

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 Turkey

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

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March 2007

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Summary

Turkey has approximately 70 million inhabitants. It is a candidate for the European Union. Its GDP is approximately 30% of the EU25 average. Agriculture is a significant economic sector (11.7% of the GDP) and employs approximately 35.9% of the total labour force. Turkey's industry sector is dominated by SMEs.

Investments in R&D in Turkey are limited, representing only 0.66% of its GDP (compared to the EU25 average of 1.93%). The government accounts for approximately 50% of investments in R&D, and industry for approximately 41%.

Several actors are involved in the national science, technology and innovation system. The Supreme Council of Science and Technology (BTYK), which is chaired by the Prime Minister, is responsible for national policy making and priority setting. The State Planning Organisation (SPO) publishes every five years a Five-Year Development Plan. In recent plans, biotechnology and biosafety are also addressed. The Scientific and Technical Research Council of Turkey (Tubitak) is a main player in the distribution of public funding for R&D. It is involved in policy making and also has its own research institutes, where biotechnology research is also being conducted. The Technology Development Foundation of Turkey (TTGV) is responsible for raising awareness of R&D in industry and manages several public R&D support programmes.

The most important actors in research in the field of biotechnology in Turkey are university research groups and a number of research institutes, including two operating under the umbrella of Tubitak.

The performance of Turkey's knowledge base in the field of biotechnology is rather poor, and the availability of human resources in life sciences is limited. The number of biotechnology publications per million capita increased in the period 1994-2004, but still lagged far behind EU25 and USA levels. Turkey's share of biotechnology publications in relation to the total number of publications it produced also increased during this period, but was lower than the EU25 average and USA level. The citation rate of biotechnology publications was lower than the EU25 and USA levels. The number of graduates in life sciences declined over the ten-year period and was low compared to EU25 and USA figures as well.

The distribution of biotechnology publications across different sub-areas shows a similar pattern to that of the USA and EU25, with health biotechnology ranking first and generic biotechnology second. All other subfields rank lower than 10% in terms of number of biotechnology publications. In the period between 1994-1996 and 2002-2004, the number of generic biotechnology publications decreased, while health, industrial and food biotechnology publication numbers increased. All subfields showed a high publication growth rate, in spite of the fact that only health biotechnology, generic biotechnology and plant biotechnology produced a significant amount of publications in 1994-1996. For the other subfields, the fact that actual publication numbers were so low in the earlier period may explain the high growth rate.

The performance indicators for knowledge transmission and application showed a very limited number of biotechnology patents per biotechnology publication. Compared to EU25 and USA figures, Turkey's performance experienced a decline in the decade

covered by this study. The number of biotechnology patents per million capita was also rather low. The index figure did not exceed 1 in the ten years (EU25 average = 100).

Five policy-directed generic instruments for R&D and innovation support have been identified in Turkey; three are managed by Tubitak and two by TTGV. Channelled through four of the five instruments (no data were available for one of the programmes), a budget of at least 43.77M EUR was spent on biotechnology in the period 2002-2005. We have not been able to collect information about non-policy funding of biotechnology in Turkey.

Most of the funding (approximately 60%) was used for commercialisation of biotechnology (including grants for industrial research). A much smaller portion was used for biotech research in public institutions (approximately 38%); the rest was allocated to ELSA and biosafety activities.

The main policy goal of the five instruments was the adoption of biotechnology for new industrial applications, which received almost half of the allocated budget. The stimulation of high levels of biotechnology research also received a large portion of the funding. Except for ELSA and generic biotechnology, all biotech subfields were covered by two of the instruments (ARDEB and BIDEB). No data were available on coverage of biotechnology areas for the other three instruments.

Two foresight studies have identified biotechnology as an important future technology for Turkey because it provides critical input for the health, agriculture and industrial production sectors. This is consistent with the new government policy goal to increase general expenditures on R&D (GERD) from 0.64% to 2% of the GDP by 2010. The government has allocated substantial additional public funding (275M EUR) in order to stimulate human resource development and promote science and technology in society and industry.

1. Introduction and background

1.1 General introduction

With more than 70 million inhabitants, Turkey is the second largest country in Europe. It is a member of NATO and an associate member of the EU. The country is a multi-party democracy and has a president as head of state.

In 2005, the Gross Domestic Product (GDP) was 285 000M EUR, which on a per capita basis, represented approximately 30% of the EU25 average (Eurostat, 2005). The country suffered from several economic crises in the late 1990s and in 2000 and 2001. The inflation rate decreased from approximately 47% in 2002 to 8% in 2005 (Eurostat, 2005). Following the economic and financial crises of the beginning of this century, the GDP in Turkey rose by approximately 10% per year (OECD, 2005).

The composition of the GDP per sector is as follows: 58.5% for services; 29.8% for industry and 11.7% for agriculture. Turkey's industry is dominated by SMEs. Although the share of agriculture in employment decreased from 43% in 1993 to 34% in 2003, it still remains the most important employment sector (OECD, 2005).

R&D activities in Turkey are limited compared to other European countries. Gross Expenditures on R&D (GERD) amounted to 1 300M EUR in 2002, approximately 0.66% of Turkey's GDP. The EU average in the same year was 1.9% of GDP. In 2000, the figure for Turkey was 0.64%, which was already an increase on previous years. The government's contribution to the GERD was 50.6%, while 41.3% was invested by industry (Eurostat, 2005). In 2000, approximately 8% of total R&D funds spent by universities and government went towards agriculture (Cetindamar, 2006).

There are approximately 90 biotechnology-active firms in Turkey; two-thirds can be classified as modern biotechnology producers, such as RTA Labs and Pak Gifa. Most of the biotechnology firms are small and were established in the last decade. The most important sector for biotechnology companies is health, followed by agriculture. The largest growth area for biotechnology companies between 2000 and 2005 involved energy and health applications (Cetindamar, 2006).

1.2 Characteristics of national S&T and innovation system

Since 1963, the Turkish government produces once every five years a development plan which lays out the basic principles and policies for the following five years. It is suitably referred to as the "Five-Year Development Plan". Science and technology policies were already included in the second development plan. These plans are published by the State Planning Organisation. The eighth development plan for 2001-2005 acknowledged the importance of specific technologies (including ICT and genetic technologies) and the necessity to increase Turkey's capacity in science and technology (SPO, 2005).

