteristics of the national S&T and the innovation system	6
1.3 National support and framework conditions for biotechnology	11
1.4 Main biotechnology research actors in Slovenia	12
2. Funding of biotechnology R&D, transfer and commercialisation	15
2.1 Introduction	15
2.2 Non-policy-directed funding of biotechnology research	16
2.3 Policy-directed funding of biotechnology research and commercialisation	16
2.3.1 Slovenian Research Agency (ARRS)	16
2.3.2 Ministry of the Economy (MG)	18
2.4 Charities	19
2.5 Participation in Sixth Framework Programme	19
3. Performance of the national biotechnology innovation system	20
3.1 Introduction	20
3.2 Performance in creating a knowledge base and supporting the availability of human resources	20
3.3 Performance in knowledge transmission and application.....	23
4. Conclusions	25
4.1 Introduction	25
4.2 Public funding of biotechnology through policy instruments.....	25
4.3 Specific features of the instruments	26
4.4 Policy goals	27
4.5 Biotechnology research application areas.....	28
4.6 Stimulation of biotechnology activities through the instruments	28
5. Future developments	29
Annex 1: List of tables	31
Annex 2: List of charts and figures	32
Annex 3: List of contact persons	33
Annex 4: References	34
Annex 5: Performance	35
Annex 6: Abbreviations	46

Summary

Slovenia has often been regarded as the economic front-runner of the countries that entered the EU in 2004. In fact, the southern Central European country mastered the transition process remarkably well and demonstrated sound macro-economic performance. Slovenia's GERD ranged between 1.52 and 1.55% of GDP during the period under review – the highest level of R&D expenditure of all new Member States. Moreover, the private sector's share of GERD equalled 60% in 2002, about five percentage points above the EU15 average.

Since the turn of the century, Slovenia's institutional landscape in science and innovation policy experienced numerous far-reaching organisational rearrangements, setting off serious problems of discontinuity and causing high transaction costs. Currently, the Ministry of Higher Education, Science and Technology, established in 2004, holds the most comprehensive responsibilities in the S&T policy area, followed by the Ministry of the Economy. Disagreements between these two ministries about competencies in innovation and technology policy caused a delayed start of the newly established Technology Agency (TIA) which has its focus on the application side of the innovation process. The belated start of the TIA, which was not fully operational until 2006, is particularly unfortunate because knowledge transfer and valorisation have been repeatedly identified as one of the major shortcomings of Slovenia's innovation system. At a strategic level, it could be observed that public promotion activities aiming to improve the processes of knowledge transmission, valorisation and commercialisation gained importance. Due to the aforementioned postponed start of the TIA, it is hard to tell if and when the new strategic priorities will materialise.

Biotechnology-related research is mainly performed in various research groups at the universities of Ljubljana and Maribor; in addition, non-university institutes such as the Institute Josef Stefan, the National Institutes of Chemistry and Biology and the Agricultural Institute of Slovenia contribute to the country's biotechnology knowledge base as well. The biotechnology industry consists of about a dozen, mainly small enterprises.

In comparative perspective, the Slovenian biotechnology research performs below the EU25 level in creating a knowledge base. However, the indicators presented in this national report show a stable upward tendency across the time periods covered.

The traditional strongholds in Slovenian biotechnology are plant and health biotechnology. The bibliometric analysis by and large confirms this pattern. Generally, all application areas experienced very strong growth rates during the period analysed; the areas with the most impressive expansion were food, health and industrial biotechnology.

The performance data in the area of knowledge transmission and application illustrate that Slovenia ranged far behind the EU25 levels. This low performance basically indicates that too few patents were applied for relative to scientific productivity. Despite life sciences, biotechnology and pharmaceutical research are among the scientific areas which Slovenian policy-makers consider to have high economic potential, no bio-

technology-specific programmes were offered during the reviewed period. Apart from lump sums for universities and research institutes, the most important source of policy-directed funding was the Slovenian Research Agency (ARRS). The ARRS promoted biotechnology-related research with a total sum of 12.52M EUR between 2002 and 2005. The Ministry of the Economy was operating a number of programmes aiming to foster entrepreneurship and competitiveness. Unfortunately, data indicating the biotechnology share of these activities are not available.

1. Introduction and background

1.1 General introduction

With a population of 1.99 million (2005), the Republic of Slovenia is one of the smallest nations in Europe. Together with nine other, mostly former Eastern block countries, Slovenia became a member of the EU in May 2004. Only thirteen years earlier, in June 1991, the country gained independence from Yugoslavia. Compared to other transition countries, the southern Central European country mastered the first years of economic transformation and the restructuring of its institutions remarkably well, without causing excessive economic and social imbalances (Šušteršič et al. 2005: 15)¹.

Between 1993 and 2003, the average rate of real economic growth was 3.8%; and during the period under review, the country's economic growth gained some momentum, achieving an average growth rate of 4.9%.² The mean rate of unemployment between 2002 and 2005 was 6.4%. All in all, Slovenia is considered to be the economic front-runner of the states that joined the EU in 2004. Due to its sound macro-economic performance, Slovenia will be the first new Member State to adopt the Euro in 2007.

As a typical small open economy, imports and exports contribute strongly to Slovenian GDP. However, immediately after its independence, Slovenia had to recover from the loss of markets in former Yugoslavia and the breakdown of many long established trade links to South Eastern Europe. In the meantime, European markets – particularly Germany, Italy, Austria and France – are the most important trading partners; and the EU15 accounts for roughly 60% of the country's total exports.³ Medical and pharmaceutical products hold a share of roughly 7% of total exports. The economy is gradually approaching the structure of advanced industrialised economies, as the importance of agriculture and industry are diminishing and the role of the service sector is growing. Additional efforts are needed with regard to business and financial services, as European standards yet have to be met (Pavlič Možina 2006: 57f.)⁴ In terms of contribution to total GDP, the largest sectors in 2004 were manufacturing (22.5%), real estate and renting (13.8%), wholesale, retail and certain services (10.1%) and transport, storage and communication (6.2%).⁵

Slovenia's gross expenditure on research and development (GERD) as a percentage of GDP ranges about 0.4 percentage points below the current EU25 level. In the years 2002 and 2003, Slovenian GERD reached 1.52%, after 1.55% in 2001. With this level of R&D expenditure the country fares quite well compared to most other new Member States. For

1 Šušteršič, J., Rojec, M., Korenika, K. (eds.) (2005) Slovenia's development Strategy, Ljubljana, Institute of Macroeconomic Analysis and Development

2 The macro-economic data are taken from Eurostat online sources, structural indicators, <http://epp.eurostat.ec.europa.eu>, accessed: 10-05-2006.

3 Statistical Office of the Republic of Slovenia, online source, <http://www.stat.si/> eng/index.asp, accessed 10-05-2006.

4 Pavlič Možina, S. (ed.) (2006) Facts about Slovenia. Ljubljana: Government of the Republic of Slovenia, Public Relations and Media Office

5 Business register of the Republic of Slovenia, cited in Pavlič Možina (2006: 70).

instance, the Czech Republic reported 1.26% GERD as a percentage of GDP, Estonia 0.82% and Poland 0.54% (all in 2003). According to a high level policy document, it is planned to increase public expenditures on R&D annually by 0.1% of GDP until 2010 (Republic of Slovenia 2005: 22)⁶. Nevertheless, due to stagnation in the growth of total R&D investments in recent years, meeting the Lisbon objectives by 2010 poses a real challenge. On a more positive note however, Slovenia's industry already contributes a relatively high share to total GERD. In 2002, the private sector's share equalled 60% of GERD, and government's expenditure for R&D amounted to 35.6% (EU15: 55.3% and 33.7% respectively). Of course, additional efforts have to be made if the Barcelona objective of 2/3 industry share of GERD is to be reached. Taken together, Slovenia's performance with regard to the overall level and the structure of its investments in R&D are largely in accordance with the EU average.

Information about Slovenia's biotechnology sector is not readily available. The University of Ljubljana hosts the largest number of research groups conducting biotechnology research in a broad range of departments. The University of Maribor is active in the biotechnology area as well, but with less personnel involved. In addition, several non-university institutes, such as the Institute Josef Stefan (biochemistry and molecular biology) or the National Institute of Chemistry, conduct biotechnology research. At the industry level, about a dozen of SMEs – mostly located in the Ljubljana area – are biotechnology companies. Their activities range from applied R&D, food quality and safety, (bio)pharmaceuticals to the production of biomedical and process equipment.

Traditional thematic strongholds are plant and health biotechnology. For instance, an important research area of the last few years has been the development of transgenic potatoes. At the Josef Stefan Institute, the country's largest public research institute, activities included research on protease inhibitors and neurodegenerative diseases. In the area of preservation biology, zoologists have started to establish a gene bank of indigenous animals.

1.2 Characteristics of the national S&T and the innovation system

Since the early 1990s, Slovenia's institutional landscape in science and innovation policy underwent numerous organisational changes, causing serious problems of discontinuity and entailing high transaction costs. Far-reaching reforms were initiated and/or implemented during the period under review. One of the most important statutes codifying the institutional arrangements and responsibilities is the Law on Research and Development which entered force in 2002.

⁶ Republic of Slovenia (2005) Reform Programme for Achieving the Lisbon Strategy Goals, Ljubljana. <http://www.sigov.si/zmar/aprojekt/alizb-strategija/alizb-strategija.pdf>, accessed: 11-05-2006

Ministries – distribution of S&T responsibilities

After the general election of 2000, the core responsibilities of the Ministry for Science and Technology were re-allocated.⁷ The competencies for science and research were assigned to the Ministry of Education, Science and Sport, and the technology portfolio was transferred to the Ministry of the Economy (MG). Important elements of the national innovation policy, including technology development and innovation support policies, became part of the MG.

