

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 Croatia

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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	5
1.3 National support and framework conditions for biotechnology	7
1.4 Main biotechnology research actors in Croatia	9
2. Funding of biotechnology R&D, transfer and commercialisation	11
2.1 Introduction	12
2.2 Non-policy-directed funding of biotechnology research	12
2.3 Policy-directed funding of biotechnology research and commercialisation	13
2.3.1 Policy-directed Instruments of the National Foundation of Science, Higher Education and Technology	14
2.5 Participation in 6th Framework Program.....	17
3. Performance of the national biotechnology innovation system	18
3.1 Introduction.....	18
3.2 Performance in creating a knowledge base and supporting the availability of human resources	18
3.3 Performance in knowledge transmission and application.....	22
3.4 Industrial development.....	23
3.5 Market conditions	23
4. Conclusions	24
4.1 Introduction.....	24
4.2 Public funding of biotechnology through policy instruments.....	24
4.3 Specific features of the instruments	25
2.3 Policy goals	25
4.5 Biotechnology research application areas.....	27
4.6 Stimulation of biotechnology activities through the instruments	28
5. Future developments	30
Annex 1: List of tables	32
Annex 2: List of charts	33
Annex 3: List of contact persons	34
Annex 4: References	35
Annex 5: Performance	36
Annex 6: Abbreviations	47

Summary

With a population of 4.4 Million the Republic of Croatia gained its independence in 1991 and received the Candidate Status for the European Union membership in June 2004. Since the independence and after the Yugoslavia conflict (1992-1995) the country has been mainly engaged in building the structure of a new state and repairing the war damages. In the reporting period 2002-2005 Croatia was in the process of building up a stable system for science, technology and innovation policy. The Ministry of Science Education and Sport and the National Foundation for Science, Higher Education and Technological Development are the two agencies responsible for promoting scientific research and technological developmental.

Data gathering in the framework of the BioPolis project for the Republic of Croatia was a complicated process due to the lack of policy documents in English for the reporting period and to the difficulties to contact the relevant policy makers in the Ministry of Science Education and Sport. The report includes a qualitative description of the instruments implemented. However, the results are quite disappointing in the sense that it was not possible to find comprehensive data on the funding invested in promoting biotechnology research.

The policy approach is horizontal in the sense that no thematic priorities have been set in the period 2002-2005. Moreover, in Croatia there is no explicit regional science, technology and innovation policy. Accordingly the research concentrated on the nation approach to the promotion of biotechnology through generic instruments. Both, non-policy-directed instruments and policy-directed instruments have been identified.

The non-policy-directed instruments involve institutional funding for research institutes (which covers the administrative and operational costs of 5 public research institutes) and the open-call system for project funding of the MSES. This open calls are the main funding instrument for research activities in Croatia. Accordingly, the Croatian funding system for biotechnology research and commercialisation is mainly based on this non-policy-directed instrument of the MSES.

The policy-directed instruments are (i) generic programs launched by the National Foundation of Science Higher Education and Technology promoting human resources for scientific research (*Brain Gain*) and (ii) generic programmes launched by the Ministry of Science, Education and Sport promoting human resources for research (*Junior Research Program*) and research infrastructure (*Equipment Grants*) as well as technology transfer through collaborative projects and company creation. Technology transfer instruments, collaboration and company creation are policy issues tackled by the *HITRA* program. No biotechnology specific instruments have been implemented in the reporting period.

In what concerns the biotechnology application areas the policy instruments identified are generic instruments targeting either the mobilisation of research resources for research or the commercialisation of research results. Due to the lack of detailed information and the fact that the programs do not explicitly promote research projects we have classified them

under the category „general“. In other words, the instruments aim at building up general capabilities and innovation infrastructure.

The set of performance indicators chosen to assess the development of the biotechnology knowledge base and its commercialisation in Croatia suggests that the Croatian biotechnology innovation system is still in its infancy. In the reporting period the volume of the biotechnology knowledge in terms of biotechnology publications per capita and in terms of the share of biotechnology publications among all publications lied well bellow the EU and the USA. However, the trend in both indicators signalises that the production of knowledge is improving. Since 1994 biotechnology is gaining importance within the Croatian knowledge base.

In what concerns the specialisation profile of the biotechnology knowledge base, in terms of publications Croatia concentrates its biotechnology research activities on health biotechnology and on generic biotechnology. In the reporting period food and specially plant biotechnology gain on importance within the Croatian knowledge base.

Regarding the Croatian performance in knowledge transmission and application, the biotechnology innovations system seems to be very much concentrated in publishing scientific knowledge rather than developing industrial applications and applying for patents. There are two interpretations for this development. Firstly, in the reporting period the intellectual property rights system was still developing. Secondly, in the reporting period the system was still creating a critical mass of biotechnology knowledge base. Considering that biotechnology has a quite linear mode of innovation, at this stage the system might not be matured enough to develop industrial applications. Nonetheless, the indicators suggest that the Croatian innovation system has serious problems in applying knowledge for industrial purposes.

In 2006 the National Science and Technology Policy 2005-2010 was adopted by the Government of Croatia. The document presents a vision of the development of the Science and Technology Sector in the Republic of Croatia. The document points out the aim of the Government on strenthening the Croatian science and education systems to reach European standards. Even though biotechnology is identified as a pririty area, the promotion of specific scientific scientific fields remains a long term objective. In the field of technology development and innovation national policy recognices the weaknesses of the Croatian Innovation System in bringing scientific results into succesfull innovations and the dependency of the innovation system on the public sector. The government aims at establishing appropriate framewrok conditions for innovation in terms of a legal framework for developing financing instruments to support the innovation process in companies and to create incentives for private R&D investment.

1. Introduction and background

1.1 General introduction

With a population of 4.4 Million inhabitants the Republic of Croatia gained its independence in 1991 and received the Candidate Status for the European Union membership in June 2004. In October 2005 the accession talks began. The country expects to join the European Union by 2009. Its integration into the European Research Area Integration is being supported through different initiatives (6th Framework Program, COST, EUREKA and CARDS). More over, the Republic obtained a loan from the World Bank in 2005 in the amount of 31M EUR to support the European integration process.

Since the independence and after the Yugoslavia conflict (1992-1995) the country has been mainly engaged in building the structure of a new state and repairing the war damages. According to the World Bank¹, the country has recovered the pre-war level of industrial production; however, the economy relies largely on the state aid. Due to the high level of public spending, the large infrastructure investments, the social spending and the subsidies the economy needs serious structural reforms and rethinking the role of the state.

According to EUROSTAT (2006)², in 2002 the Gross Domestic Product (GDP) per capita measured in standard purchasing power (SPP) amounted 43.5% of the European average (EU25). In 2005 the same indicator reached 48.8%. In the reporting period 2002-2005 the economy grew at an average rate of 4.75% (measure in terms of real GDP). Investments in research and development (R&D) amounted 1.11% of the GDP in 2004. This level was bellow the European Average (EU25:1.9%). Moreover, 55.9% of the investment was carried out by the state. The predomination of public sector investment in the innovation system is even stronger if we consider that the public sector employs 90% of all researches(Republic of Croatia 2006)³.

1.2 Characteristics of the national S&T and the innovation system⁴

In the reporting period 2002-2005 Croatia has been engaged in establishing a stable system for science, technology and innovation policy.