In 2002, in line with the decision of the Supreme Council of Science and Technology, the "Vision 2023" project was initiated in order to create a science and technology policy for Turkey for the period 2003-2023. A steering committee has since been established with

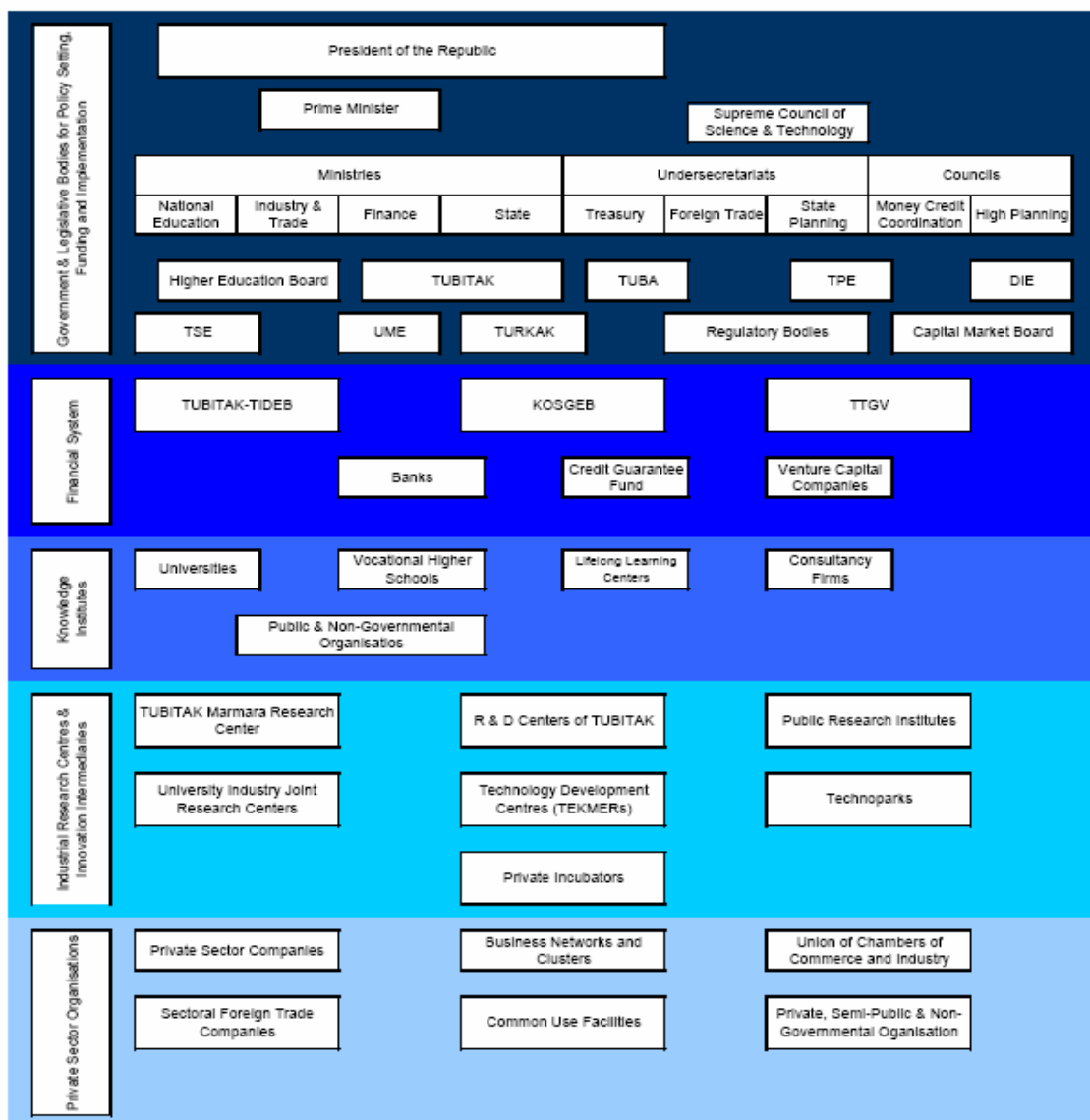
the participation of high-level representatives from 65 public and private organisations and universities.

Vision 2023 has four sub-projects:

- The National Technology Foresight Project,
- The Technological Capabilities Project,
- The Researcher’s Inventory Project, and
- The National R&D Infrastructure Project.

The main policy actors in the national innovation system in Turkey are presented in Figure 1.1.

Figure 0.1 Organisational chart of the national R&D and innovation governance system



Source: European Commission, 2005

The Supreme Council of Science and Technology (BTYK) is the highest level policy coordination body for science, technology and innovation in Turkey. The Council is chaired by the Prime Minister and its members are representatives from governmental

bodies, NGOs and universities. The BTYK was established by law in 1983 but did not function properly until the beginning of 2004, mainly due to an absence of political commitment to science, technology and innovation issues (Erawatch 2005). Since a few years, the Council meets twice annually; its decisions are binding for public agencies since they are issued in the form of a Prime Minister's Circular, in which actions are requested for implementation.

Tubitak is the Scientific and Technical Research Council. It is responsible for the design of science and technology policy and acts as a secretariat for the BTYK. Furthermore, Tubitak has the task to promote, develop, organise, conduct and coordinate research and development in accordance with national targets and priorities. It also funds research projects in universities, as well as public and private organisations.

The State Planning Organisation (SPO) designs and implements the Five-Year Development Plans. In these plans, macro-economic and financial policies are presented, as well as policies on science and technology.

There are three different types of incentives to promote academic R&D in Turkey. The Ministry of Finance provides a research fund to each public university, which represents around 40% of the total public funding. Public universities have their own mechanisms for allocating this fund to several research projects within the university. SPO is the second organisation that promotes academic R&D. It also represents about 40% of the total public funding. SPO provides financial support for research projects and also for building research infrastructure in public universities. Tubitak's support programme, which represents around 10% of the total public funding, is the third mechanism. Tubitak runs its programme through eight Research Grant Committees, representing various areas of specialization. These research grant committees fund and monitor national research projects, and co-finance international projects in relation with bi-lateral agreements. The remaining public funding for academic research comes from various ministries and state departments in the form of contract research.

Different types of legal and administrative incentives exist to promote RD&D in Industry, including the government's R&D Assistance Programme for Industry. This includes a financial contribution by Tubitak and by the Under-secretariat of Foreign Trade for up to 50% of the total eligible costs of an individual R&D project. Another incentive are low-interest loans that are provided by the Technology Development Foundation of Turkey (TTGV) to provide financial incentives to the private companies in order to promote their innovative R&D activities. TTGV was established in 1991 as a joint effort of the private sector, the Turkish government and the World Bank. Its goal is to raise industries' awareness of the importance of R&D and to support technology development projects with funds from the World Bank and the Under-secretariat of the Treasury. The organisation provides loan funds and financing for start-ups (TTGV, 2005). TTGV also has the responsibility to facilitate university-industry cooperation on innovation; to stimulate and support the creation of science and technology parks, venture capital funds and technology service centres; and to provide technology support for SMEs. It manages financial support schemes for research and technology development, technology service centres, techno parks, technology support services and venture capital programmes.