Four years later, a newly appointed government re-established a ministry covering both science and technology. Since 2004, the new Ministry for Higher Education, Science and Technology (MVZT) carries the responsibility for a large part of Slovenia's S&T policies, including university education and certain technology development and innovation units which were previously assigned to other ministries. Despite the significantly extended competencies of the MVZT in the S&T field, the MG retained responsibilities for the promotion of entrepreneurship and specific aspects of innovation policy, including the support of technology centres, incubators and clusters.

An immediate negative side effect of the organisational changes was that the 2005 budget, which had been adopted by the previous government, had not allocated any funds for a ministry which was not yet established at that point. Due to complicated technicalities of the budget process, lengthy negotiations were necessary to make available a budget for the MVZT. As a consequence, new policy plans and strategic initiatives had to be postponed.

Intermediaries – the Slovenian Research Agency and the Technology Agency

An important element of Slovenia's quest to develop an effective institutional framework for the S&T field was the establishment of two intermediaries – one focusing on scientific research, the other on application-oriented technology development – to promote science and innovation and to administer public programmes. The rationale to remove various operational R&D promotion functions from the ministerial level was to guarantee professional and independent procedures as far as possible.

As stipulated by the Law on Research and Development of 2002, the Slovenian Research Agency (ARRS) supports science and research by orchestrating, managing and supervising national research programmes since 2004. In order to ensure professional and independent selection procedures of scientific projects, the ARRS is governed by its own board and scientific council. Certain functions, organisational units and most programmes which previously had been with the Ministry of Science, Education and Sport were re-assigned to the ARRS. Today, the agency is responsible to the MVZT. The ARRS is Slovenia's most important public investor in the area of scientific research.

The situation with regard to the second intermediary, the Technology Agency (TIA), which was founded in the same year as the ARRS, was a bit obscure during the initial

⁷ The following is largely based on European Commission (2005a: 6-8).

phase. Due to several delaying factors, TIA was not fully operational until 2006. After delays caused by leadership changes at the ministerial level, the establishment of an enlarged ministry for higher education and science entailed some conflicts with the MG about management responsibilities and competencies. The legal authority and management responsibilities over TIA were transferred from the MG to the newly established MVZT. However, the two ministries seemed to be in conflict over certain legal provisions, delaying the employment of staff, and the design of programmes.

The basic purpose of TIA is to foster the competitiveness of Slovenia's industry and the business sphere by supporting the development and realization of technologies and the application of knowledge. The emphasis of the activities lies on the so-called technology programmes which aim to promote the development of specific fields of technology or industry. The technology programmes are planned in cooperation with companies, knowledge creating institutions and the TIA. Running time will presumably range from three to five years. TIA finances 50% of the costs. Another central objective of TIA is to enhance the cooperation between the academic sphere and the business community.

As an attempt to make funding more accessible to SMEs, particularly during the early phases of their business development, the national government founded the Slovene Enterprise Fund (Slovenski podjetniški sklad, SEF). This national financial institution operates its own administrative board and supervisory committee, composed of representative from government and the business community. The SEF receives funding from the national budget. These sources represent the earmarked capital – equity of the fund. At the end of 2004, the equity amounted to a total of 43.9M EUR. Financial support ranges from granting favourable and direct loans to new companies to issuing guarantees for investments.

Another, though relatively small institution in Slovenia's funding landscape is the Slovenian Science Foundation (Slovenska znanstvena fundacija, SZF). The SZF was founded in 1994 by the Republic of Slovenia with the mission to advance the role of science in public life. Apart from funding made available directly to researchers, the SZF aims to foster international scientific cooperation and increase public awareness about scientific and technological developments. The foundation supports scientists mainly through grants to young researchers; private donations are the foundation's chief source of money.

Policy development and strategy

At the level of strategic policy development in the field of S&T, the National Science and Technology Council clearly represents the highest ranking advisory body in Slovenia's innovation system. Chaired by the Prime Minister, the Council is composed of each six members of the scientific and business communities, and one member each from the general public and the union representing the researchers. Ex-officio members are the Ministers of the MVZT, the MG and the Ministry of Finance, the presidents of the universities, of the Slovenian Academy of Sciences and Arts (SAZU) and of the chamber of commerce. The current composition of the Council was introduced with the Law on Re-

search and Development in 2002; the increased representation of the business community reflects the intention to better integrate the academic and the business spheres. In spite of this impressive high level membership, the policy impact of the Council has so far been rather disappointing (European Commission 2005a: 2)⁸. An institutional reform of this advisory body might follow the successful examples of Switzerland or Austria where high level policy advice is formulated by independent institutions – the Swiss Science and Technology Council and the Austrian Council for Research and Technology Development – which are composed of distinguished scientists and experts.

The main documents spelling out the national approach to science and innovation policy are the National Development Plan and the National Research and Development Programme. The current National Development Plan was adopted by the government in June 2005. Of the five central policy priorities specified, one is directly related to S&T. This development priority puts special emphasis on increased efficiency of public investments in science and technology and highlights the importance of knowledge transmission and valorisation. Among the technology areas that are considered to have high economic potential and thus justify special attention are information and communication technologies, nanotechnology, new materials, process and environmental technologies and biotechnology (Šušteršič et al. 2005: 30-34).

The National Research and Development Programme normally specifies Slovenia's science and research policies every five years. However, between 2000 and 2005 no such document had been prepared; a new Programme was adopted in January 2006 for the period 2006-2010. This National Research and Development Programme spells out the following research policy priorities: information and communication technologies, new materials and nanotechnology, complex systems and innovative technologies, technologies for sustainable economy, and health and life sciences.

Main research actors

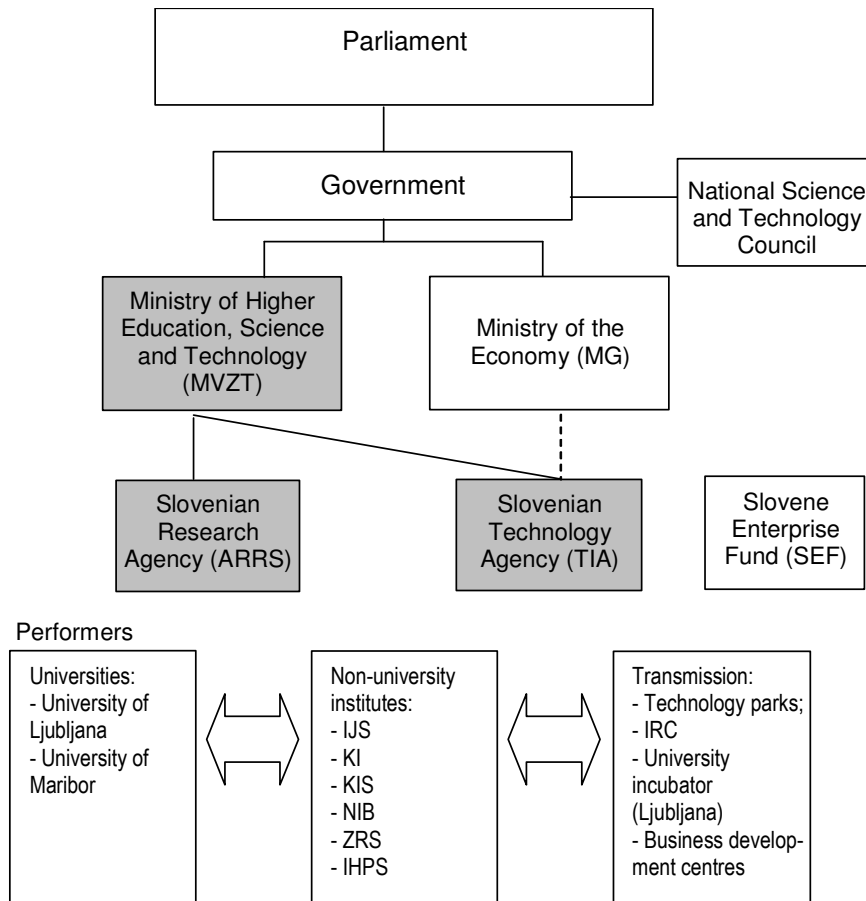
To a large extent, scientific research is conducted at Slovenia's universities. The University of Ljubljana with 255 research teams and the University of Maribor reporting 86 research teams are clearly the two largest academic institutions in the country. Newly established and considerably smaller are the University of Primorska in Koper and the University of Nova Gorica.

In addition, non-university research institutes contribute to the country's knowledge base with a comparable share as the university system. Slovenia counts 47 research establishments outside the universities, 15 of which have the status of public research institutes. Usually, about 20% of the research institutes' budgets are composed of lump sums provided by public sources. The Slovenian Academy of Sciences and Arts (SAZU) serves the national scientific community as an important network and information exchange platform, thereby also contributing to the development of different scientific disciplines.

⁸ European Commission, DG Enterprise (2005a) European Trend Chart on Innovation, Annual Innovation Policy Trends and Appraisal Report Slovenia 2004-2005, http://trendchart.cordis.lu/reports/documents/Country_Report_Slovenia_2005.pdf, accessed 09-02-2006

In addition to the research activities conducted at the universities and publicly funded institutes, more than 250 companies operate their own R&D units (Pavlič Možina 2006: 100f.).

Figure 1.1 Biotechnology promotion in Slovenia – institutional landscape



Source: BioPolis Research

With regard to the transmission of scientific knowledge to industrial application and marketable products and services, Slovenia has been quite active in setting up institutions to improve valorisation. In the past few years, technology parks – most notably the Technology Park Ljubljana –, university incubators, cluster initiatives and technology platforms have been established. These activities have been complemented by several business information offers such as development agencies, business development centres and innovation relay centres. Observers generally acknowledge the necessity to improve the application side of the innovation process, but it has also been criticised that the existence of a large number of different institutions will not automatically deliver the desired results (European Commission 2005a: 3).

Figure 1.1 gives an overview over Slovenia's public funding regime in the area of S&T and the main biotechnology research performers.