Figure 1.1 gives an overview of the main institutional bodies involved in science, technology and innovation policy making as for 2005⁵. The system of science and higher education is under the responsibility of the Ministry of Science, Education and Sports (MSES). Two councils, the National Council for Science (NCS) and the National Council

1 Croatia Brief 2006. retrieved October 2006 from <http://www.worldbank.hr/>

2 EUROSTAT (2006). "General Economic Background and Innovation Indicators". Retrieved October 2006 from <http://epp.eurostat.ec.europa.eu>

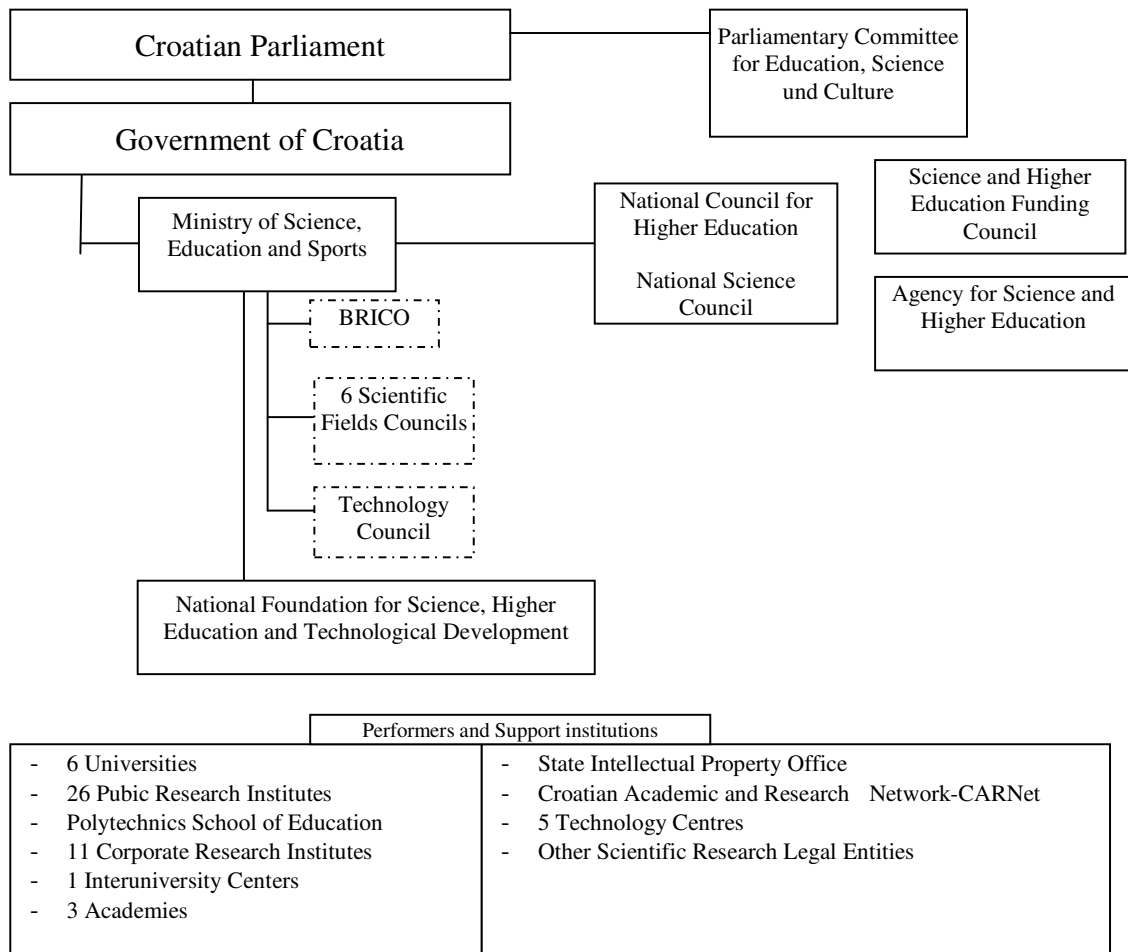
3 Republic of Croatia (2006). Strategic Development Framework for 2006-2013. Zagreb, Central State Office for Development Strategy and Coordination of EU Funds.

4 This section is largely based on European Commission. (2006). "ERAWATCH." Retrieved October 2006, from <http://cordis.europa.eu/erawatch/>.

5 In 2006 new institutions were created. The chart gives the situation in the reporting period 2002-2005.

for Higher Education (NCHE) care for the development and quality of the scientific research landscape and the functioning of the education system. Their main tasks are to provide the Government with criteria and recommendations for funding allocation and to propose measures for the development of the scientific and education systems. Since 2005 two bodies support the councils with specific tasks: the Science and Higher Education Funding Council with budget planning issues and the Agency for Science and Higher Education (ASHE) with administrative work such as reporting activities.

Figure 1.1 Main public institutions in Croatian Science, Research and Innovation System in 2005



Source: BioPolis Research, based on European Commission (2006)⁶ and European Commission (2004)⁷

Project management activities (such as evaluation of the project proposals, budget allocation and project monitoring) is carried out by six Scientific Field Councils, classified by scientific area - natural, technical, biomedical, bio-technical, social science and the humanities. Additionally, in the area of technology the Technology Council

⁶ European Commission. (2006). "ERAWATCH." Retrieved October 2006, from <http://cordis.europa.eu/erawatch/>.

⁷ European Commission (2004). A new Candidate to EU Accession - Croatia S&T Developments, European Commission, DG-Research.

evaluates project proposals, coordinates the funding allocation and the project implementation.

Parallel to the scientific councils and the technology council, BICRO (Business Innovation Centre of Croatia) was established in 1998 as the national innovation agency. BICRO reports to the MSES and its main task is to promote efforts of innovative entrepreneurs and enterprises and encourage science-industry cooperation. on the activities and results.

Besides the promotion activities of the MSES, the National Foundation for Science, Higher Education and Technological Development was established in 2001 to support scientific research. It is the first government agency (besides the Ministry of Science, Education and Sport) responsible for funding scientific and developmental projects. For the period 2004-2008 the foundation has set a strategic plan with 5 strategic fields:

- Higher Education System reform,
- Brain Gain
- Information and telecommunication technologies (ICT)
- Biotechnology
- New Materials and new production processes
- Socio-cultural transition from industrial to the society of knowledge

In the reporting period the first two strategic fields have been tackled.

1.3 National support and framework conditions for biotechnology

- National Support

In the last 10 years the Republic of Croatia has engaged in establishing governance structure according to EU standards for innovation policy and in developing adequate framework conditions for innovation. Table 1.1 gives the main strategic measures in this direction:

Table 1.1 Strategic policy documents relevant for innovation policy in the period 2002-2005

<i>Year</i>	<i>Document</i>
1996	The National Science and Research Program 1996-1998 (extended for more 3 years)
2001	Croatian Program for Innovative Technological Development (HITRA)
2003	Act on Scientific Activity and Higher Education
2003	Strategy of Development of the Republic of Croatia in the 21 Century- Science
2004	Strategic plan of the National Foundation for Science, Higher Education and technological Development (NFS) 2004 – 2008

Source: BioPolis research

The National Science and Research Program was launched in 1996 for a period of two years and extended for three more years. It was an ambitious program setting the first guidelines for innovation policy. The two main tasks were to set up the national network of institutions for technology development and commercialisation of new technologies and, on the other hand, to design measures and create infrastructure for supporting the establishment of technology-based companies. This resulted in the establishment of 3 technology centres in the major universities.

Moreover, the programme listed general and specific research priorities structured along 6 scientific fields: natural sciences, technical sciences, biomedicine, biotechnology and humanities. Accordingly, the first framework for science and research policy already identified biotechnology as a priority area. However, we do not have information to assess the extent to which biotechnology was promoted in terms of funding.

In 2001 the Croatian Program for Innovative Technological Development was launched. The program was especially tailored to promote technology transfer and collaboration between academia and the industrial sector. The policy measures implemented within the program are still running and described in chapter 2.

In 2003 the strategy of Development of the Republic of Croatia in the 21 Century related to the science system was published. This strategic document aimed at stimulating the needed changes in the Croatian Science and Education System to move towards the EU Standards. Also in 2003 the Act on Scientific Activity and Higher Education was approved. The law set up the framework to reform the research system in Croatia and to establish university autonomy and self-governance. The main goal was to harmonize the areas of research and education with the European standards.

Finally, in 2004 the National Foundation for National Foundation for Science, Higher Education and technological Development (NFS) published its strategic plan for the period 2004 – 2008. The Foundation was established in 2001 in order to strengthen the knowledge base in Croatia. As already introduced above the Foundation is the second public body together with the MSES that allocates competitive funding to promote the development of the knowledge base. The Strategic Plan defines the following strategic fields for funding:

- Brain gain
- Information and Communication Technology
- Biotechnology
- New Materials and New Production Processes
- Reform of Higher Education System in Croatia
- Environmental Sciences and Sustainable Development
- Sociocultural Transition from Industry to Knowledge-base Society.