The Small- and Medium-Sized Industry Development Organisation (KOSGEB) was created in 1990, based on a merger of two organisations. KOSGEB aims to stimulate the innovative capacity of SMEs in Turkey. It develops policies for stimulation of entrepreneurship, with a view to increasing the competitive advantage of SMEs.

The Turkish Academy of Sciences (TUBA) was established in 1993 and is affiliated with the Office of the Prime Minister. Its aim is to stimulate, support and upgrade the status of science and scientists.

1.3 National support and framework conditions for biotechnology

Biotechnology has been an issue for R&D and innovation policy in Turkey since the mid-1980s. In 1983, the State Planning Organisation and the Scientific and Technical Research Council of Turkey (Tubitak) proclaimed that biotechnology would be one of the priorities areas of the following 20 years (Gozukirmizi, 2005).

In the 1990s, TTGV – together with Tubitak and TUBA – assessed the status of biotechnology in Turkey. The goal of these organisations was to design a biotechnology policy for the short, medium and long term. Many meetings took place during which scholars expressed their opinions about biotechnology and its future impact on Turkey. This led in 1995 to the document ‘Science-Technology-Industry Discussion Platform: Report of the Working Group on Policies for Genetic Engineering-Biotechnology’.

In the State Planning Organisation’s eighth Five-Year Development Plan, which covered the period 2001-2005, a special committee for biotechnology and biosafety was announced. The special committee was later disbanded, and the responsibility for biosafety was transferred to the Ministry of Agriculture (FAS, 2005).

Although biotechnology has been a priority area in Turkey for more than twenty years, there are no specific national stimulation programmes or government budgets allocated for biotechnology research and commercialisation activities.

Regulation

There are hardly any regulations in Turkey in the field of biotechnology. Turkey does not have a well-regulated biosafety policy or intellectual property rights law. The only existing regulation, which is directly related to GMOs, is the ‘Directive on the principles of field trials of genetically-modified plants’. This directive prohibits the deliberate introduction of GMOs into the environment without first carrying out a risk assessment (UNEP, 2003).

Since 2005, Turkey has been defining regulations on the use of biotechnology in agriculture. According to a study on biotechnology applications in Turkey, no genetically-modified products are cultivated or imported at the moment in Turkey (Cetindamar, 2006). However, the importation and production of biotechnology products is expected to be regulated in the future. The current version of the draft law on biotechnology, liability and penal provisions is expected to disrupt the current market (GAIN, 2005). The implementation of the new framework law is not expected to be in place before 2007. At the moment, there is no legislation concerning the importation of biotech products for food. Since the beginning of 2004, after the Parliament approved the

adoption of the Cartagena Protocol, there have been controlled imports of GMOs. The Ministry of Agriculture and Rural Affairs has prepared rules for field trials under strict conditions to avoid accidental release and gene escape from GMOs (Tubitak, 2005).

Public opinion

Public opinion in Turkey on the issue of biotechnology applications is much more supportive than in most EU25 countries. On questions about different applications of biotechnology, fewer people on average than in the EU25 responded negatively about specific biotechnology applications (i.e. that a given application should never be approved), and a higher percentage responded that the technology should be approved in all circumstances. Table 1.1 presents some of the results of the Eurobarometer Survey for Turkey and the EU25 (average).

Table 0.1 The extent of Turkish approval of applications of new technologies, expressed in percentages (with EU25 averages listed below the Turkish figures)

Topics for consideration	Never	Only in exceptional circumstances	Only if highly regulated & controlled	In all circumstances	Dnk*
Animal cloning for research into human diseases	30 31	13 22	18 35	24 8	15 4
Human cloning so couples can have a baby despite a genetic disorder	35 59	14 16	22 15	15 4	15 5
Cloning human stem cells from embryos for organ transplants	30 22	12 20	20 41	23 11	15 5
Growing meat from cell cultures to avoid the slaughter of animals	42 54	11 12	16 18	14 6	17 9
Developing GM crops to increase the variety of regionally-grown foods	29 37	11 17	16 31	25 8	19 7
Developing GM bacteria for cleaning up environmental catastrophes	12 19	10 16	22 37	36 20	20 8

- do not know

Source: Eurobarometer, 2005.

1.4 The main biotech policy and research actors

Within Turkey's government, the Ministry of Agriculture and Rural Affairs (MARA) is responsible for all biotechnology policy issues, including regulation. This is because agriculture plays an important role in Turkey's economy and agricultural applications are the most important applications of biotechnology in the country. The role of the Ministry of Health and Environment is limited to participating in a number of biosafety committees (GAIN, 2005).

Biotechnological research in Turkey is performed at a number of universities, the Marmara Research Centre and a number of research institutes. The private sector does not conduct biotechnological research (Kolankaya, 2000).

The universities in Turkey with departments that are active in biotechnology are:

- The Bogazici University, with its department of Molecular Biology and Genetics;
- The Ege University, with its department of Bioengineering (Ege University established the Excellence Centre in Biotechnology, which already has one spin-off company);
- The Middle East Technical University, with its Molecular Biology-Biotechnology R&D Centre and Plant Biotechnology Research Laboratory; and Hacettepe University, which established a Biomedical Technologies Centre in 2004 in collaboration with six firms and Tubitak to commercialise research findings and conduct applied research (Cetindamar, 2006).

Some other universities involved in biotechnology research are Istanbul University, Cukurova University, Ankara University, Aegean University, Akdeniz University, Bilkent University and Sabanci University.

The Marmara Research Centre (MAM) of Tubitak was established in 1963. In 1995, the research centre was reorganized and received the status of a semi-autonomous organisation. It is regarded as Turkey's first and only multidisciplinary research centre, and aims to solve Turkish industry's technological problems. There are six institutes that operate in the centre:

- The Chemistry and Environment Institute,
- The Earth and Marine Sciences Institute,
- The Energy Institute,
- The Food Institute,
- The Information Technologies Institute, and
- The Materials Institute.

The Food Institute conducts research in the field of microbiology and fermentation technologies. It has a laboratory for GMO research that offers services for Turkey's industry.

The Department of Biology of the Research Institute for Basic Sciences was founded by Tubitak in 1983. At the start, research in the department was basically focused on the transfer of enzyme and hybridoma technologies, and the investigation of early diagnosis of hereditary diseases (e.g. β thalassemia) at DNA level. In 1992, the Biology Department was transformed into the Research Institute for Genetic Engineering and Biotechnology (GMBAE), by decision of Tubitak's Board of Governors. This transformation gave GMBAE a new impetus. Since that time, new laboratories have emerged, including plant biotechnology and transgenic animal laboratories, as well as fermentation facilities. GMBAE has a staff of 51 (33 of whom are academic staff). Three of five divisions of GMBAE deal with biotech research: the plant biotechnology, animal biotechnology and microbial biotechnology divisions. Furthermore, there is a technical support division and a technology transfer division. Research activities of GMBAE include generating mutant bacteria for producing clean energy; plant genetic mapping and plant gene transfer; the development of transgenic mice; and the development of monoclonal antibodies.