1.3 National support and framework conditions for biotechnology

Public promotion of biotechnology

National policies exclusively promoting biotechnology have not been implemented in Slovenia. However, since the mid 1990s, national S&T policy has repeatedly regarded life sciences, biotechnology and pharmaceutical research as scientific fields which are to be promoted with priority. Other promising fields identified by the national policy-makers are and have been nanotechnology and particularly information and communications technologies.

In recent years public funding of biotechnology experienced a shift from basic science to applied research. However, the reallocation of funds was not welcomed by every member of the scientific community.

Public acceptance

Public acceptance of life sciences and biotechnology in Slovenia by and large follows the broad patterns of the European public. Generally, the Slovenian population holds positive views on science and technology. According to a recent Eurobarometer (European Commission 2005b: 73-97)⁹ survey, Slovenes are quite receptive to the advances of scientific progress. The responses to a number of technology fields such as solar energy, nanotechnology or new medical technologies show conformity with the EU25 average. However, the data also reveal reservations regarding some technologies in controversial areas, including nuclear energy. The opinions on biotechnology and genetic engineering show solid support – 64% of the respondents believe that this technology will have positive effects (EU25: 65%). This attitude is contrasted by the pronounced scepticism towards genetically modified foods and agricultural products. When asked whether they would approve of the use of genetically modified crops, 53% of Slovenian respondents declared "never", compared to the EU25 average of 37%.

Regulatory framework

The Slovenian government generally recognises the importance of an effective biosafety framework. The regulatory system related to GMOs is largely based on the corresponding EC legislation and the Cartagena Protocol on Biosafety.¹⁰

In July 2002, the Management of Genetically Modified Organisms Act (GMO Act) was adopted, regulating the contained use, the handling and the deliberate release of GMOs into the environment. Other application areas of GMOs such as pharmaceuticals or food stuffs are dealt with separately by the following acts:

⁹ European Commission (2005b) Social Values, Science and Technology (Special Eurobarometer 225/Wave 63.1 – TNS Opinion & Social, Brussels, Directorate General Press and Communication

¹⁰ The following is largely based on Strel/Stanič Racman (2003).

- Pharmaceuticals containing GMOs are regulated by the Medicinal Products and Medical Devices Act of 1999; the authority enforcing the provisions is the Agency for Medicinal Products and Medical Devices under the Ministry of Health.
- Foodstuffs containing GMOs, their placement on the market and their import and export are dealt with by the Health and Hygiene Safety of Foods, and of Materials and Articles Intended to Come into Contact with Foods Act of 2002. Again, the regulatory authority is the Ministry of Health.

The following acts also demand compliance with some of the provisions of the GMO Act: the Forest Reproductive Material Act, the Agricultural Seeds and Propagating Material Act, Protection of New Varieties of Plants Act and the Act on Feeding Stuffs, all enforced by the Ministry of Agriculture, Forestry and Food.

With regard to intellectual property rights, the MG is enforcing the legal protection of biotechnological inventions as part of the efforts to harmonise national regulation with the EC and to encourage investment in biotechnology.

In the next few years, the government plans to further complement and institutionalise the national biosafety framework with regard to legal provisions and administrative procedures. For instance, risk assessment processes based on the GMO Act still need to be made operational.

1.4 Main biotechnology research actors in Slovenia

Research and development in the area of biotechnology is mainly the domain of two of Slovenia's four universities. The University of Ljubljana, the country's largest university, covers a broad range of different biotechnology areas. The research groups at the University of Maribor predominantly conduct biotechnology research within the faculties of agriculture and chemistry (see Table 1.1).

Table 1.1 Biotechnology-related research at Slovenian universities

University	Selection of departments/units
University of Ljubljana	Biotechnical Faculty <ul style="list-style-type: none"> - Centre for Plant Biotechnology and Breeding - Institute of Microbiology and Microbial Biotechnology - Chair of Biotechnology - Chair of Food Assessment - Biochemistry Research Group - Molecular Genetics and Microbiology Research Group - Agrobiotechnology
	Faculty of Chemistry and Chemical Technology <ul style="list-style-type: none"> - Chemical, Biochemical and Environmental Engineering - Chair of Biochemistry

University	Selection of departments/units
	Faculty of Medicine <ul style="list-style-type: none"> - Laboratory for Enzyme Research - Laboratory for Studies of Isoprenoid and steroid Biochemistry - Medical centre for Molecular Biology
University of Maribor	Faculty of Agriculture <ul style="list-style-type: none"> - Research group for biology and plant physiology
	Faculty of Chemistry and Chemical Engineering <ul style="list-style-type: none"> - Laboratory for Separation Process

Source: Slovenian Biosafety Clearing-House, see: <http://www.bch.bf.uni-lj.si/en/index.htm>, accessed: 13-06-2006; BioPolis Research

Table 1.2 Non-university biotechnology R&D

Research institutes (including National Research Institutes)
Institute Jozef Stefan <ul style="list-style-type: none"> - Biochemistry and Molecular Biology
National Institute of Chemistry <ul style="list-style-type: none"> - Laboratory for Biosynthesis and Biotransformation - Laboratory for Molecular Modelling and NMR - Laboratory of biotechnology
National Institute of Biology <ul style="list-style-type: none"> - Department of Genetic Toxicology and Cancer Biology - Department of Plant Physiology and Biotechnology
Agricultural Institute of Slovenia <ul style="list-style-type: none"> - Crop and Seed Production Department
Slovenian Institute for Hop Research and Brewing
Science and Research Centre of Koper <ul style="list-style-type: none"> - Institute for Mediterranean Agriculture and Olive Growing

Source: Slovenian Biosafety Clearing-House, see: <http://www.bch.bf.uni-lj.si/en/index.htm>, accessed: 13-06-2006; BioPolis Research

The non-university research institutes represent another important pillar in Slovenia's biotechnology research scene. The institutes with the largest biotechnology portfolios are the Institute Josef Stefan (IJS) and the National Institute of Chemistry (KI). In addition, the National Institute of Biology (NIB) hosts several research groups which conduct research related to biotechnology. The Agricultural Institute of Slovenia (KIS), the Slovenian Institute for Hop Research and Brewing (IHPS) and the Institute for Mediterranean Agriculture at Koper are active in plant and food biotechnology (see Table 1.2).

About a dozen Slovenian SMEs are conducting biotechnology-related research (see Table 1.3). Their research activities, products and services cover medical equipment and processes, food stuffs, pharmaceuticals, immunology, (cartilage) cell therapy and immunology. Large pharmaceutical companies in Slovenia have a strong focus on the production of generic medicinal products, which, in turn, is linked to a low share of genuine research

activities. One of the country's most important pharmaceuticals is the company Lek in Ljubljana which was bought by Sandoz in 2004. Thanks to the support of the government, the initial plans to shut down Lek's research laboratories were thus far not realised.

The Technology Park Ljubljana was quite successful to attract a small concentration of biotechnology SMEs, including BIA, Celica, Cosylab and Educell.

Table 1.3 Slovenian enterprises active in biotechnology-related areas

Company
BIA, Laboratory and process equipment company, Ltd.
BIA Separations L.t.d., Separations technology company
CELICA R & D, Manufacturing and Sales of Biomedical Equipment
EDUCELL cell therapy service Ltd. Ljubljana
EMONA - Nutrition Research & Development Department
– Nutrition Research & Development Department
Krka, tovarna zdravil, d.d., Novo Mesto (Slovene)
– Research and Development Division
Krka, tovarna zdravil, d.d., Novo Mesto (Slovene)
– Sektor biokemija, Služba za tehnološki razvoj
Lek Pharmaceutical Company d.d.
– Research and Development Division
Mlinotest, zivilska industrija, d.d. (Slovene)
– Biotechnology Department
Pinus, tovarna kemskih izdelkov, d.d. (Slovene)
– PINUS - Research and Development
Semenarna Ljubljana, proizvodnja in trgovina, d.d. (Slovene)
– Biotechnology center
Transcell
Maribor Veterinary Hospital
– Maribor Veterinary Hospital - Biotechnology Research Centre

Source: Slovenian Biosafety Clearing-House, see: <http://www.bch.bf.uni-lj.si/en/index.htm>; BioPolis Research

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

2.1 Introduction

This report reviews the funding of biotechnology research and commercialisation. A distinction is made between policy-directed funding and non-policy-directed funding of biotechnology.

Policy-directed funding includes funding which was directed by an explicit policy decision to establish 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. Policy-directed funding may include biotechnology specific 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 programme 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 public research institutes, the open-call system of research councils etc. Research councils, research institutes and public research institutes develop their own programmes through which biotechnology may be supported. In the BioPolis project only the funds for block grants to (public) research institutes and through the open-call systems 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 activities are presented. The data were collected through desk research (publications, documents, websites of national and regional public funding organisations and/or governmental departments), surveys of representatives of funding organisations that manage the generic and biotech-specific programs and interviews with representatives of organisations that are involved in non-policy-directed and policy-directed funding. The funding organisations' website addresses and the names of contact persons that have kindly participated in the survey and/or have been interviewed can be found in Annex 3 (List of Contact Persons) and Annex 4 (References). Section 2.2 describes the non-policy-directed funding and section 2.3 the policy-directed funding. Charities do not play an important role in the funding of biotechnology research in Slovenia; the only charity that is active in the promotion of science will be briefly discussed in section 2.4. The final

section of this chapter provides a short overview over Slovenia's participation in the Sixth European Framework Programme.

2.2 Non-policy-directed funding of biotechnology research

The Slovenian Research Agency (ARRS) offers an avenue for funding that can be defined as non-policy-directed due to its chiefly bottom-up, open call approach.