In the reporting period the foundation has launched initiatives concerning Brain Gain and the reform of the Higher Education System.(NFS 2004)⁸.

All in all, efforts of science, technology and innovation policy in Croatia move primarily towards the creation and strengthening of institutions characteristic for a National System of Innovation with a market economy rather than establishing sector or technology specific appropriate conditions. However, already in 1996 Biotechnology was identified as a strategic field for funding. In the current policy strategy biotechnology is still in the policy agenda.

- Regulatory Framework

In what concerns the regulatory framework for research and innovation in biotechnology until May 2005 two laws set the legal framework for biotechnology issues: the Law on Protection of Nature and the Food Law. On May 2005 the Croatian Government passed a new Law on Genetically Modified Organisms (GMOs) that replaced the “biotechnology-regulating provisions” of the Law on Protection of Nature. Accordingly, since May 2005 the new Law on GMOs and the Food Law regulate biotechnology issues.

An important regulatory aspect for innovation in Croatia in the reporting period was the protection of intellectual property (IP). On January 2004 a new Patent Law has been in force. This law establishes the legal framework of the new Croatian IP system.(HGK 2005)

1.4 Main biotechnology research actors in Croatia

Most research activities in Croatia take place at Universities and at public Research Institutes. We have no detailed information on all university faculties in Croatia carrying out biotechnology research. Regarding the research institutes there 3 Institutes in the area of agriculture and forestry and 2 institutes in the area of biomedicine (human and veterinary medical research). These institutes are listed in table 1.2. and carry out biotechnology related research.

Table 1.2 Public research Institutes carrying biotechnology research

Institute	Location
Forest Research Institute	Jastrebarsko
Agricultural Institute	Osijek
Institute for Agriculture and Tourism	Poreč
Croatian Veterinary Institute	Zagreb
Croatian National Institute for Public Health	Zagreb

Source: BioPolis Research

Besides universities and public research institutes the research landscape in Croatia counts with 6 technology centres fostering technology development and innovation.

⁸ NFS. (2004). "NFS Strategic Plan." National Foundation for Science, Higher Education and technological Development Retrieved October 2006, from <http://www.nzz.hr/en/strategy.php>.

Additionally corporate research institutes complement the public research institutions. In the field of biotechnology the Mediterranean Institute for Life Sciences (MedILS) is in the process of building up research infrastructure(Follete 2004)⁹. Regarding the private sector, there is no information available on the R&D biotechnology activities of the industry.

⁹ Follete, P. (2004). Bringing Biology Back to Croatia. *Science*. 304: 1103-1104.

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

In this chapter the funding of biotechnology research through policy and non-policy-directed instruments and of biotechnology commercialisation through policy-directed is presented. Data were collected through desk research (publications, documents, websites of national public funding organisations and/or governmental departments).¹⁰

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

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

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

Section 2.1 introduces the main findings. Section 2.2 presents the non-policy-directed funding and section 2.3 the policy-directed funding. Charities and Foundations also play an important role in funding of biotechnology research in some countries; they will be addressed in section 2.4. The final section provides a short overview of the European funding of biotechnology research in Croatia through the 6th Framework Program.

¹⁰ The Ministry of Science Education and Sport was contacted several times in order to collect information on the promotion programmes and the funding invested in the promotion of biotechnology. Unfortunately, despite the efforts to obtain information between May 2006 and September 2006 no data were provided for the purpose of the BioPolis Project.

2.1 Introduction

Data gathering in the framework of the BioPolis project for the Republic of Croatia was a complicated process due to the lack of policy documents in English for the reporting period and to the difficulties to contact the relevant policy makers in the Ministry of Science Education and Sport

The few documents and articles found reporting on science, technology and innovation policy in Croatia give a good overview of the main non-policy-directed and policy-directed instruments implemented in Croatia in the reporting period. The policy approach is horizontal in the sense that no thematic priorities have been set in the period 2002-2005. Moreover, in Croatia there is no explicit regional science, technology and innovation policy. Accordingly the research concentrated on the nation approach to the promotion of biotechnology through generic instruments. Both, non-policy-directed instruments and policy-directed instruments have been identified. However, the results are quite disappointing in the sense that it was not possible to find comprehensive data on the funding invested in promoting biotechnology research.

The information available from different sources is contradictory in some cases or not complete enough to make fair estimations on biotechnology funding by the different instruments. The most up-to-date official data that could be found has been published by European Commission (2006).¹¹ According to this source in 2004 the total budget of the Ministry for Science, Education and Sport was for research promotion was invested among different scientific as follows:

- Natural Sciences: 24.83%
- Technical Sciences: 17.42%
- Bio-medical Sciences: 28.21%
- Bio-technical Sciences: 9.62%
- Social Sciences: 9.09%
- Humanities: 9.83%

2.2 Non-policy-directed funding of biotechnology research

Table 2.1 gives the information available on the non-policy-directed instruments of biotechnology research in Croatia in the period 2002-2005.

Firstly the table includes the public research institutes involved in biotechnology research. These institutes report to the Ministry of Science, Education and Sport. The budget is determined by the State budget once a year and covers administrative and other fixed operating costs.

¹¹ European Commission. (2006). "ERAWATCH." Retrieved October 2006, from <http://cordis.europa.eu/erawatch/>.

Research activities in these institutes and in research institutions in Croatia are mainly financed through the competitive open calls launched by the Ministry of Science, Education and Sport at least twice a year (Research Grants). Funding allocation in the different scientific fields follows response mode mechanisms in the sense that researchers and research units are free to hand in their project proposals reflecting their own scientific interests. Project evaluation runs in the 6 Scientific Field Councils. Projects selected receive funding for a period of 3 to 5 years.

There is no information available on the biotechnology funding of these institutes and open calls in the period 2002-2005.

Table 2.1 Non-policy-directed funding of biotechnology research in M EUR

Funding organisation	Public Research Institutions / Response Mode programs	Period	Funds *
MSES	Forest Research Institute, Jastrebarsko	2002-2005	n.a.
MSES	Agricultural Institute, Osijek	2002-2005	n.a.
MSES	Croatian Veterinary Institute, Zagreb	2002-2005	n.a.
MSES	Institute for Agriculture and Tourism, Poreč	2002-2005	n.a.
MSES	Croatian National Institute for Public Health, Zagreb	2002-2005	n.a.
MSES	Research Grants / Open Calls	2002-2005	n.a.

Source: BioPolis Research

2.3 Policy-directed funding of biotechnology research and commercialisation

This section presents the policy-directed instruments promoting biotechnology research and commercialisation identified in Croatia for the period 2002-2005. Table 2.2 shows an overview of the instruments. Since there is no explicit regional research and innovation policy in Croatia, the table gives national programs only. These are a program launched by the National Foundation of Science Higher Education and Technology promoting human resources for scientific research and programmes launched by the Ministry of Science, Education and sport promoting research human resources and infrastructure as well as technology transfer and company creation. All the programs identified are generic programs. Unfortunately no specific information on biotechnology funding is available.

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

Instrument	Funding Agency	Budget in M EUR
National Instrument		
<i>Generic</i>		
Brain Gain	NSF	n.a.
Junior Researchers Program	MSES	n.a.
Equipment Grants	MSES	n.a.
HITRA – (TEST, RAZUM)	MSES - BICRO	n.a.
Total National		n.a.

Source: BioPolis Research

2.3.1 Policy-directed Instruments of the National Foundation of Science, Higher Education and Technology

In the reporting period the National Foundation of Science has focused its funding activities science on the promotion of human resources.

- Brain Gain (2004-2007)

In October 2004 the foundation launched the 3 year program “Brain Gain” aiming at supporting researchers in Croatia and abroad to develop located beyond the Croatian borders to develop their scientific carrier in Croatia. The positions and fellowships last from 3 to 12 months. The program is structured in three sub-programmes: Visitor, Senior and PostDoc.

- The Visitor Program offers fellowships (max. 75 000 EUR) for researchers from the scientific community and industry living abroad with 5 years research experience.
- The Senior Program offers positions at university (max. 100 000 EUR) for outstanding professors and scientists from the scientific community and industry living abroad with at least 10 years of research experience.
- The PostDoc Program offers fellowships (max. 20 000 EUR) for young researchers in Croatia that have recently earned their doctorate to conduct research abroad and for foreign researchers to go to Croatia.