Several other research institutes that are active in the field of biotechnology are the Şap Institute, Veterinary Control and Research Institute, Çukurova Advanced Agriculture Technologies Research and Development Institute, and Ankara Nuclear Agriculture and Animal Research Centre.

With contributions from KOSGEB and government agencies, a number of techno-parks have been created in Turkey. Approximately 20% of the firms located in techno-parks are active in biotechnology (Cetindamar, 2006).

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

2.1 Introduction

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

Policy-directed funding includes funding directed by explicit policy decisions about specific instruments, such as R&D programmes, programmes encouraging collaboration, industrial research grants, support for centres of excellence, support for commercialisation of research, support for start-ups, programmes encouraging mobility of researchers, programmes with open calls, *etc.* This policy-directed funding can include biotechnology-specific policy instruments and generic policy instruments. Biotechnology-specific policy instruments have been specifically set up to stimulate biotechnology. Generic policy instruments are not dedicated to a specific technology, but in principle stimulate all technologies, including biotechnology. The BioPolis project only considers those generic instruments that make a reference to (the stimulation of) biotechnology activities in the policy of the funding organisation running the programme, or that of the ministry/government department itself.

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

Section 2.2 describes the funding of biotechnology research and biotechnology commercialisation through policy-directed instruments. We have not been successful in identifying non-policy-directed funding of biotechnology in Turkey. Charities can also play an important role in funding biotechnology research in some countries; the issue is briefly addressed in section 2.3. The final section (2.4) of this chapter provides a short overview of European funding of biotechnology research in Turkey through the 6th Framework Programme.

2.2 Policy-directed instruments

In this section, we present five policy-directed instruments that supported (and continue to support, since most are still running) biotechnology/life sciences research, transfer and commercialisation in Turkey during the period 2002-2005. Three programmes are managed by Tubitak and two by TTGV.

Table 0..1 gives an overview of the instruments, their funding organisations, total budget and share of the budget spent on biotechnology. The regions in Turkey do not have their

own specific programmes. The instruments are presented in greater detail in the rest of the section.

Table 0.1 National public policy-directed funding of biotechnology in the period 2002 – 2005 (M EUR)

Instrument	Funding organisation	Budget	% of total	Use of DF/SF
<i>Generic</i>				
ARDEB	Tubitak	19.75	23.3%	
BIDEB	Tubitak	1.02	2.3%	
TEYDEB	Tubitak	16,20	37.0%	
Industrial Technology Project	TTGV	6.8*	15.4%	DF
R&D Programme	TTGV	NA**		
TOTAL		43.77	100%	

* the budget was divided by the number of years that the programme ran. For the period 2002-2005, annual budgets were added up for those years that the programme ran.

** NA: Not Available

Source: BioPolis Research

2.2.1 ARDEB

ARDEB (Research Support Programmes Directorate) funds basic and applied scientific research. It is a generic programme with biotechnology as a priority. Approximately 10% of its projects are in the field of biotechnology. Only public sector research organisations can apply for funding, and up to 100% of a project can be financed by ARDEB. In the period 2002-2005, 19.75M EUR were spent on biotechnology projects.

2.2.2 BIDEB

The BIDEB (Directorate of Human Resources Development) Programme provides financial support to scientists for activities, such as visits abroad, short- or long-term scientific missions to learn new techniques or carry out small experiments abroad, PhD grants, publications support, arranging or attending scientific meetings and inviting experts from abroad. It is estimated that at least 10-15% of programme spending is related to biotechnology.

In 2005, within the BIDEB Programme, the following areas were eligible for PhD grants:

- Nanotechnology,
- Alternative energy technologies,
- Curing genetic diseases,
- Gene therapy,
- Stem cell studies and tissue engineering,
- Space technologies,
- Production of pharmaceuticals and vaccines for medical and veterinary purposes,
- Technologies related to plant and animal genetics,
- Technology and research management,
- Materials, and
- Social science and laws for science and technology in international relations.

Biotechnology is a priority field for BIDEB, as illustrated by the areas listed above (most of these are related to biotechnology). Through this programme, 1.02M EUR were spent on biotechnology-related activities during the reporting period.

2.2.3 TEYDEB

TEYDEB (Technology Monitoring and Evaluation Board) aims to stimulate industry investments in R&D. Between 1996 and 2004, up to 1 303 projects received funding, 3% of which were biotechnology projects (related to food, agriculture, medicine, animal production, pharmacy and forestry).

In the period 2002-2005, approximately 200M EUR were granted to industry in all fields, 16.2M EUR of which is estimated to have been allocated to biotechnology.

Funding comes from the Under-secretariat of Foreign Trade. Grants are provided to industry for R&D, for up to 60% of a given project budget. The projects can have a maximum duration of 36 months (interview with M. Kuhran, 2005; European Commission, 2005; Cetindamar, 2006).

2.2.4 Industrial Development Project

TTGV managed two programmes funded by the World Bank and the Under-secretariat of the Treasury: the Technology Development Project (1991-1998) and the Industrial Technology Project (1999-2005). Support to firms represented 50% of all R&D costs, for a maximum of four years and 1.75M EUR (2M USD). The total budget for the second programme in the period 1999-2004 was 37.7M EUR.

Approximately 8% of the total funding provided through these programmes went towards biotechnology projects, which amounted to around 7.6M USD (of a total of 95 M USD) in the period 1991-2005. The figure of 6.8M EUR in Table 2.1 was calculated on the basis of average funding per year times four years (2002-2005).

2.2.5 R&D programme

The second programme run by TTGV was the R&D Programme, with funds made available by the Under-secretariat of Foreign Trade. Unfortunately, there is no data available on projects in the field of biotechnology. The total budget for this programme during the period 1995-2004 was 33.9M EUR (38.7M USD) (Miskbay, 2004).

2.3 Charities

The Turkish Association of Cancer Research and Control (TKAK) does not finance research at the moment.

2.4 Participation in 6th Framework Programme

In the context of the sixth Framework Programme, Turkey has participated in 13 (out of a total of 8537) projects under the theme 'Life sciences, genomics and biotechnology for

health', and in 12 (out of a total of 1599) projects under the theme 'Food quality and safety'. Turkey did not participate in any nanotechnology-related projects, nor did it participate as a coordinator in any 6th Framework projects.