The funding instrument Research Projects (Raziskovalni projekti, RPROJ) supports both individual scientists and research groups. Funding is made available for basic, applied and post-doctoral research. Basic research projects may be funded up to 100% of the eligible project costs, whereas applied projects need to obtain at least 25% third-party funding. The total annual budget for RPROJ amounted to 14.59M EUR in 2002 and increased to 21.47M EUR in 2005. The share of projects related to biotechnology also increased significantly during this period, from about 1.6% in 2002 to 2.9% in 2005.

Table 2.1 Non-policy-directed funding of biotechnology research

Funding organisation	Public Research Institutions / Response Mode programs	Period	Funds in M EUR
ARRS	Research Projects RPROJ	2002-2005	1.7
Total			1.7

Source: BioPolis Research

2.3 Policy-directed funding of biotechnology research and commercialisation

Public funding for R&D is mainly the domain of the Ministry of Higher Education, Science and Technology (MVZT) – largely mediated through the Slovenian Research Agency (ARRS) – and, to a lesser extent, the Ministry of the Economy (MG). Due to the initial difficulties in establishing the Slovenian Technology Agency (TIA), the application-oriented agency was not fully operational during the period under review (see chapter 1.2). Biotechnology-related research mandated by the ministries of the relevant policy areas (health, agriculture, food, environment) has not been identified. The support provided to newly founded SMEs by the Slovene Enterprise Fund (SEF) is generally available to companies in all business areas. However, between 2002 and 2005, the SEF did not report any clients with a business model related to biotechnology.

2.3.1 Slovenian Research Agency (ARRS)

The ARRS implements the bulk of public instruments intended to promote scientific research. Most of the agency's programmes are designed and administered in close cooperation with the Ministry of Higher Education, Science and Technology (MVZT). The MVZT operates a small number of programmes without engaging an intermediary, but none of these have been relevant for research funding related to biotechnology. Slove-

nia's chief funding agency in the area of scientific research supported biotechnology through one non-policy-directed instrument and three policy-directed generic funding instruments; the agency did not offer any biotechnology-specific instruments during the period under review.

The instrument Research Programmes (Raziskovalni programi, RPROG) supports comparatively broad, long-term research projects, usually involving more than two project applicants. Other than in the case of the Research Projects (RPROJ), the Research Programmes are confined to those research topics that have been defined as a national priority in the official National Research and Development Programme. Within these thematic limits, the application procedure follows an open-call (bottom-up) approach.

The annual budget made available within RPROG amounted to 42.76M EUR in 2002 and was gradually increased to 49.52M EUR in 2005. The biotechnology share of the total programme expenditures remained quite stable with 2.4% to 2.6%. The total amount spent for biotechnology between 2002 and 2005 was 4.84M EUR.

In 2001, the ARRS introduced the Target Research Programmes (Ciljni raziskovalni program, CRP). This instrument supports inter-sectoral, networked R&D projects in specific areas of public interest. The research themes and priorities, which have to be based on the recommendations of the National Development Strategy, are determined by the ministries involved. As such, the CRPs have to be understood as a tool to operationalise the Slovenian national development strategy.

In the period under review, biotechnology-related research was supported by the CRP programme line with a total of 1.37M EUR or 12.9% of the total programme expenditures. Most of the funding was directed towards plant biotechnology, followed by food biotechnology.

The ARRS supports the training of young researchers – mainly doctoral students – in research institutions and universities through the Young Researchers Programme (Program mladih raziskovalcev); the agency thereby aims to increase the number of available research staff, enhance the research capacity of groups carrying out publicly funded research projects, and to generally increase the available human capital. Funds for the training of the young researchers are allocated for a fixed-term, up to a maximum of four and a half years for a science PhD programme. The average annual grant for one young researcher amounts to 30 000 EUR.

Between 2002 and 2005, the ARRS spent 98.14M EUR for the scientific training of young researchers. About 6.4% of the total sum or 6.3M EUR was allocated to researchers focusing on projects related to biotechnology.

2.3.2 Ministry of the Economy (MG)

The funding activities of the Ministry of the Economy focus on the promotion of entrepreneurship and competitiveness. The emphasis on economic efficiency, growth and international competitiveness has to be understood as an integral element of the National Development Policy. On the operational level, the policy priorities are carried out through three basic programme lines, each of which augmented by sub-programmes and measures:

- Knowledge for Development: This programme line aims to improve the knowledge flow from universities and research institutes to the applied side of the innovation process. An additional goal of the programme is to increase international R&D co-operation and the mobility of researchers.
- Improving Enterprises' Competitive Capacity: The programme line intends to strengthen a broad range of factors which are believed to create competitive advantages, e.g. investment in technologies and innovation, internationalisation, improved productivity and the development of clusters.
- Promoting Entrepreneurship and Utilising Entrepreneurial Opportunities: The third programme line has the objective to facilitate the founding of new enterprises by creating a supportive, business-friendly environment.

Between 2002 and 2005, the MG made available nearly 80M EUR for the three programme lines. The programmes with the highest relevance for biotechnology during this time period were Knowledge for Development with its goals to improve knowledge transmission, and Improving Enterprises' Competitive Capacity with the special foci on promoting business investments in innovation and the development of clusters. Unfortunately, data indicating the respective biotechnology shares of these instruments are not available.

Table 2.2 National public policy-directed biotechnology stimulating instruments during the period 2002-2005

Instrument	Funding organisation	Budget in M EUR	% of total	Use of DF/SF
National				
<i>Generic</i>				
RPROG	ARRS	4.84	38.7	
CRP	ARRS	1.37	10.9	
Young Researchers Programme	ARRS	6.31	50.4	
Total		12.52	100	

Source: BioPolis Research

2.4 Charities

Charities aiming to promote biotechnology – either specifically or at least with considerable funds – have not been identified. The only non-profit organisation that promotes science and technology and is predominantly financed by private sources is the Slovenian Science Foundation (SZF). However, the SZF's supports science mainly through networking and communication activities. Expenditure data on the grants provided to (young) researchers are not available.

2.5 Participation in Sixth Framework Programme

Slovenian researchers have been involved as regular team members in FP 6 projects related to biotechnology/life science and, to a lesser extent, in the area of food quality and safety. The participation in both areas represents less than 1% of the European totals. The participation of Slovenian researchers in the position of project coordinators has not been reported.

Table 2.4 Slovenian involvement in biotechnology/life sciences programmes of the Sixth Framework Programme

Sixth Framework Programme¹	Participation as coordinator	Participation as member of the project team²
Thematic priority		
1. Life sciences, genomics and biotechnology for health	0	47 (0.6%)
2. Nanotechnologies, section biotechnology	0	0
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 participation

Source: BioPolis Research

3. Performance of the national biotechnology innovation system

3.1 Introduction

This chapter analyses the performance of the Slovenian 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. In order to avoid capturing erratic trends, each time period includes several years. National trends are benchmarked against the performance of the EU Member States and the US.

The presentation of the performance is structured along two main areas of the innovation system: the knowledge base and processes of knowledge transmission and application. Unfortunately, performance data for industrial development and market conditions were not obtainable for Slovenia. For the two available areas, data are shown for a number of different indicators for Slovenia, the USA and EU25 (or EU15). The EU-values 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 given 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 and provides additional background information.

As Slovenia is a new Member State of the EU, the performance data presented in this report should be treated with additional 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, for instance, Slovenian scientists have a tendency to publish in journals in languages that are not covered by the SCI. Moreover, lack of patent data may reflect failure by the national patent system or in its implementation to meet international standards.

3.2 Performance in creating a knowledge base and supporting the availability of human resources¹¹

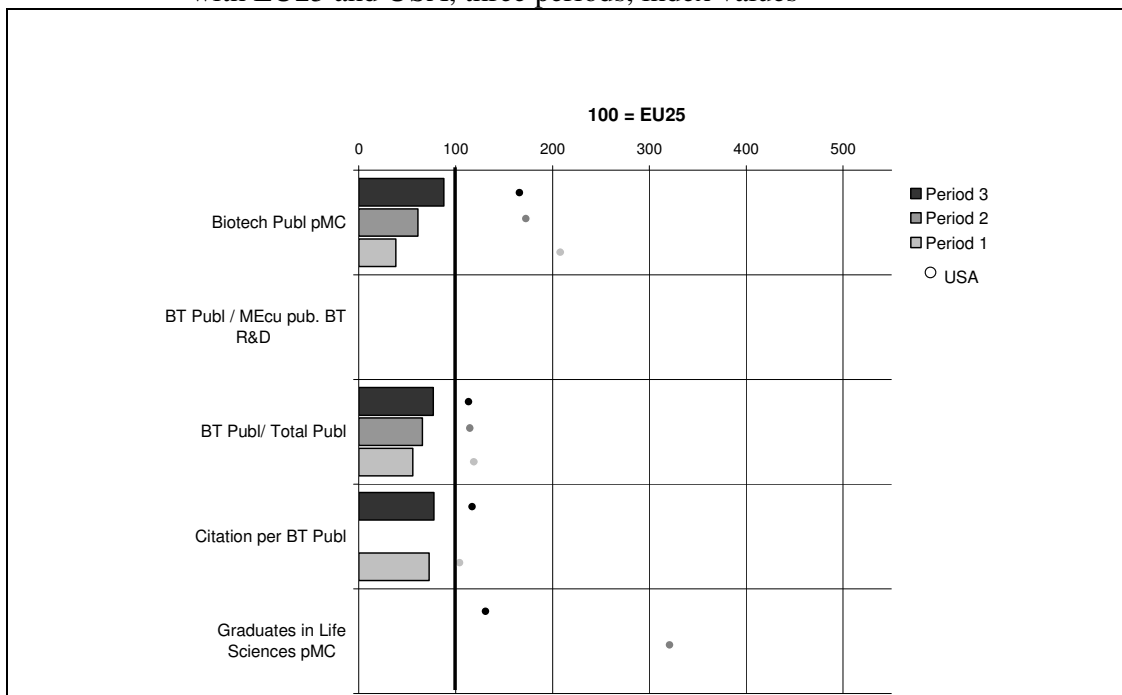
The performance indicator biotechnology publications pMC shows that Slovenia's biotechnology scientists have been catching to the European level at a fast pace. During the first time period (1994-1996), Slovenia reached less than 40% of the EU25 level. But already in the third time period (2002-2004), the publication activities came close to 90% of the EU25 stage.