According to European Commission (2006)¹², each subprogram has a budget of 6M HRK (0.81 M EUR) over the tree years. The program is generic in the sense that it is not focused on any scientific field; however, applications from the scientific areas prioritised in the strategic plan of the foundation for the period 2004-2008 should have an advantage. Biotechnology belongs to these fields.

¹² European Commission. (2006). "ERAWATCH." Retrieved October 2006, from <http://cordis.europa.eu/erawatch/>.

Biotechnology Funding in the period 2002-2005: n.a.

- Junior Researchers Program (since 1994)

The “Junior researchers program” or early stage researchers program (ESR-Program) is launched and managed by the Ministry of Science, Education and Sports (MSES) since 1994. The main aim of the program is to increase the share of young researchers in the science and higher education system by financing new positions for young researchers in science and higher education institutions. The program offers funding for a period of 10 years for young researchers carrying out master and doctorate thesis. The number of grants is proportionally distributed among disciplines. According to the information available in 2005 2510 early stage researchers were supported through the program. The statistics of the ministry classified the ESR supported in 6 fields. In the field of Biotechnology about 200 researchers were participating in the program.

Biotechnology Funding in the period 2002-2005: n.a.

- Equipment Grants (since 1994)

The program “Research equipment” is launched and managed by the Ministry of Science, Education and Sports (MSES) since 2001 to strengthen the scientific equipment for the research activities in public research institutions. Target group are research institutions and project leaders of all scientific fields having contracted research projects with the Ministry of Science, Education and Sports (MSES). The funds are determined in annual plan of the State budget. The Ministry invites tenders, at least, twice a year, for the procurement of scientific equipment required for the realisation of the contracted research projects.

Biotechnology Funding in the period 2002-2005: n.a.

- HITRA – Croatian Program for Innovative Technological Development (since 2001)

The program was adopted by the Government on 2001 as a clear measure to stimulate innovation and entrepreneurship in Croatia. As an umbrella program it establishes the framework for developing technology policy in Croatia. Accordingly, it aimed at creating supporting institutions for implementing and monitoring technology policy. Additionally, it aimed at launching stimulating policy measures, activities and programmes for promoting technology development and innovation (European Commission 2004)¹³. According to MSES (2006)¹⁴, between 2001 and 2005 close to 30M EUR have been invested in HITRA Technology Projects. Table 2.3.2 gives the information available on the HITRA budget for several years.

13 European Commission (2004). A new Candidate to EU Accession - Croatia S&T Developments, European Commission, DG-Research.

14 MSES (2006). Science and Technology Policy of the republic of Croatia 2006-2010. Ministry of Science Education and Sport. Republic of Croatia.

Table 2.3 HITRA – Budget 2001, 2002, 2003

Year	2001	2002	2003
EURO	7 184 410	6 669 433	11 649 750

Sources: European Commission (2004),

In the reporting period the program has concentrated on following policy goals:

- Promoting applied research,
- Promoting collaboration between academia and industry,
- Creating technology oriented companies
- Supporting technology transfer from academia to the industry
- Establishing technology and innovation centres for supporting company creation

The policy measures launched since in the reporting period consist of two subprograms: TEST, RAZUM.

- TEST Subprogram -Technology Related Research and Development Projects
The program was first managed by the MSES and latter on by BICRO. It focuses on the promotion of technology development projects. More specifically, its aim is to support the pre-commercial development of new products, processes and services in the public and private research and development sectors. Both, PROs and companies are eligible to apply for funding. The funding conditions depend on the type of project. The program differentiates between simple technology projects, collaborative technology projects. Between 2001 and 2004, 200 projects had been accepted for financial support. 28% of the projects were biotechnology related.

Biotechnology Funding in the period 2002-2005: n.a.

- RAZUM Subprogram – Development of Knowledge Base Companies
The RAZUM program is managed by BICRO and focuses on the establishment and development of technology based companies. The main goal is the commercialisation of research results from the TEST subprogram through company creation and company development.

Biotechnology Funding in the period 2002-2005: n.a.

2.5 Participation in 6th Framework Program

The integration of Croatia into the European research Area is supported through the participation in the 6th Framework Program. Table 2.3 shows the participation of Croatian research groups in the 6th Framework in those thematic priorities relevant for biotechnology. The information shows the number of groups being involved as co-ordinators and as participants in the projects.

Table 2.4 Involvement of Croatia in biotechnology/life sciences programmes of the 6th Framework Program

Sixth Framework Programme¹	Participation as project manager in # of projects (% of total)²	Participation as member of the project team in # of projects (% of total)²
Thematic priority		
1. Life sciences, genomics and biotechnology for health	0	11 (0.1%)
2. Nanotechnologies, section bio-nanotechnology	0	0
5. Food quality and safety	0	0

¹ First and second call, all types of projects

² Persons/groups can participate in more projects, resulting in more participations

Source: BioPolis Research

According to the available information, Croatian research teams participated in projects of the 6th Framework Programme in the thematic priority “Life sciences, genomics and biotechnology for health”. Only 0.1% of the participating teams came from Croatia.

The data suggest a very low participation quota of Croatian researchers in the 6th Framework programme.

3. Performance of the national biotechnology innovation system

3.1 Introduction

This chapter analyses the performance of the Croatian 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.¹⁵ Each time period includes several years, in order to avoid capturing erratic trends. National trends are benchmarked against the performance of the EU25 Member States and the US.

The presentation of the performance of is structured along the 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, the different indicators for Croatia, the USA and EU25 will be shown. To establish a comparison, the values reach by EU25 have been chosen as reference in each indicator. The absolute figures are presented in Annex 5. For each indicator data are presented for three periods. Depending on the data availability, the periods chosen can vary considerably between the indicators; Table A.5.1 presents for each indicator the specific years for each period.

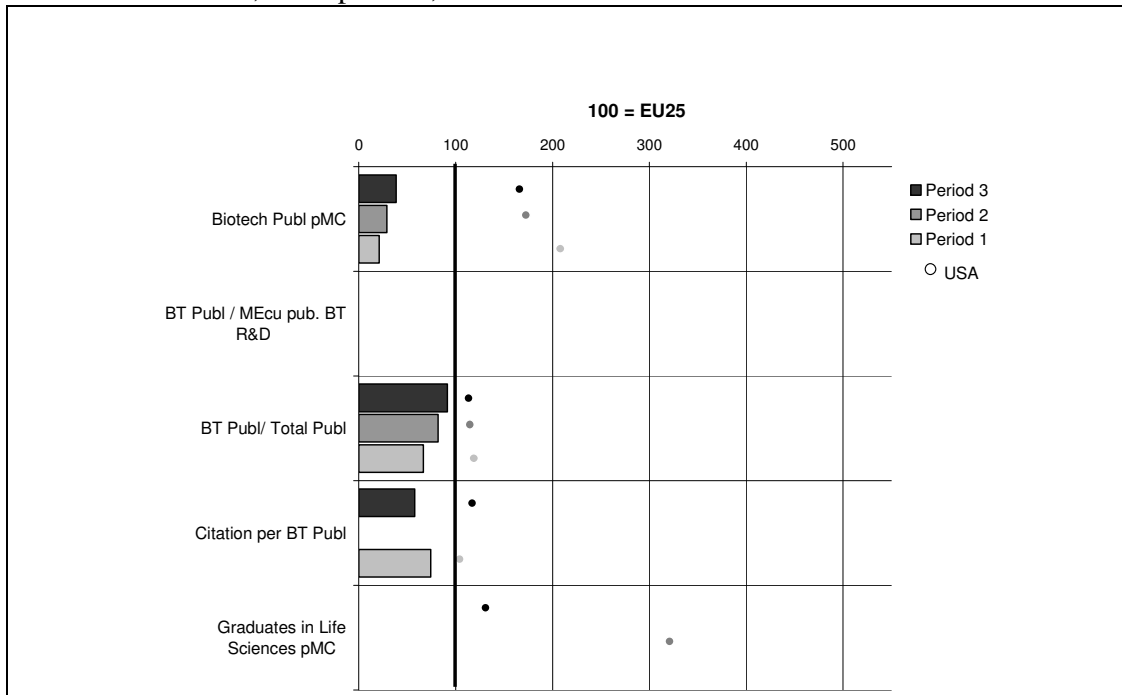
3.2 Performance in creating a knowledge base and supporting the availability of human resources

The indicators chosen for the assessment of the overall performance in creating a knowledge base and supporting the availability of human resources are given in Chart 3.1. Indicators for human resources and the indicator relating biotechnology publications to expenditures in biotechnology research and development are not available for Croatia.