Table 0.2 Turkey's involvement in biotechnology/life sciences projects of the 6th Framework Programme

6th Framework Programme¹	Participation as project coordinator	Participation as member of the project team²
Thematic priority		
1. Life sciences, genomics and biotechnology for health	0	13 (0.2%)
2. Nanotechnologies (section bio-nanotechnology)	0	0
5. Food quality and safety	0	12 (0.8%)

¹ First and second call, all types of projects.

² Persons/groups can participate in more than one project, resulting in greater participation

Source: BioPolis Research.

3. Performance of the national biotechnology innovation system

3.1 Introduction

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

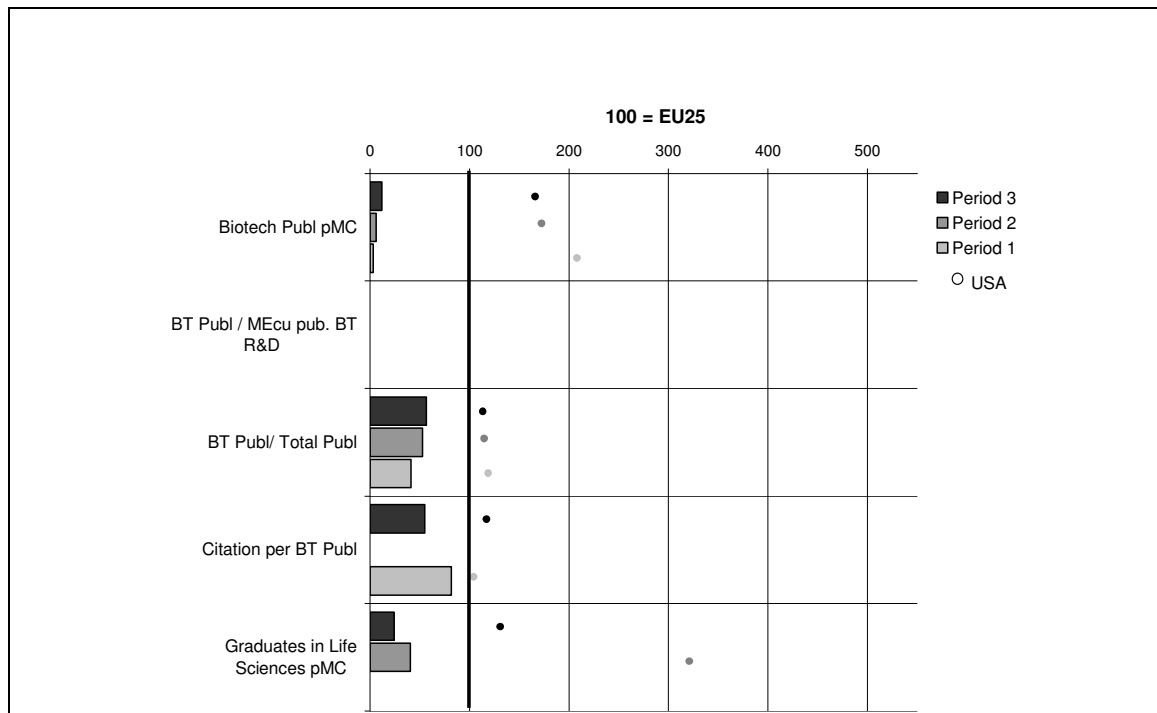
The presentation of the performance is structured along four main areas of the innovation system: the knowledge base, processes of knowledge transmission and application, industrial development, and markets for biotechnology-based products. In each area, data for a number of different indicators are shown for Turkey, the USA and EU25. The values of EU25 were chosen as a reference for each indicator. Absolute figures used to calculate the values of these indicators and the sources for the data can be found in Annex 5. In principle, for each indicator, data are presented for three periods. The periods chosen can vary considerably between 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

Knowledge base performance indicators (see Chart 3.1) show that Turkey still performs at a low level. The number of biotechnology publications per million capita in the periods 1994-1996, 1998- 2000 and 2002-2004 was much lower than in the USA and EU25. During these periods, the index figure increased from 2 in the first period to 13 in the third (the EU25 average was set at 100).

Turkey's share of biotechnology publications in relation to the total number of publications it produced was, in the ten years covered by this study, also much lower than the EU25 average and USA level. The number of citations per biotechnology publication as well as the number of graduates in life sciences were behind the EU25 and USA figures.

Chart 0.1 Turkey biotechnology knowledge base indicators: comparison with EU25 and USA figures in three periods (index value)

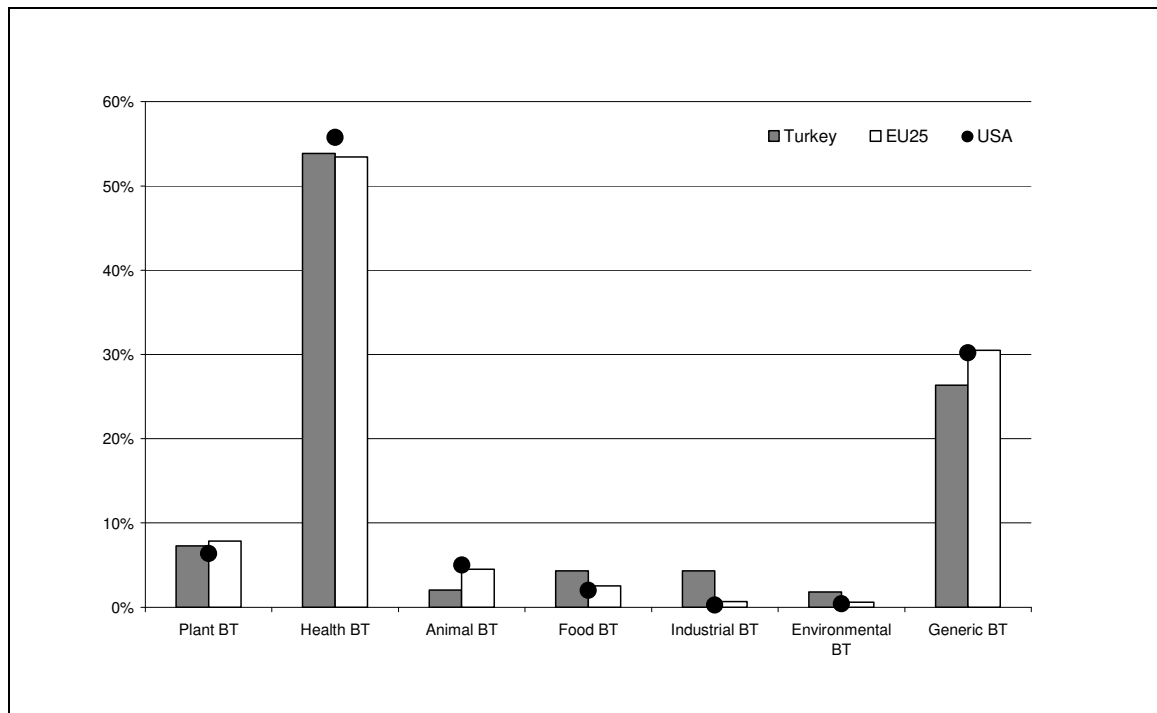


Source: BioPolis Research
Data: Science Citation Index

In the period 1994-1996, the distribution of biotechnology publications across different subfields showed a similar pattern to that of the EU25 and USA (see Chart 3.2.1). Health biotechnology had the largest share of biotech publications (54%), followed by generic biotechnology (26%). Industrial biotechnology had the smallest share of publications (4%) even though it exceeded the EU25 average (1%) and USA level (0%).