A steady upwards trend can be observed with regard to the biotechnology share of the country's total publication activities as well. Between the first and the third time period, the share of biotechnology publications increased from 6% to 10%. At the level of the EU25, the share during the time period 2002-2004 was 13%.

¹¹ Performance data for biotechnology publications per public expenditure on biotechnology R&D and graduates in life sciences pMC are not available for Slovenia.

Judging from the citation rates, the quality of Slovenian biotechnology publications also ranges below the EU25 level; however, the comparison of two time periods reveals a slight upward tendency. Slovenia holds a position in the lower third of all countries covered, far behind top performers such as Iceland, Ireland or Switzerland. Within the group of new Member States, the Slovenia ranks above Poland and Slovakia, but below Estonia and Hungary. Nonetheless, in the case of Slovenia, this indicator should be interpreted with caution as the applied calculation method tends to depreciate large countries with a high number of total publications, resulting in a so-called "small country effect".¹²

Chart 3.1 The biotechnology knowledge base indicators for Slovenia, comparison with EU25 and USA, three periods, index values

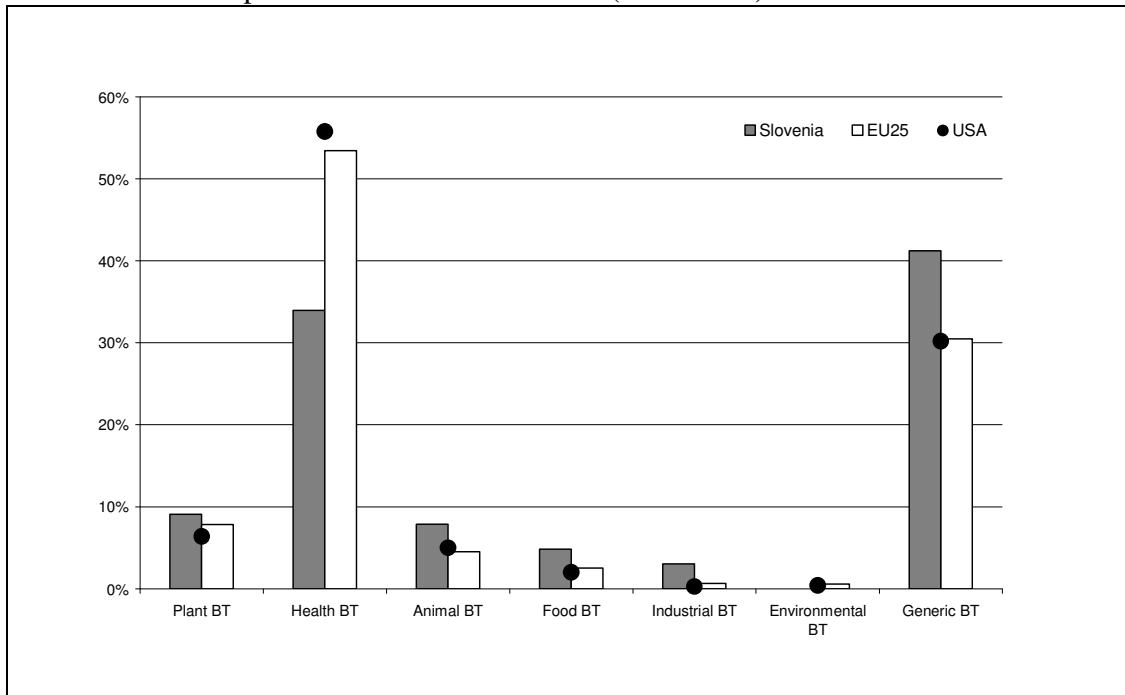


Source: BioPolis Research

The analysis of Slovenian publication activities clearly shows that health and generic biotechnology are the by far most important application areas in the Slovenian research science. Between the two time periods covered (1994-1996 and 2002-2004), the share of health biotechnology slightly increased from 34% to 40%, whereas generic biotechnology lost some of its prominence as its share declined from 41% to 33%. The relative strength of all other subfields remained largely stable over the two time periods. Compared with the two reference regions, Slovenian publication activities show some deviation from the EU25 and US patterns. For instance, the share of health publications in Slovenia is about 20 percentage points lower than in the reference regions; in turn, Slovenia's share of generic biotechnology publications is about ten percentage points higher than in the EU25 and the US.

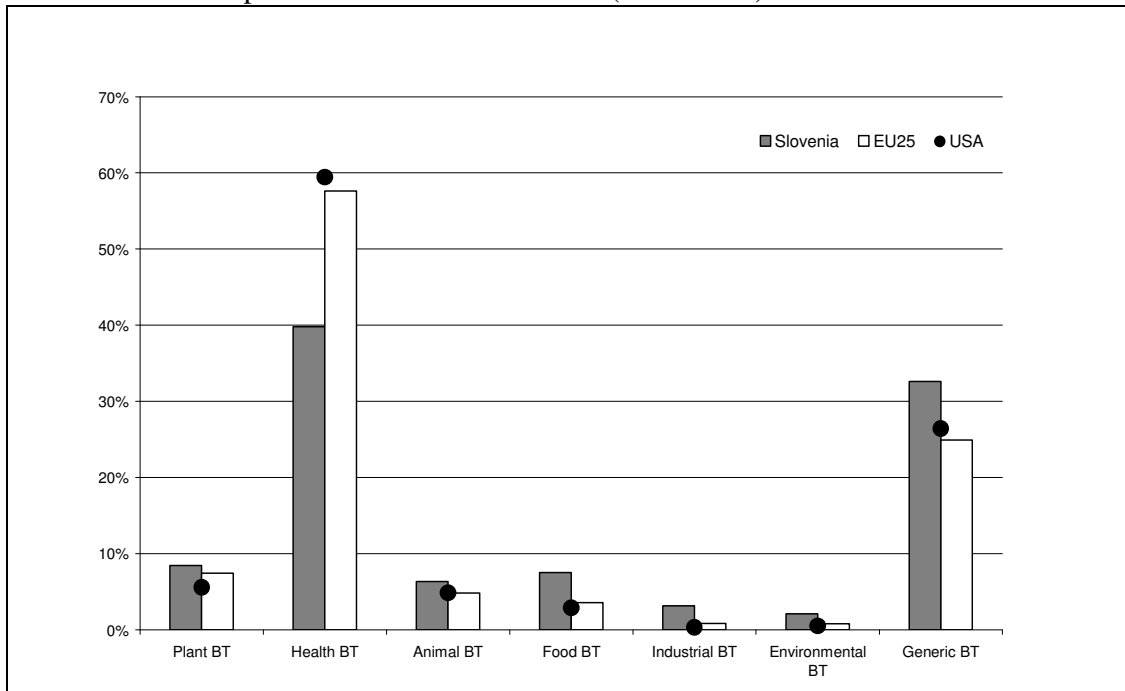
¹² See Annex 5, indicator 5.

Chart 3.2.1 Share of subfields (in %) of total biotechnology publication for Slovenia in comparison with EU25 and USA (1994-1996)



Source: BioPolis Research

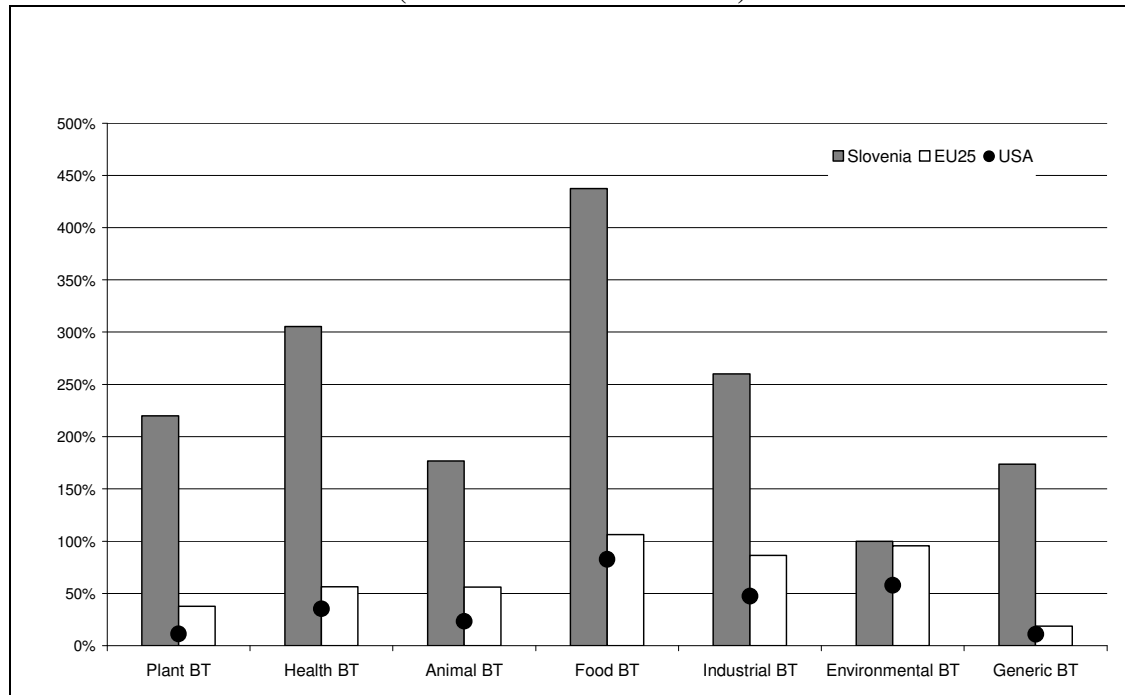
Chart 3.2.2 Share of subfields (in %) of total biotechnology publication for Slovenia in comparison with EU25 and USA (2002-2004)



Source: BioPolis Research

Between 1994-1996 and 2002-2004, Slovenia showed impressive growth rates of publication activities in all biotechnology subfields, exceeding the EU25 in all but one subfield by far. The strongest growth was measured in food (+ 438%), health (+ 305%) and industrial (+ 260%) biotechnology. Of course, apart from the health area, the growth occurred from very low starting points.