The set of indicators given in chart 3.1 suggests that Croatian biotechnology innovation system is still in its infancy in what concerns the production of biotechnology related knowledge. In terms of biotechnology publications per capita and in terms of the share of biotechnology publications among all publications Croatia lies well below the EU and the USA for the reporting period. However, the trend in both indicators signals that the production of knowledge is improving. Since 1994 the biotechnology knowledge base has been growing and, in terms of publications, biotechnology is gaining importance within the Croatian knowledge base. All in all, the Croatian biotechnology knowledge base seems to be developing a critical mass.

¹⁵ For a detail discussion on the strengths and limitations of science and technology indicators see 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.

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



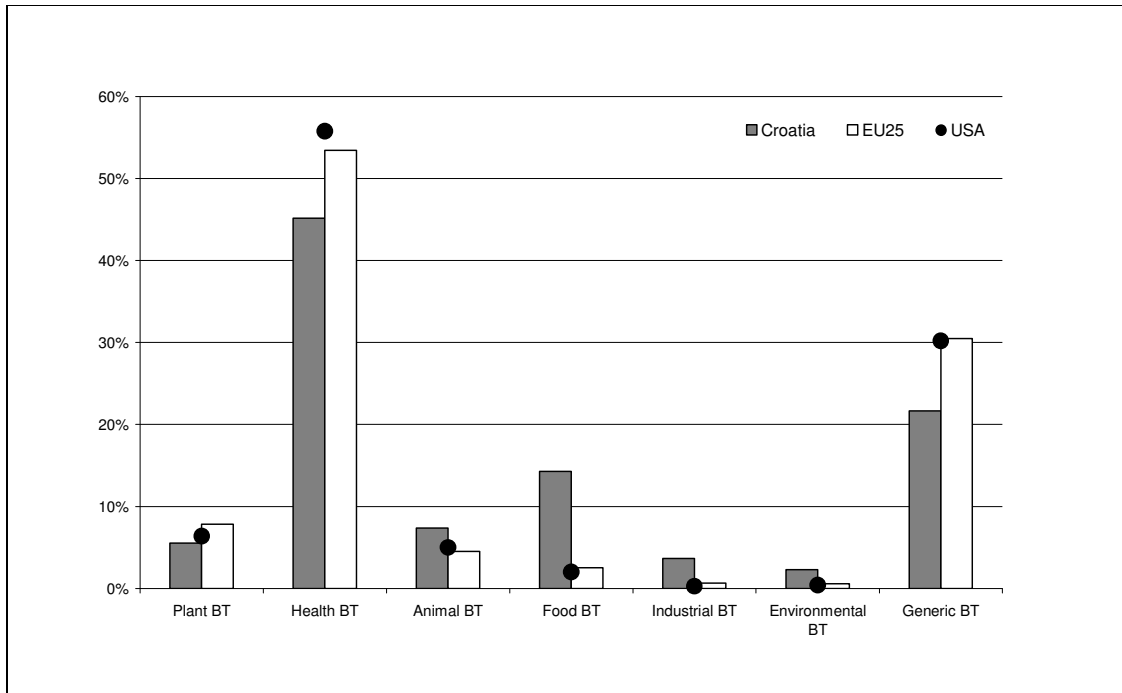
Source: BioPolis Research

Data: Science Citation Index, OECD Education Database, European Commission 1999

Note: The European reference region for indicator 2 (BT Publ./MEcu pub. BT R&D) is EU15.

Charts 3.2.1 3.2.2 and 3.2. give bibliometric indicators per biotechnology subfield. The indicators give a specialisation profile of the research activities in biotechnology in Croatia compared to EU25 and to the USA and the changes between two different periods of time.

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

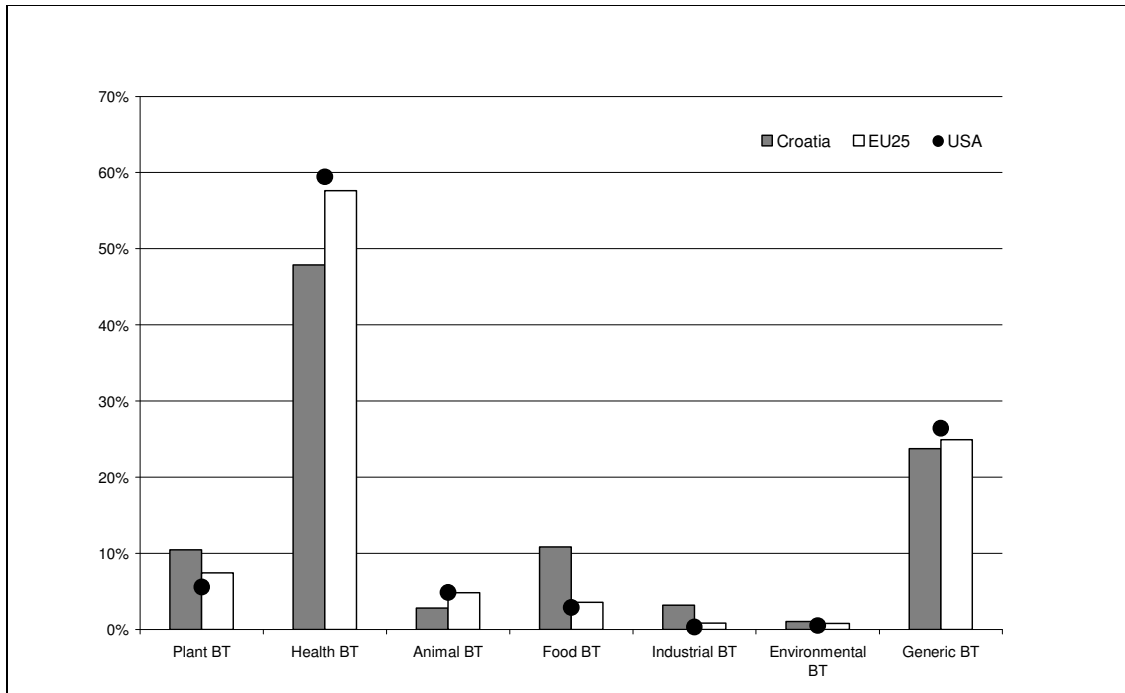


Source: BioPolis Research
Data: Science Citation Index

In terms of publications Croatia concentrates its biotechnology research activities on health biotechnology and on generic biotechnology. In both periods under consideration these subfields are responsible for more than 60% of the publication output in biotechnology. In this aspect Croatia behaves in line with EU and USA, even though the focus of Croatia on health and on generic biotechnology is less extreme than in these regions. Moreover, due to the lower publication output in absolute terms Croatia is growing much faster than EU25 and USA in these fields (see chart 3.3).