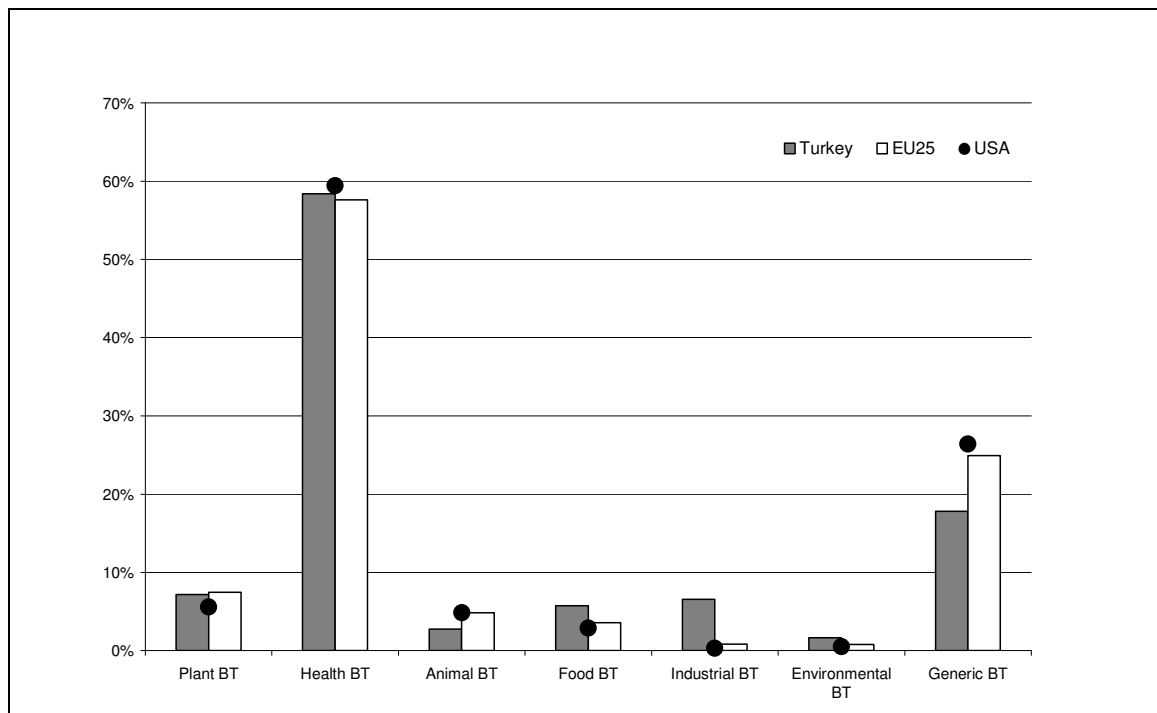
In the period 2002-2004, the distribution of biotechnology publications in Turkey was much the same as in the USA and rather similar to the EU25 average. Health biotechnology (58%) and generic biotechnology (18%) still ranked highest in terms of biotech publication numbers. Generic biotechnology's share of publications (18%) was smaller than the EU25 average (25%) and USA level (26%). By contrast, the industrial biotechnology subfield had a larger share (7%) of biotechnology publications than in the EU25 (1%) and USA (1%).

Chart 0.2.1 Share of biotechnology subfields, as a percentage of total biotechnology publications: comparison with EU25 and USA figures (1994-1996)



Source: BioPolis Research
Data: Science Citation Index

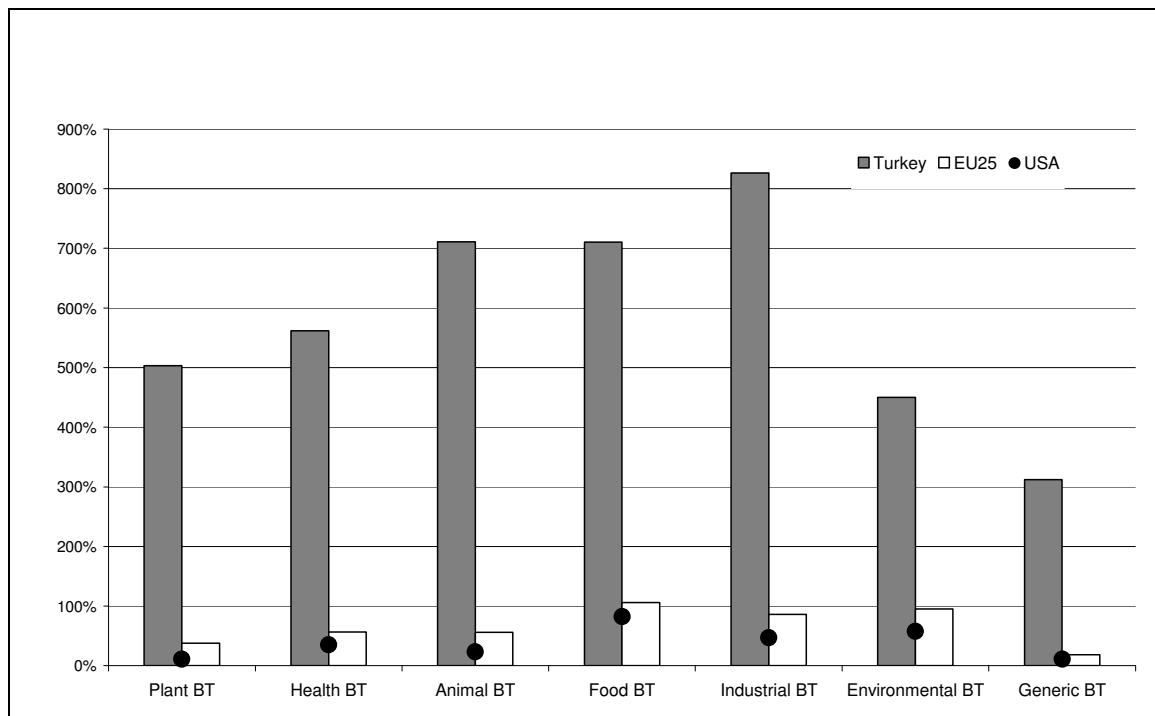
Chart 0.2.2 Share of biotechnology subfields, as a percentage of total biotechnology publications: comparison with EU25 and USA figures (2002-2004)



Source: BioPolis Research
Data: Science Citation Index

Chart 3.3 shows that the growth rate of biotechnology publications for all subfields was very high between 1994-96 and 2002-2004. Except for environmental biotechnology and generic biotechnology, all subfields showed growth rates higher than 500%. The high growth rates for industrial, animal and food biotechnology might be explained by the fact that actual publication numbers were very low – fewer than 20 in each case – in the earlier period (1994-1996). The number of plant biotechnology publications increased from 32 (1994-1996) to 193 (2002-2004), whereas the number of health publications increased from 236 in 1994-1996 to 1569 in 2002-2004.