Chart 3.3 Biotechnology subfields growth rates for Slovenia in comparison with EU25 and USA (1994-1996 and 2002-2004)



Source: BioPolis Research

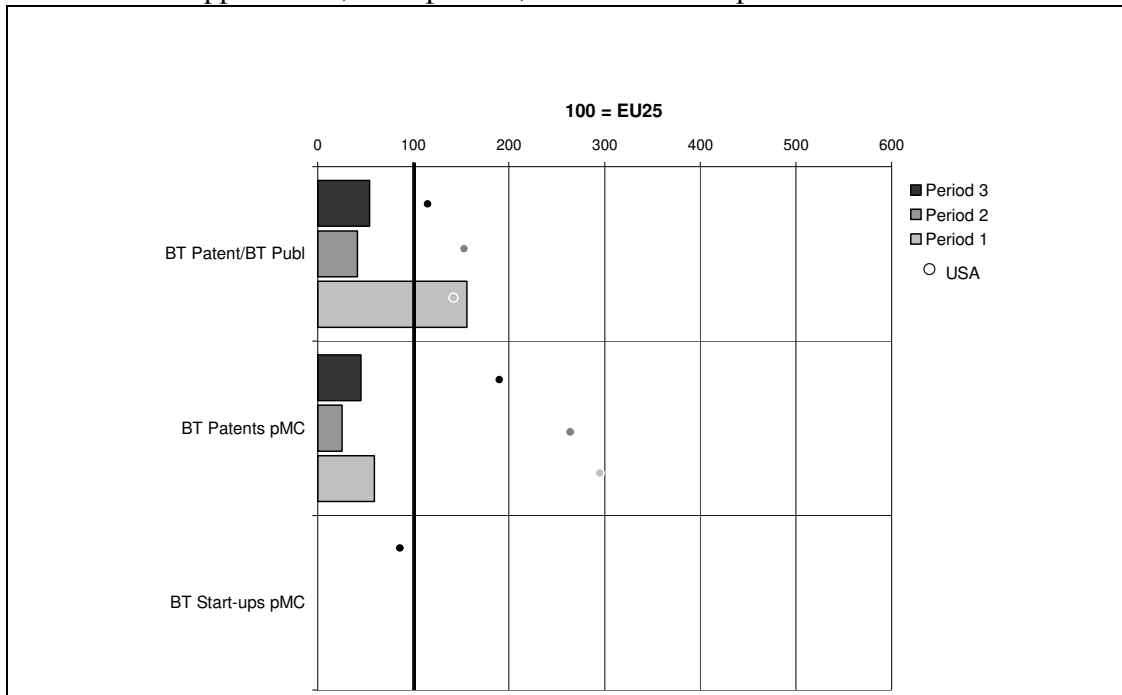
3.3 Performance in knowledge transmission and application¹³

The first of the two indicators which inform about a country's performance with regard to knowledge transmission and application – biotechnology patents per biotechnology publications – shows that Slovenia ranged far behind the EU25 level in all but one of the three time periods covered. Only in the first period (1994-1996), Slovenia outperformed EU25. A closer look at the data reveals that in absolute terms, the number of biotechnology patents increased from 13 to 20 between the first and the third time period, whereas the total number of publications more tripled during this time span.

The second indicator – biotechnology patents pMC – underscores the problem of Slovenia's small number of biotechnology patents. In the period 2001-2003, Slovenia reported ten biotechnology patents pMC, twelve less than the EU25 (pMC). However, 18 European countries – including Italy and Spain – show even lower performance rates.

¹³ Performance data for biotechnology start-ups pMC are not available for Slovenia.

Chart 3.4 Performance indicators for biotechnology knowledge transmission and applications, three periods, Slovenia in comparison with EU25 and USA



Source: BioPolis Research

4. Conclusions

4.1 Introduction

This concluding chapter provides an overview over the main characteristics of the policy-directed instruments that have been operated by the Slovenian government in the period 2002-2005 to stimulate biotechnology R&D, technology transfer and commercialisation, including research on social, ethical and legal aspects of biotechnology. The overview summarises the funding of biotechnology in terms of the types of policy instruments used, the policy goals addressed, the research application areas funded and the activities that are stimulated.

Table 4.1 summarises the public expenditure totals for the period 2002-2005 by two main categories (research and commercialisation). In addition, totals for sub-categories such as generic and specific funding schemes are listed. The ensuing Table 4.2 gives information about the main recipients of the promotion activities. Tables 4.3 through 4.5 provide overviews over the policy goals, the biotechnology application areas and the activities covered by each of the policy instruments that have been relevant for biotechnology promotion activities between 2002 and 2005. While the shown funding patterns for the policy goals, application areas and activities deliver useful indications of priorities, promotional styles and perhaps certain lacunae, the aggregated budgets for each of the categories should be interpreted with due caution. In most instances, the reported budget shares had to be based on informed approximations of the programme officers of the funding agencies and ministries because the BioPolis classifications are not in accordance with the internal accounting and budgeting systems of the institutions providing the funding data. Furthermore, particularly with regard to Table 4.5 (coverage of biotechnology activities), the reported funding totals tend to be sketchy because making coherent assignments of specified budgets for individual activities was not always feasible.

4.2 Public funding of biotechnology through policy instruments

In the period 2002 until 2005, public institutions promoted biotechnology related activities in Slovenia with a total sum of 14.2M EUR. The largest share – 78.2% – of the funds was spent through generic policy-directed instruments guided towards research. Non-policy-directed research funding accounted for roughly 12% of the total. However, unconditional lump sums given to public research institutes are not included in this category due to the lack of data. Similarly, the low share of funding devoted to commercialisation (5.6%) has to be interpreted with caution because the leading ministry for these promotion activities did not provide the relevant information.

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

	Total
RESEARCH	
1. Non-policy-directed	
Response Mode	1.68
Total	1.68
2. Policy-directed Generic	
National	11.11
Total	11.11
COMMERCIALISATION	
1. Policy-directed Generic	
National	0.79
Total	0.79
OTHER	
National	0.62
Total	0.62
GRAND TOTALS	14.2

Source: BioPolis Research

4.3 Specific features of the instruments

Table 4.2 indicates that the three Slovenian policy-directed instruments promoting biotechnology provide support for public research organisations as well as for the business sector. Based on the information presented in Table 4.2, funding gaps or excessive duplication with regard to funding opportunities for the different types of applicants cannot be observed.

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 (%)	
		PROs	SMEs	LFs	Recipients	Other public authorities
National						
<i>Generic</i>						
Targeted Research Programmes (CRP)	ARRS	√	√	√		
Research Programmes (RPROG)	ARRS	√	√			
Young Researchers Programme	ARRS	√				

Source: BioPolis Research

4.4 Policy goals

According to Table 4.3, Slovenian policy-directed instruments promoting biotechnology cover eight of the ten policy goals. Judging from the funding amounts distributed across these eight policy goals, the support of high level biotechnology research (policy goal 1) is the by far most important funding priority in Slovenia's biotechnology promotion strategy. Over 50% of the total expenditures are allocated in favour of this policy goal. The policy goals with the second and third largest allotments are the availability of human resources (4) and biosafety and risk assessment (10), backed with 30.9% and 4.2% of the total expenditures respectively. The policy goals with the lowest funding shares are social acceptance of biotechnology (8) and the adoption of biotechnology for new industrial applications (6). The policy goals firm creation (7) and encouraging business investment in R&D (9) were not covered by any of the instruments.

Table 4.3 Coverage of policy goals and funding by goal by policy-directed instruments in the period 2002-2005 (in MEUR)

	Policy goals									
	1*	2	3	4	5	6	7	8	9	10
National										
<i>Generic</i>										
Targeted Research Programmes (CRP)		√	√		√	√				√
Research Programmes (RPROG)	√		√	√	√			√		√
Young Researchers Programme	√			√						
Total	6.3	0.41	0.52	3.88	0.51	0.27	–	0.1	–	0.52
% of Total	50.4	3.3	4.1	30.9	4.1	2.2	–	0.8	–	4.2

* Legend:

1 = High level of biotechnology research

6 = The adoption of biotechnology for new industrial applications

2 = High level of industry-oriented (and applied) research

7 = Firm creation

3 = Knowledge flow and collaboration among scientific disciplines

8 = Social acceptance of biotechnology

4 = Availability of human resources

9 = Business investment in R&D

5 = Transmission of knowledge from academia to industry and its application to industrial resources

10 = Bio-safety, Risk assessment

Note: The figures in this table should be read as merely indicative of the relative expenditure allocated to the various policy goals. Since many goals overlap in one instrument, the split of expenditure between goals is only a rough estimate and/or informed guess. On the other, it is important to bear in mind that instruments of some goals (e.g., social acceptance programmes) may require less expenditure than others even if they are set as a policy priority.

Source: BioPolis Research

If the individual expenditures for policy goals are grouped into the five policy areas defined by BioPolis¹⁴, policy areas 1 and 2 are supported unevenly. About 89% of the ex-

¹⁴ The policy area 1 "creation of knowledge base and human resources" is composed of policy goals 1 to 4, policy area 2 "knowledge transfer and application" includes policy goals 5 to 7 and 9. The remaining policy goals 8 and 10 constitute policy areas of their own.

penditures are directed towards the creation of a knowledge base, whereas policy area 2 (knowledge transfer and application) receives merely 6.3% of the funds.