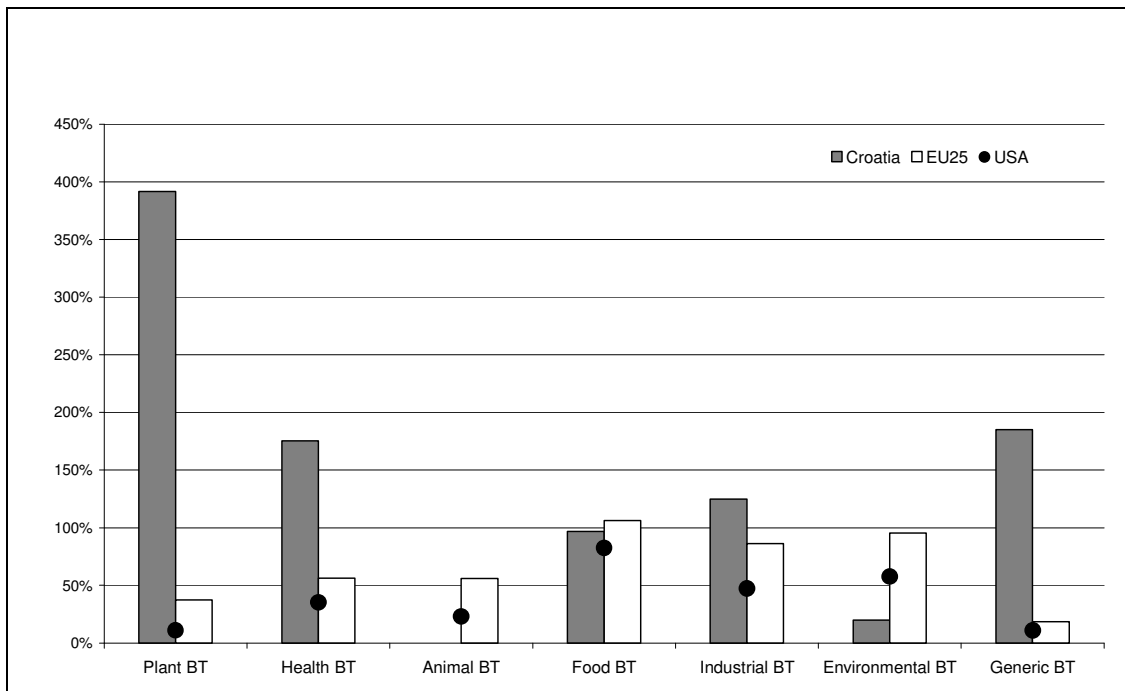
In what concerns the role played by the other biotechnology subfields, food, plant and animal biotechnology are the next subfields with a share over 5% in the period 1994-1998. Animal biotechnology loses relative importance in the period 2002-2004 while food and specially plant biotechnology reached the 10% share (see chart 3.2.2). In the period 2002-2004 animal and industrial biotechnology reached the 3% share. These shares are higher for Croatia than for the EU and USA. Environmental biotechnology reaches 1%, which is similar to the share reached by EU25 and USA in the same period.

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



Source: BioPolis Research. Data: Science Citation Index

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

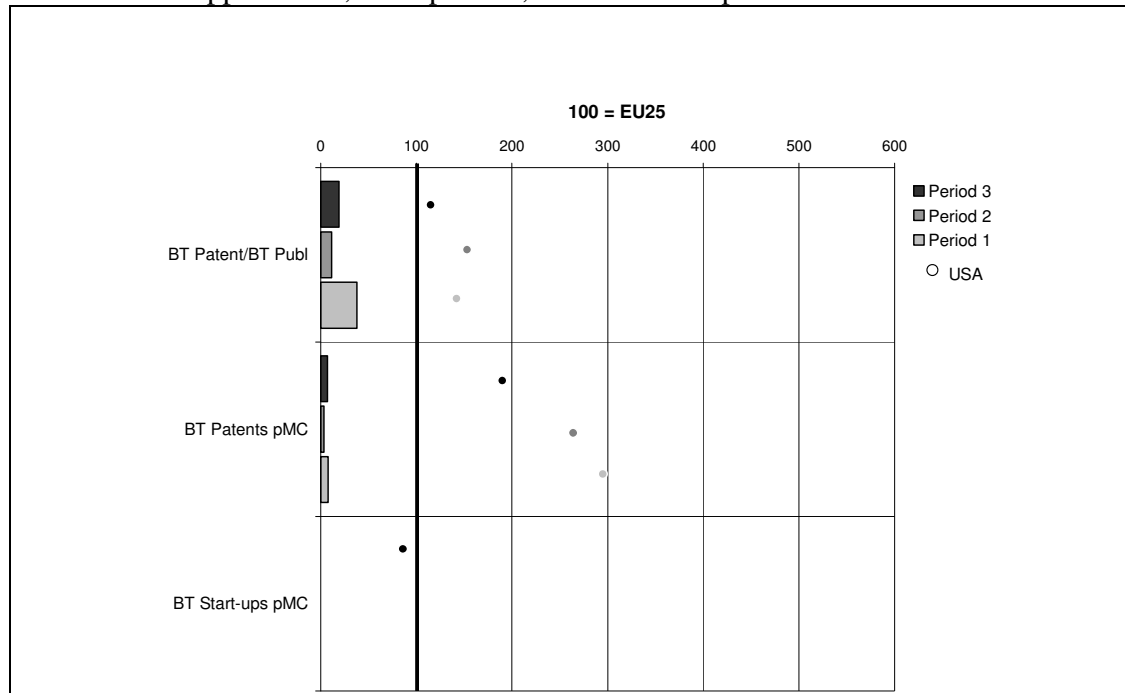


Source: BioPolis Research, Data: Science Citation Index

3.3 Performance in knowledge transmission and application

The indicators chosen for the assessment of the overall performance in knowledge transmission and application are given in Chart 3.4. There are no comprehensive data available of biotechnology start-ups in the Croatian industry to make a comparison with EU25 and USA.

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



Source: BioPolis Research

Data: Database of European Patents (Host Questel Orbit , EPPATENT), Database of International Patent Applications (WOPATENT), EuropaBio

Note: The European reference region for indicator 11 (number of biotech start-ups pMC) is EU15.

In what concerns the first indicator – biotechnology patents per biotechnology publication – Croatia lays way below EU25. Moreover, if we consider the 3 time periods in period 1 (1994-96) the share of patents per publication was the highest among the 3 periods considered. In other words, publications are growing faster than patent applications. In period 3 the share recovered compared to period 2, however, the biotechnology innovations system seems to be very much concentrated in publishing scientific knowledge rather than developing industrial applications and applying for patents. There are two interpretations for this development. Firstly, in the reporting period the intellectual property rights system was still developing. Secondly, in the reporting period the system was still creating a critical mass of biotechnology knowledge base. Considering that biotechnology has a quite linear mode of innovation, at this stage the system might not be matured enough to develop industrial applications at the same pace than scientific publications.

The second indicator (biotechnology patent applications per million capita) confirms the problems of the Croatian innovation system in applying knowledge for industrial purposes.

3.4 Industrial development

There are no comprehensive data available to assess the Croatian performance in developing a biotechnology industry vis-à-vis EU25 and USA.

3.5 Market conditions

During the time period 1995 – 2002 no biomedicines nor field trials with GMPs were reported from Spain.

4. Conclusions

4.1 Introduction

This chapter aims at giving an analytical overview of the information described in the previous chapters. The information is presented in tables giving selected aspects of the policy instruments implemented in Croatia at the National and Regional levels in the period 2002-2005. The key aspects of the German biotechnology policy approach considered in the analysis are:

- Funding per type of instrument
- Target groups of the instruments and co-financing conditions
- Policy goals addressed by the instruments in terms of funding
- Biotechnology research fields covered by the instruments
- Biotechnology activities stimulated through the policy instruments
- Trends in the types of policy instruments implemented (comparison with the period 1994-1998)

The next sections comment on these issues.

4.2 Public funding of biotechnology through policy instruments

As already mentioned in section 2.1 data gathering in the framework of the BioPolis project for the Republic of Croatia was a complicated process due to the lack of policy documents in English for the reporting period and to the difficulties to contact the relevant policy makers in the Ministry of Science Education and Sport. The information available on funding from different sources is contradictory in some cases or incomplete to make fair estimations on biotechnology funding by the different instruments. For this reason there this report does not include funding data on biotechnology promotion. The analysis presents a qualitative assessment on the type of policy instruments implemented.

As introduced in chapter 2, non-policy-directed funding covers institutional funding for research institutes (which covers the administrative and operational costs of 5 public research institutes) and the open-call system for project funding of the MSES. This open calls are the main funding instrument for research activities in Croatia. Accordingly, the Croatian funding system for biotechnology research and commercialisation is mainly based on this non-policy-directed instrument of the MSES. Regional policy does not play a role in the Croatia funding system of science, technology and innovation.

In what concerns policy-directed instruments, these target both the knowledge base and the commercialisation or research resources. No biotechnology specific instruments have been implemented in the reporting period.

4.3 Specific features of the instruments

Table 4.1 includes the policy-directed instruments per type according to the categories National/ Regional and Generic/Biotechnology specific). Additionally the table shows the target groups of each instrument and whether the subsidies or grants are based on the co-financing principle (the subsidy does not finance the entire costs of the actions promoted).