Chart 0.3 Growth rates of biotechnology publications (by subfield) in Turkey: comparison with EU25 and USA figures (1994-1996 and 2002-2004)

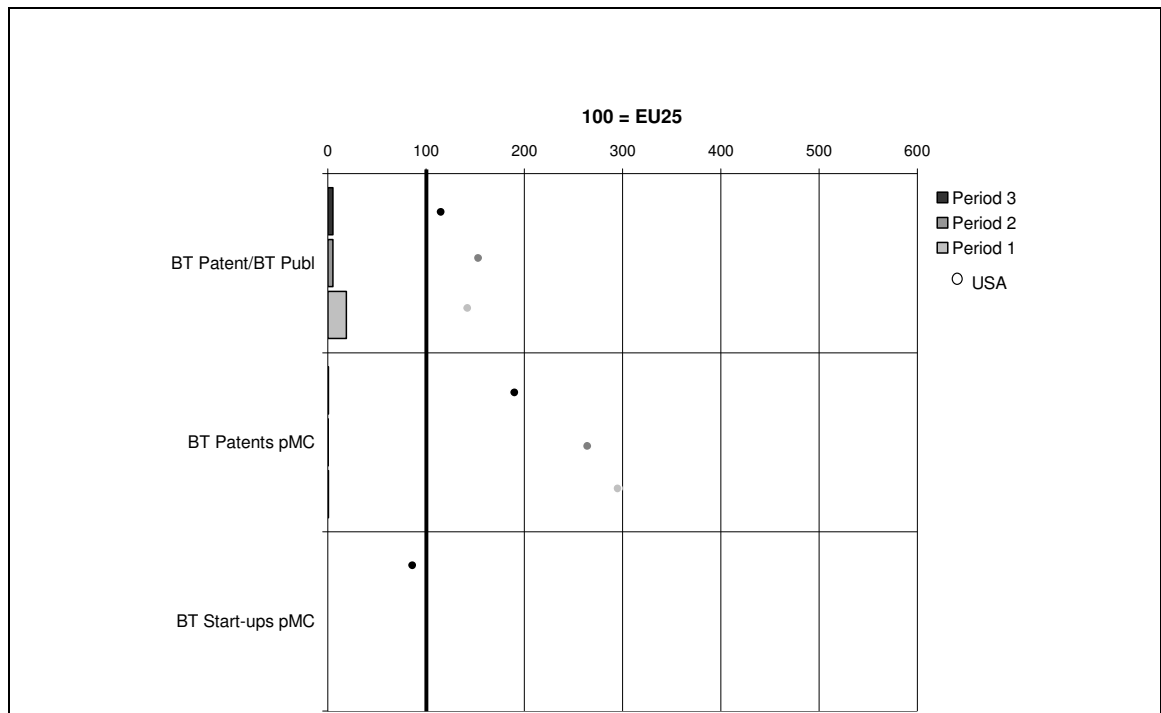


Source: BioPolis Research
Data: Science Citation Index

3.3 Performance in knowledge transmission and application

The number of biotechnology patents per biotechnology publication decreased in the ten years covered by this study (see Chart 3.4). Whereas in 1994-1996 Turkey's index value was 19 (compared to the EU25 average of 100 and USA figure of 142), in the periods 1998-2000 and 2001-2003 this figure decreased to 5. Although the actual number of patents increased from 4 (1994-1996 and 1998-2000) to 8 (2001-2003) the number of biotechnology publications also increased by a relatively significant amount. This explains the very low figure for biotechnology patents per million capita. The index figure did not exceed 1 in all three periods (1994-1996, 1998-2000 and 2001-2003). There was no data available for the number of biotechnology start-ups in Turkey.

Chart 0.4 Performance indicators for biotechnology knowledge transmission and application in Turkey (1994-1996, 1998-2000 and 2002-2004)



Source: BioPolis Research
Data: Science Citation Index

3.4 Industrial development

In the BioPolis project, indicators used to assess performance in industrial development measured the number of biotechnology companies pMC, number of Biotech IPO's pMC, and amount of venture capital invested in terms of EUR pC. In the sources used for these performance indicators (see Annex 5), no data were available for Turkey. According to a study on Turkey's biotechnology industry, there are approximately 90 biotechnology companies in the country (Cetindamar, 2006).

3.5 Market conditions

In the BioPolis project, two indicators are used to assess the market conditions: approved biomedicines (1995-2002) and field trials (1996-2002). For the periods covered, there were no data available for Turkey.

4. Conclusions

4.1 Introduction

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

4.2 Public funding of biotechnology through policy instruments

Table 0.1 shows that public support of biotechnology increased enormously in 2005. In the period 2002-2004, the total annual budget for biotechnology was approximately 5M EUR; in 2005, the budget increased to approximately 29M EUR. This is mainly due to the significant budget increase for ARDEB and, to a lesser extent, TEYDEB - two instruments used to fund biotechnology. These figures are not complete, as data on the funding of the TTGV R&D Programme and non-policy-directed funds were not available.

In the period 2002-2005, at least 43.77M EUR were spent on biotechnology activities in Turkey. Most of the funding was used for commercialisation of biotechnology (26.41M EUR). Funds for biotechnology research in public institutes amounted to 16.75M EUR, while 0.6M EUR were allocated to ELSA and biosafety research.