4.5 Biotechnology research application areas

Table 4.4 indicates that research related to health biotechnology receives the most funding – more than 22% of the total expenditures are directed towards this application area. Plant biotechnology is supported with the second (18.2%) and promotion activities of basic biotechnology received the third largest share (16.3%). The application area that is supported with the smallest funding amount is industrial biotechnology. Activities relating to social acceptance of biotechnology were not covered by any of the three policy-directed instruments.

This distribution of funds across the application areas confirms the general output performance pattern presented in chapter 3.2.

Table 4.4 Coverage of biotech application areas and funding through policy-directed instruments by biotech application area in the period 2002-2005 (in M EUR)

	Biotechnology application areas								
	1*	2	3	4	5	6	7	8	9
National									
<i>Generic</i>									
Targeted Research Programmes (CRP)	√	√	√	√	√	√			
Research Programmes (RPROG)	√	√		√	√		√		√
Young Researchers Programme	√	√	√	√	√		√		
Total	2.28	1.73	0.77	2.82	1.88	0.14	2.04	–	0.87
% of Total	18.2	13.8	6.1	22.5	15	1.1	16.3	–	6.9

* Legend:

1 = Plant biotechnology

4 = Health biotechnology

7 = Basic biotechnology

2 = Animal biotechnology

5 = Food biotechnology

8 = Ethical, legal, social aspects of biotechnology

3 = Environmental biotechnology

6 = Industrial biotechnology

9 = General

Note: Figures in the table should be understood as rough estimates of expenditure in a given application area.

Source: BioPolis Research

4.6 Stimulation of biotechnology activities through the instruments

According to the data presented in Table 4.5, the top three activities of the instruments included in the BioPolis survey are the support of basic research (activity 1), biotechnology training (6) and applied research (2). Those activities with the lowest shares of funding are the support of research networks (4), the mobility of researchers among scientific

disciplines (5) and providing grants for industrial research (17). The activities 9 to 16, 18 and 19 were not covered by any of the policy-directed instruments.

Table 4.5 Coverage and funding of biotech activities in the period 2002-2005 through policy-directed instruments (in M EUR)

	Biotechnology activities							
	1*	2	4	5	6	8	17	19
National								
<i>Generic</i>								
Targeted Research Programmes (CRP)		√	√	√		√	√	
Research Programmes (RPROG)	√	√						
Young Researchers Programme	√				√			
Total	7.03	1.86	0.14	0.07	3.15	0.2	0.07	–

* Legend

- | | |
|---|---|
| 1 Basic research | 11 Science and technology park |
| 2 Applied research | 12 Protection of IPR in public research organisations |
| 3 Centres of excellence | 13 Financial support for start-ups |
| 4 Research network | 14 Non-financial support for start-ups |
| 5 Mobility of researchers among disciplines | 15 Creation of incubators |
| 6 Biotechnology training | 16 Awareness of biotech by companies not yet active in it |
| 7 Mobility of researchers between academia and industry | 17 Grants for industrial research |
| 8 Collaborative research between industry and public research organisations | 18 Other incentives for business investment |
| 9 Set up research institute/centre of industrial interest | 19. Support for public discourse activities |
| 10 Technology transfer office | |

Note: Figures in the table should be understood as rough estimates of expenditure for a given activity.

Source: BioPolis Research

5. Future developments

Major changes in the Slovenian biotechnology landscape are not to be expected in the next few years. Life sciences, biotechnology and pharmaceuticals will most likely remain on the policy-makers' short list of scientific areas that are to be supported with priority. Even so, the development of promotion instruments aiming to specifically foster biotechnology R&D is currently not on the agenda.

Additional effort will most likely be invested in the application side of the innovation process and the valorisation of scientific knowledge. A number of high level policy documents – notably the National Development Plan – have already identified the commercialisation of research results as a major deficit in Slovenia's innovation system; consequently, first steps have been taken to improve the cooperation between science and business, and with a fully operational TIA the implementation of application-oriented projects will be facilitated. The next few years will show whether Slovenia's innovation system will move in the desired direction.

Annex 1 List of tables

Table 1.1	Biotechnology-related research at Slovenian universities.....	12
Table 1.2	Non-university biotechnology R&D	13
Table 1.3	Slovenian enterprises active in biotechnology-related areas.....	14
Table 2.1	Non-policy-directed funding of biotechnology research.....	16
Table 2.2	National public policy-directed biotechnology stimulating instruments during the period 2002-2005	18
Table 2.4	Slovenian involvement in biotechnology/life sciences programmes of the Sixth Framework Programme	19
Table 4.1	Public funding of biotechnology through non-policy-directed and policy-directed instruments in the period 2002-2005 (in M EUR)	26
Table 4.2	Participants/recipients and co-financing requirements of policy-directed programs that fund biotech activities in the period 2002-2005	26
Table 4.3	Coverage of policy goals and funding by goal by policy-directed instruments in the period 2002-2005 (in M EUR)	27
Table 4.4	Coverage of biotech application areas and funding through policy-directed instruments by biotech application area in the period 2002-2005 (in M EUR).....	28
Table 4.5	Coverage and funding of biotech activities in the period 2002-2005 through policy-directed instruments (in M EUR)	29

Annex 2 List of figures and charts

Figure 1.1	Biotechnology promotion in Slovenia – institutional landscape.....	10
Chart 3.1	The biotechnology knowledge base indicators for Slovenia, comparison with EU25 and USA, three periods, index values	21
Chart 3.2.1	Share of subfields (in %) of total biotechnology publication for Slovenia in comparison with EU25 and USA (1994-1996).....	22
Chart 3.2.2	Share of subfields (in %) of total biotechnology publication for Slovenia in comparison with EU25 and USA (2002-2004).....	22
Chart 3.3	Biotechnology subfields growth rates for Slovenia in comparison with EU25 and USA (1994-1996 and 2002-2004).....	23
Chart 3.4	Performance indicators for biotechnology knowledge transmission and applications, three periods, Slovenia in comparison with EU25 and USA	24

Annex 3 List of contact persons

Name, first name	Institution	Contact date
Pečaver, Margareta	TIA	04-04-2006
Pečlin, Stojan	ARRS	04-04-2006
Pukl, Boris	ARRS	05-04-2006
Mediča, Natalija	Ministry of the Economy	05-04-2006
Sterle, Barbara	Ministry of the Environment and Spatial Planning	06-04-2006
Hrastar, Tomaž	MKGP	06-04-2006
Čot, Darja	Slovenian Science Fund	06-04-2006
Močnik, Vlasta	Ministry of Health	07-04-2006
Tomanič-Vidovič, Maja	SEF	04-04-2006
Vuga, Andrej	Ministry of the Environment and Spatial Planning	10-04-2006
Pogacnik, Aljana	ARRS	09-05-2006
Černel, Simona	SEF	08-06-2006
Dovč, Peter	University of Ljubljana, Biotechnical Faculty	13-06-2006
Umek Venturini, Andreja	Ministry of Higher Education, Science and Technology	04-08-2006
Tusar, Livija	Ministry of Higher Education, Science and Technology	31-03-2006

Annex 4 References

European Commission, DG Enterprise (2005a) European Trend Chart on Innovation, Annual Innovation Policy Trends and Appraisal Report Slovenia 2004-2005, http://trendchart.cordis.lu/reports/documents/Country_Report_Slovenia_2005.pdf, accessed 09-02-2006

European Commission (2005b) Social Values, Science and Technology (Special Eurobarometer 225/Wave 63.1 – TNS Opinion & Social, Brussels, Directorate General Press and Communication.

Europäische Kommission, GD Wissenschaft, Forschung und Entwicklung, RTD actions – Biotechnology (DG XII/E.1) et al. (1999) Inventory of public biotechnology R&D programmes in Europe: Volume 2: National Reports (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland), Luxembourg, Office for Official Publications of the EC (European Commission: Studies).

Pavlič Možina, S. (ed.) (2006) Facts about Slovenia. Ljubljana: Government of the republic of Slovenia, Public Relations and Media Office.

Moed, H.F., Glänzel, W., Schmoch, U. (eds.) (2004) Handbook of Quantitative Science and Technology Research. The Use of Publication and Patent Statistics in Studies of S&T Systems., Dordrecht: Kluwer Academic Publishers.

Republic of Slovenia (2005) Reform Programme for Achieving the Lisbon Strategy Goals, Ljubljana. <http://www.sigov.si/zmar/aprojekt/alizb-strategija/alizb-strategija.pdf>, accessed: 11-05-2006.

Strel, B., Stanič Racman, D. (eds.) (2003) National Biosafety Framework for Slovenia, Geneva: United Nations Environment Program, Global Environment Facilities, Ljubljana, The Ministry of Environment, Spatial Planning and Energy: National Institute of Biology.

Šušteršič, J., Rojec, M., Korenika, K. (eds.) (2005) Slovenia's development Strategy, Ljubljana, Institute of Macroeconomic Analysis and Development.

Websites:

Slovenian Research Agency	http://www.arrs.gov.si/en/index.asp
Ministry of the Economy	http://www.mg.gov.si/
Ministry of Higher Education, Science, and Technology	http://www.mvzt.gov.si
Slovenian Biosafety Clearing-House	http://www.bch.bf.uni-lj.si/en/index.htm
Slovenian Technology Agency	http://www.tia.si
Statistical Office	http://www.stat.si/eng/index.asp

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	3.1	Index: Reference	(2) 1998

	Indicator	Chart	Comments	Time periods
	sciences pMC		Region EU17 =100 and US data for comparison	(3) 2002
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 ¹⁵	2005
Ind. 16	Biomedicines	3.6	Source: BT Policy Benchmarking 2005 Index: Reference Region EU15 =100 US data for comparison	1995-2002

¹⁵ http://europa.eu.int/comm/public_opinion/archives/ebs/ebs_225_report_en.pdf

	Indicator	Chart	Comments	Time periods
Ind. 17	Field trials	3.6	Source: Biotechnology Innovation Scoreboard 2002 Index: Reference Region EU15 =100 US data for comparison	1996-2001

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

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
Slovenia	165	346	558	2	2	2
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
Slovenia	8	174	280	38	61	88
USA	454	492	529	208	172	166

Source: BioPolis Research

Publication data: Science Citation Index (through online database vendor STN International)

Population data: EUROSTAT and 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 (M Ecu)	BT publications/ M Ecu 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.		
Slovenia	558				n.a.		0
USA	154402				n.a.		n.a.