Table 4.1 Participants/recipients and co-financing requirements of policy-directed programs that fund biotech activities in the period 2002-2005

Instrument	Funding agency	Co-financing	Participants/ Recipients		
			LF	PRO	SME
National Policy Instruments					
<i>Generic (non biotechnology specific)</i>					
Brain Gain	NFS			√	
Junior Researchers Program	MSES			√	
Equipment Grants	MSES			√	
HITRA – (TEST, RAZUM)	MSES -BICRO	√		√	√

Source: BioPolis Research

According to the information available, the instruments target mainly public research organisations. HITRA focuses on PRO and SMEs using co-financing principles.

2.3 Policy goals

Table 4.2 presents the policy-directed instruments per type according to the categories National/ Regional and Generic/Biotechnology specific). Additionally the table shows the policy goals explicitly addressed by each instrument. The policy goals considered are:

1. To stimulate high level of biotechnology research
2. To stimulate high level of industry-oriented (and applied) research
3. To stimulate knowledge flow and collaboration among scientific disciplines
4. To guarantee the availability of human resources
5. To stimulate the transmission of knowledge from academia to industry and its application to industrial resources
6. To promote the adoption of biotechnology for new industrial applications
7. To stimulate firm creation
8. To stimulate social acceptance of biotechnology
9. To promote business investment in R&D
10. To promote bio-safety research and risk assessment

Finally, for each type of policy instrument the table gives an estimation of the funding allocated for each policy goal in terms of granted grants, subsidies and/or credits.

Table 4.2 Coverage of policy goals and funding by goal by policy-directed instruments in the period 2002-2005 (in M EUR)

	1*	2	3	4	5	6	7	8	9	10
National										
<i>Generic</i>										
Brain Gain				√						
Junior Researchers Program				√						
Equipment Grants	√	√								
HITRA – (TEST, RAZUM)					√		√		√	
Grand Total in M EUR¹⁾	n.a.	n.a.	-	n.a.	n.a.	-	n.a.	-	n.a.	-

Source: BioPolis Research

1) No information / estimations available on the budget invested per policy goal

*

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

The instruments implemented in the reporting period aimed at establishing the basic elements of the innovation system. The instruments “Brain Gain”, “Junior Researchers Program” and “Equipment Grants” target the promotion of human resources for research activities and research infrastructure. Indirectly, these instruments target hence the development of the knowledge base by mobilising the appropriate resources. On the other hand, “HITRA”, with the subprograms “TEST” and “RAZUM” targets technology transfer and other commercialisation goals such as firm creation and collaboration between industry and academia.

4.5 Biotechnology research application areas

Table 4.3 presents the biotechnology research application areas stimulated by the national policy-directed instruments and the funding going into each research area in the period 2002-2005. The applications areas considered are:

- 1) Plant biotechnology
- 2) Animal biotechnology
- 3) Environmental biotechnology
- 4) Health biotechnology
- 5) Food biotechnology
- 6) Industrial biotechnology
- 7) Basic biotechnology
- 8) Ethical, legal, social aspects of biotechnology
- 9) General (applies to programmes addressing capability building, patenting activities, networking, etc and a research field can not be specified)

Table 4.3 Coverage of biotech application areas through policy-directed instruments by biotech application area in the period 2002-2005

	Biotech application areas								
	1*	2	3	4	5	6	7	8	9
National Instruments									
Generic									
Brain Gain									√
Junior Researchers Program									√
Equipment Grants									√
HITRA – (TEST, RAZUM)									√
Grand Total National Instruments¹⁾									n.a.

Source: BioPolis Research

1) No information / estimations available on the budget invested per biotechnology field

*

1 = Plant biotechnology

2 = Animal biotechnology

3 = Environmental biotechnology

4 = Health biotechnology

5 = Food biotechnology

6 = Industrial biotechnology

7 = Basic biotechnology

8 = Ethical, legal, social aspects of biotechnology

9= General capabilities, infrastructure; not are specific

In what concerns the biotechnology application areas the policy instruments identified are generic instruments targeting either the mobilisation of research resources for research or the commercialisation of research results. Due to the lack of detailed information and the fact that the programs do not explicitly promote research projects we have classified them under the category „general“. In other words, the instruments aim at building up general capabilities and innovation infrastructure.

4.6 Stimulation of biotechnology activities through the instruments

Table 4.4 presents the biotechnology activities stimulated by the national policy-directed instruments. The biotechnology activities considered are:

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

Regarding the type of activities in the innovation system, again Brain Gain, the Junior Researchers Program and the Equipment grants promote human resources for research and research infrastructure. Indirectly these activities support hence basic and applied research. HITRA, on the other hand, focuses on activities typical for commercialisation process (applied research, collaboration, company creation and grants for industrial research).

Table 4.4 Coverage of biotech activities in the period 2002-2005 through policy-directed instruments

Biotechnology Activities																			
	1*	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
National Policy Instruments																			
<i>Generic</i>																			
Brain Gain	√	√				√													
Junior Researchers Program	√	√				√													
Equipment Grants	√	√																	
HITRA – (TEST, RAZUM)		√						√					√	√	√		√		
Total National Funding ²⁾	n.a.	n.a.	-	-	-	n.a.	-	n.a.	-	-	-	-	n.a.	-	-	-	n.a.	-	-

Source: BioPolis Research

¹⁾ No information / estimations available on the budget invested per activity

²⁾ The figures include only those instruments for which comprehensive data per activity are available.

* Many different types of activities are supported by the policy instruments:

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

5. Future developments

In 2006 the National Science and Technology Policy 2005-2010 was adopted by the Government of Croatia on May 2006 (Republic of Croatia 2006)¹⁶. The document presents a vision of the development of the Science and Technology Sector in the Republic of Croatia.

In Science and Higher Education the main objectives refer to the development of the knowledge base. The following objectives are listed in the document:

- 1) Increasing investments in research and development and their efficiency. For this purpose the government will prepare a national action plan based on the allocation of 3% of the GDP for R&D activities. The government aims at increasing the funds for R&D at a rate of at least 25%. A new expert evaluation system should enable greater transparency of the science system.
- 2) Restructuring Croatia's Science System. For this purpose the government will cluster the existing scientific projects into integrated collaborative scientific programmes. Moreover, the doctoral studies should be reform into efficient 3rd cycle research studies. Additionally, the government intends to strengthen the system of transfer and application of research results.
- 3) Strengthening cooperation between science, government and industry in the creation of knowledge and goods. For this purpose the government intends to create the appropriate framework conditions by adapting the legal framework in the science labour market and developing financial instruments to create incentives for collaboration.
- 4) Increasing participation of Croatia Scientists and other bodies in EU Framework programmes.

For budget allocation the government gives the responsibility the Ministry of science, Education and Sport (MSES) and to the National Foundation for Science, Higher Education and Technological Development (NSF). Accordingly, in the next years no major changes in the governance system and in the policy instruments launched are expected. Research Grants, Equipment Grants, and Support Program for Young Researchers remain the main instruments of the MSES. In what concerns the NFS, the foundation will implement the strategic plan published in 2004. An important aspect of the National Science and Technology Policy 2005-2010 is the awareness of the need to define priority areas in a systematic manner and implement support instruments to develop them. Moreover, the government recognises the need of introducing technology foresight instruments for decision making.

Even though priority areas have already been defined in the past, science and technology policy has not systematically implemented any initiatives to promote these areas. The National Science and Technology Policy 2005-2010 is still quite unprecise in what concerns the instruments that need to be develop in this direction. Accordingly,

¹⁶ Republic of Croatia (2006). Strategic Development Framework for 2006-2013. Zagreb, Central State Office for Development Strategy and Coordination of EU Funds.

even though biotechnology appears again in the document as a priority area, the extent to which the biotechnology knowledge base will be promoted in the next future remains unclear.