Source: BioPolis Research

Publication data: Science Citation Index (through online database vendor STN International)

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
Slovenia	165	346	558	2605	4204	5585
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
Slovenia	6%	8%	10%	56	65	77
USA	13%	14%	15%	119	115	113

Source: BioPolis Research

Publication data: Science Citation Index (through online database vendor STN International)

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
Slovenia	4.46	5.64	73	77
USA	6.39	8.54	104	117

Source: BioPolis Research

Citations data: Science Citation Index (through online database vendor STN International)

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
Slovenia	n.a.	n.a.	2	2
USA	75253*	70950	276*	288
	Graduates pMC		Index EU17=100	
	1998 / 1999	2002	1998 / 1999	2002
EU17	85**	189	100	100
Slovenia	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
 Graduates data OECD Education Database
 Population source for US is the OECD

Raw data for Chart 3.2.1. BT publications in subfields, as share of total number of BT publications for the period 1994-1996

	1994-1996							
	Total	Plant	Health	Animal	Food	Industrial	Environmental	Generic
EU25	100%	8%	53%	5%	3%	1%	1%	30%
Slovenia	100%	9%	34%	8%	5%	3%	0%	41%
USA	100%	6%	56%	5%	2%	0%	0%	30%

Source: BioPolis Research
 Publication data: Science Citation Index (through online database vendor STN International)

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

	2002-2004							
	Total	Plant	Health	Animal	Food	Industrial	Environmental	Generic
EU25	100%	7%	58%	5%	4%	1%	1%	25%
Slovenia	100%	8%	40%	6%	8%	3%	2%	33%
USA	100%	6%	59%	5%	3%	0%	1%	26%

Source: BioPolis Research
 Publication data: Science Citation Index (through online database vendor STN International)

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

	1994-1996							
	Total	Plant	Health	Animal	Food	Industrial	Environmental	Generic
EU25	97217	7629	51944	4375	2434	624	576	29635
Slovenia	165	15	56	13	8	5	0	68
USA	111686	7118	62274	5580	2230	296	459	33729

Source: BioPolis Research
 Publication data: Science Citation Index (through online database vendor STN International)

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

	2002-2004							
	Total	Plant	Health	Animal	Food	Industrial	Environmental	Generic
EU25	140984	10494	81220	6821	5017	1162	1126	35144
Slovenia	8	48	227	36	43	18	12	186

USA	141680	7910	84234	6872	4070	436	724	37434
-----	--------	------	-------	------	------	-----	-----	-------

Source: BioPolis Research

Publication data: Science Citation Index (through online database vendor STN International)

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	Environmental	Generic
EU25	38%	56%	56%	106%	86%	95%	19%
Slovenia	220%	305%	177%	438%	260%	100%	174%
USA	11%	35%	23%	83%	47%	58%	11%

Source: BioPolis Research

Publication data: Science Citation Index (through online database vendor STN International)

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
Slovenia	13	10	20	2	2	2
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
Slovenia	7	5	10	59	25	45
USA	33	52	42	295	264	190

Source: BioPolis Research

Publication data: Science Citation Index (through online database vendor STN International)

Patent data: EPPATENT, WOPATENT (online database vendor 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
Slovenia	13	10	20	165	346	511
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
Slovenia	0.08	0.03	0.04	156	42	54
USA	0.07	0.11	0.08	142	153	115

Source: BioPolis Research

Publication data: Science Citation Index (through online database vendor STN International)

Patent data: EPPATENT, WOPATENT (online database vendor Questel Orbit)

Raw data for Chart 3.5. Number of BT companies pMC for years 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
Slovenia	n.a.	n.a.	n.a.	n.a.				
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
Slovenia	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
USA	5,11045	5,112158	5,06553	4,95054	99	99	116	99

Note: EU Available is the result of the sum of available EU Member States

Source: BioPolis Research

Biotech companies data: Ernst and Young 2002-2005, EuropaBio

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

	BTsStart-ups		Population in T	
	2001-2003	2003	2003	
Europe (EU15 - Cyprus - Greece + Norway + Switzerland)	523	132	367051	
Slovenia	n.a.	n.a.		
USA	355	83	290789	
	Biotech start-up/pMC	Index	Biotech start-up/pMC	Index
	2001-2003	2001-2003	2003	2003
Europe (EU15 - Cyprus - Greece + Norway + Switzerland)	1.4	100	0.36	100
Slovenia	n.a.	n.a.	n.a.	n.a.
USA	1.2	86	0.29	79

Source: BioPolis Research

Start-ups data: EuropaBio

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

	BT IPO	Population T				
	2002-2005	2002	2003	2004	2005	2002-2005
EU Available	29	452927	454869	457154	461593	456636
Slovenia	0	1994	1995	1996	1998	1996
USA	52	287941	290789	291685		290138
	IPO /pMC	Index				
	2002-2005	2002-2005				
EU Available	0.00	100				
Slovenia	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: Ernst and Young 2002-2006, 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 EUR			Population in T		
	2002	2002	2002	2002	2003	2004
Europe	1100	920	2800			
EU Available	890	883	1111	315584	319663	325131
Slovenia	n.a.	n.a.	n.a.			
USA	2288	2498	2855	287941	290789	291685
	Venture capital in EUR/pC			Index		
	2002	2003	2004	2002	2003	2004
Europe						
EU Available	2.8	2.8	3.4	100	100	100
Slovenia	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
Slovenia	n.a.	n.a.	n.a.	n.a.
USA	115	289	0.40	387

Note: EU15 is the result of the sum of the 15 old EU Member States

Source: BioPolis Research

Number of medicines: 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
Slovenia	n.a.	n.a.	n.a.	n.a.
USA	6745	278	24	688

Note: EU15 is the result of the sum of the 15 old EU Member States

Source: BioPolis Research

Field trails: 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)
EU15*	100.29	16828
Slovenia		

*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

References:

Biotechnology Innovation Scoreboard 2002 (2002), European Commission Enterprise DG. <http://194.78.229.48/extranettrend/reports/documents/report7.pdf>, accessed 1/6/2005.

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

Ernst & Young (2002, 2003, 2004) Beyond Borders - The Global Biotechnology Report, Cambridge, Ernst & Young Global Health Sciences.

Reiss, T. et al. (2005) Benchmarking of public biotechnology policy 2005, European Commission Enterprise DG. http://europa.eu.int/comm/enterprise/phabiocom/comp_biotech_comp.htm, accessed 1/6/2005.

Websites:

London Stock Exchange <http://www.londonstockexchange.com/>

Frankfurt Stock Exchange <http://deutsche-boerse.com/>

Euronext <http://www.euronext.com/>

Nasdaq <http://www.nasdaq.com/>

Burril & Company <http://www.burrillandco.com/>

EuropaBio <http://www.europabio.org/>

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

ARRS	Javna agencija za raziskovalno dejavnost Republike Slovenije	Slovenian Research Agency
CRP	Ciljni raziskovalni program	Target research programmes
EC		European Communities
EU		European Union
FP		Framework Programme
GERD		Gross expenditure on research and development
GDP		Gross domestic product
GMO		Genetically modified organism
IHPS	Inštitut za hmeljarstvo in pivovarstvo Slovenije	Slovenian Institute for Hop Research and Brewing
IJS	Institut Jožef Stefan	Institute Josef Stefan
IRC		Innovation Relay Center
KI	Kemijski inštitut Ljubljana Slovenija	National Institute of Chemistry
KIS	Kmetijski inštitut Slovenije	Agricultural institute of Slovenia
MG	Ministrstvo za gospodarstvo	Ministry of the Economy
MKGP	Ministrstvo za kmetijstvo, gozdarstvo in prehrano	Ministry of Agriculture, Forestry and Food
MVZT	Ministrstvo za visoko šolstvo, znanost in tehnologijo	Ministry of Higher Education, science and Technology
NIB	Nacionalni inštitut za biologijo	National Institute of Biology
pMC		per million capita
PMG	Program mladih raziskovalcev	Young researchers programme
PRO		public research organisation

R&D		research and development
RPROJ	Raziskovalni projekti	Research Projects
RPROG	Raziskovalni programi	Research Programmes
SAZU	Slovenska akademija znanosti in umetnosti	Slovenian Academy of Sciences and Arts
SEF	Slovenski podjetniški sklad	Slovene Enterprise Fund
SME		small and medium-sized enter- prises
S&T		science and technology
SZF	Slovenska znanstvena fundacija	Slovenian Science Foundation
TIA	Javna agencija za tehnološki razvoj Republike Slovenije	Technology agency
US		United States (of America)
ZRS	Znanstveno-raziskovalno središče Koper	Science and Research Centre of Koper

All rights reserved.

No part of this publication may be reproduced and/or published by print, photoprint, microfilm or any other means without the previous written consent of TNO, Fraunhofer and SPRU.

In case this report was drafted on instructions, the rights and obligations of contracting parties are subject to either the Standard Conditions for Research Instructions given to TNO, Fraunhofer and SPRU or the relevant agreement concluded between the contracting parties. Submitting the report for inspection to parties who have a direct interest is permitted.

© 2007 TNO (NL) - Fraunhofer (DE) – SPRU (UK)