In the area of technology and innovation policy the main objective of the government is to create the conditions for increasing R&D investments in the private sector with the goal of reaching a 1:1 ratio of public vs. private sector investment by 2010. The National Science and Technology Policy 2005-2010 includes the established innovation policy instruments in the period 2002-2005 (referring to human capital, research infrastructure, technology transfer, collaboration and company creation). Moreover, it emphasizes the need to strengthen the IPR regime, to stimulate R&D investments through tax policy and to ease the market access for new products by establishing a supportive regulatory environment. As in the reporting period 2002-2005, the HITRA should continue to set the main guidelines for technology policy with the subprogrammes TEST and RAZUM.

The following measures should shape technology policy in the next future:

- 1) Establishment of the Croatian Institute of Technology (HIT) was established in March 2006 to support the implementation of technology policy and policy development. HIT will concentrate on the field of financial support to technology based companies.
- 2) JEZGRA projects in the TEST programme. The projects aim at grouping research programmes to create centres of excellence based on public-private partnerships.
- 3) Technology Infrastructure Development Programme (TehCro) administered by BICRO will grant support for the establishment of incubators and research and technology centers.
- 4) Research and Development programme (IRCro). The programme administered by BICRO intends to promote collaboration between academia and industry by introducing grants with co-financing mechanisms.
- 5) Business Competitiveness Upgrading Programme (KonGro). The programme administered by BICRO intends to assist SME to upgrade their business organisation to reach ISO standards.
- 6) Act on Investment Funds. The Act was passed in December 2005 and intends to develop the venture capital industry in Croatia.
- 7) Venture Capital Programme (VenCro). To be launched in 2007 by BICRO in order to stimulate the establishment of venture capital funds in Croatia.

All in all, the National Science and Technology Policy 2005-2010 seems to focus on strengthening the development of Croatian knowledge base by supporting the process of reaching European research and education standards. The promotion of specific scientific fields remains a long term objective. In the field of technology development and innovation the National Policy recognises the need to establish appropriate framework conditions for innovation in terms of a legal framework for developing financing instruments to support the innovation process and to create incentives for private R&D investment.

Annex 1 List of tables

Table 1.1	Strategic policy documents relevant for innovation policy in the period 2002-2005.....	7
Table 1.2	Public research Institutes carrying biotechnology research	9
Table 2.1	Non-policy-directed funding of biotechnology research in M EUR.....	13
Table 2.2	National and regional public policy-directed biotechnology stimulating instruments during the period 2002-2005.....	14
Table 2.3	HITRA – Budget 2001, 2002, 2003	16
Table 2.4	Involvement of Croatia in biotechnology/life sciences programmes of the 6th Framework Program.....	17
Table 4.1	Participants/recipients and co-financing requirements of policy-directed programs that fund biotech activities in the period 2002-2005	25
Table 4.2	Coverage of policy goals and funding by goal by policy-directed instruments in the period 2002-2005 (in M EUR).....	26
Table 4.3	Coverage of biotech application areas through policy-directed instruments by biotech application area in the period 2002-2005.....	27
Table 4.4	Coverage of biotech activities in the period 2002-2005 through policy-directed instruments	29

Annex 2 List of figures and charts

Figure 1.1	Main public institutions in Croatian Science, Research and Innovation System in 2005	6
Chart 3.1	The biotechnology knowledge base indicators, comparison with EU25 and USA, three periods, index values	19
Chart 3.2.1	Share of subfields (in%) of total biotechnology publication for Croatia in comparison with EU25 and USA (1994-1996)	20
Chart 3.2.2	Share of subfields (in%) of total biotechnology publication for Croatia in comparison with EU25 and USA (2002-2004)	21
Chart 3.3	Biotechnology subfields growth rates for Croatia in comparison with EU25 and USA (1994-1996 and 2002-2004)	21
Chart 3.4	Performance indicators for biotechnology knowledge transmission and applications, three periods, Croatia in comparison with EU25 and USA	22

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| ERAWATCH | http://cordis.europa.eu/erawatch/ |
| EUROSTAT | http://epp.eurostat.ec.europa.eu |
| Ministry of Science Education and Sports | http://www.mzos.hr |
| National Foundation for Science Higher Education and Technological Development | http://www.nzz.hr |
| World Bank – Croatia | http://www.worldbank.hr/ |

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	(1) 1994-1998 (3) 2000-2004

	Indicator	Chart	Comments	Time periods
			Small country effect	
Ind. 6	Graduates in life sciences pMC	3.1	Index: Reference Region EU17 =100 and US data for comparison	(2) 1998 (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 ¹⁷	2005
Ind. 16	Biomedicines	3.6	Source: BT Policy Benchmarking 2005 Index: Reference Region EU15 =100	1995-2002

¹⁷ http://europa.eu.int/comm/public_opinion/archives/ebs/ebs_225_report_en.pdf

	Indicator	Chart	Comments	Time periods
			US data for comparison	
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
Croatia	210	379	547	5	5	4
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
Croatia	46	83	123	21	29	39
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 (Mecu)	BT Publications/ Mecu BT public expenditure	Index
			Biotech specific	Generic			
	2002-2004	1994-1998	1994-1998	1994-1998	1994-1998	2002-2004/1994-1998	
EU25	145646				n.a.		
Croatia	547				n.a.		n.a.
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. Share of BT publications of Total publications: absolute and indexed

	BT publications			Total publications		
	94-96	98-00	02-04	94-96	98-00	02-04
EU25	97521	128716	145646	860652	1024327	1117392
Croatia	210	379	547	2778	3681	4591
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
Croatia	8%	10%	12%	67	82	91
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
Croatia	4,55	4,19	74	58
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
Croatia	n.a.	n.a.	5	4
USA	75253*	70950	276*	288
	Graduates pMC		Index EU17=100	
	1998 / 1999	2002	1998 / 1999	2002
EU17	91**	189	100	100
Croatia	n.a.	n.a.	n.a.	n.a.
USA	273*	246	299	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%
Croatia	100%	6%	45%	7%	14%	4%	2%	22%
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%
Croatia	100%	10%	48%	3%	11%	3%	1%	24%
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
Croatia	217	12	98	16	31	8	5	47
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
Croatia	564	59	270	16	61	18	6	134
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%
Croatia	392%	176%	0%	97%	125%	20%	185%
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
Croatia	4	3	7	5	5	4
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
Croatia	1	1	2	8	3	7
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
Croatia	4	3	7	210	379	510
USA	8590	14396	12348	119802	135508	148853
	BT patents/ BT p			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
Croatia	0,02	0,01	0,01	38	11	19
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 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
Croatia	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
Croatia	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 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

	BT start-ups		Population in T	
	2001-2003	2003	2003	
Europe (EU 15 - Cyprus - Greece + Norway + Switzerland)	523	132	367051	
Croatia	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 (EU 15 - Cyprus - Greece + Norway + Switzerland)	1,4	100	0,36	100
Croatia	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 values

	BT IPO	Population T				
	2002-2005	2002	2003	2004	2005	2002-2005
EU Available	29	452927	454869	457154	461593	456636
Croatia	0	4444	4442	4442	4444	4443
USA	52	287941	290789	291685		290138
	IPO /pMC		Index			
	2002-2005		2002-2005			
EU Available	0.00		100			
Croatia	0.00		0			
USA	0.00		282			

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

IPO data: Ernst and Young 2002-2006, London Stock Exchange, Frankfurt Stock Exchange, Euronext, Nasdaq, Burril & Company

Source: BioPolisResearch

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
Croatia	n.a.	n.a.	n.a.			
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
Croatia	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
Croatia	n.a	n.a	n.a	n.a
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 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
Croatia	n.a.	n.a.	n.a.	n.a.
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
Croatia		

*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

BT	Biotechnology
BICRO	Business Innovation Centre of Croatia
EU	European Union
GDP	Gross Domestic Product
GMOs	Genetically Modified Organisms
HITRA	Croatian Program for Innovative Technological Development
ICT	Information and Communication Technology
IP	intellectual property
LFs	Large Firms
M EUR	Million Euro
MedILS	Mediterranean Institute for Life Sciences
MSES .	Ministry of Science, Education and Sports
NCHE	National Council for Higher Education
NCS	National Council for Science
NFS	National Foundation for Science, Higher Education and Technological Development
pMC	Per million capita
PROs	Public Research Organisations
Publ.	Publications
R&D	Research and Development
SMEs	Small and Medium Enterprises

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