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

	2002	2003	2004	2005	Total
RESEARCH					
1. Non-policy-directed					
Public research institutions	NA	NA	NA	NA	NA
Response mode	NA	NA	NA	NA	NA
Total	-	-	-	-	-
2a. Policy-directed, Generic					
National	1.77	1.82	2.01	11.15	16.75
Regional	-	-	-	-	-
Total	1.77	1.82	2.01	11.15	16.75
2b. Policy-directed, Biotech-specific					
National	-	-	-	-	-
Regional	-	-	-	-	-
Total	-	-	-	-	-
COMMERCIALISATION					
1a. Policy-directed, Generic					
National	2.79	2.88	3.17	17.58	26.42
Regional	-	-	-	-	-
Total	2.79	2.88	3.17	17.58	26.42
1b. Policy-directed, Biotech-specific					

	2002	2003	2004	2005	Total
National	-	-	-	-	-
Regional	-	-	-	-	-
Total	-	-	-	-	-
OTHER					
1a. Policy-directed, Generic					
National	0.06	0.07	0.07	0.40	0.60
Regional	-	-	-	-	-
Total	0.06	0.07	0.07	0.40	0.60
1b. Policy-directed, Biotech-specific					
National	-	-	-	-	-
Regional	-	-	-	-	-
Total	-	-	-	-	-
GRAND TOTALS	4.62	4.77	5.25	29.13	43.77

Source: BioPolis Research

4.3 Specific features of the instruments

Table 4.2 provides information about the recipients of grants and the proportion of grant money provided by public authorities. The ARDEB Programme only applies to public research organisations (PROs). The BIDEB Programme applies to PROs as well as small and medium enterprises (SMEs), while the TEYDEB and Industrial Technology programmes are only relevant for companies. There is no information about the R&D Programme of TTGV.

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

Instrument	Funding agency	Participants/Recipients			Financial contribution required (%)	
		PROs	SMEs	LFs	Recipients	Other public authorities
<i>Generic</i>						
ARDEB	Tubitak	√				
BIDEB	Tubitak	√	√			
TEYDEB	Tubitak		√	√	√	
Industrial Technology Project	TTGV		√	√	√	
R&D Programme	TTGV	NA*	NA	NA	NA	NA

*NA: Not Available

Source: BioPolis Research

4.4 Policy goals

Four of the five instruments cover six of the ten policy goals identified for this study. The adoption of biotechnology for new industrial applications (policy goal 6) is covered by two instruments and received 20.64M EUR. High levels of biotechnology research (policy goal 1) received 9.11M. The stimulation of high levels of applied research (goal 2) and the transmission of knowledge from academia to industry and its application to

industrial resources (goal 5) also received a significant share of the budget, i.e. approximately 6M EUR.

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

	Policy goals				
	1*	2	4	5	6
<i>Generic</i>					
ARDEB	√				√
BIDEB			√		
TEYDEB				√	√
Industrial Technology Project		√			
R&D Programme	NA**	NA	NA	NA	NA
Total	9.11	17.73	1.03	6.07	10.32

*

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

** NA: Not Available

Source: BioPolis Research

4.5 Biotech research application areas

Data on coverage of biotech areas is only available for two of the five instruments. ARDEB and BIDEB cover almost all biotechnology areas, except for area 8 (ELSA). TEYDEB is a generic instrument, which does not address commercialisation of specific areas but focuses on high technologies in general. There is no data available on the budgetary allocations to the different areas.

Table 0.4 Coverage of biotech research application areas, by policy-directed instruments, in the period 2002-2005 (M EUR)

	Biotech application areas							
	1*	2	3	4	5	6	7	8
<i>Generic</i>								
ARDEB	√	√	√	√	√	√	√	
BIDEB	√	√	√	√	√	√	√	
TEYDEB	NA**	NA	NA	NA	NA	NA	NA	NA
Industrial Technology Project	NA	NA	NA	NA	NA	NA	NA	NA
R&D Programme	NA	NA	NA	NA	NA	NA	NA	NA

*

1 = Plant biotechnology
 2 = Animal biotechnology
 3 = Environmental biotechnology

5 = Food biotechnology
 6 = Industrial biotechnology
 7 = Basic biotechnology

4 = Health biotechnology

8 = Ethical, legal, social aspects of biotechnology

** NA – Not Available

Source: BioPolis Research

4.6 Stimulation of biotech activities through policy instruments

For four of the five instruments, information is available about biotech activities. Each instrument supports different activities, except activity 17 (grants for industrial research) which applies to both the TEYDEB Programme and the Industrial Project.

Table 0.5 Coverage of biotech activities, by policy-directed instruments, in the period 2002-2005

	Biotech activities							
	1*	2	4	6	8	11	13	17
<i>Generic</i>								
ARDEB	√	√						
BIDEB			√	√				
TEYDEB					√	√	√	√
Industrial Technology Project								√
R&D Programme	NA**	NA	NA	NA	NA	NA	NA	NA

*

1 Basic research

2 Applied research

3 Centres of excellence

4 Research networks

5 Mobility of researchers among disciplines

6 Biotechnology training

7 Mobility of researchers between academia and industry

8 Collaborative research between industry and public research organisations

9 Establishment of research institute/centre of industrial interest

10 Technology transfer office

** NA: Not Available

Source: BioPolis Research

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 the field

17 Grants for industrial research

18 Other incentives for business investment

19 Support for public discourse activities

5. Future developments

In 2001, the Turkish Academy of Sciences initiated a foresight project for science policies in the field of biotechnology: the 'Molecular Life Science and Technologies Foresight' (MLST) Project. The MLST Project, which started in 2002, is completed by now. The exclusive goal of the MLST Project was to carry out a long-term foresight study for Turkey in the fields of molecular biology, genetics and biotechnologies applied to such fields as health, agriculture, stock-raising, food, environment, genetic resources and industrial production. In these seven fields, the most important socio-economic targets (including research, innovation, education and legal provisions) for the following 20 years were determined, with a view to raising the level of social welfare.

In another foresight project – the 'Vision 2023' study, produced by BTYK – the importance of having a national technology policy that will allocate resources for new technologies was stressed. In the vision report, the importance of biotechnology for Turkey was also recognised. Biotechnology for agriculture, in particular, was characterised as an opportunity and priority area for the country (Cetindamar, 2006). Biotechnology and genetic engineering are considered equally important, because they provide critical input for the health, agriculture and industrial production sectors. The study concluded that Turkey has the potential to become a world player in certain domains of molecular biology, biotechnology and genomics, and that the health and agriculture sectors would be the main industries to benefit starting from about 2010 (EFMN, 2005).

This is consistent with the Turkish government's aim to increase GERD spending from 0.64% to 2% by the year 2010. The government has already made available an additional 275M EUR to support human resource development and promote science and technology in society and industry (EFMN, 2005).

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Annex 5 Performance

Introduction

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

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

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

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

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

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

¹ http://europa.eu.int/comm/public_opinion/archives/ebs/ebs_225_report_en.pdf

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

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

Raw data for Charts in chapter 3

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

	BT publications			Population (million)		
	94-96	98-00	02-04	1996	2000	2004
EU25	97521	128716	145646	447	451	457
Turkey	420	1156	2711	63	67	71*
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
Turkey	7	17	38	3	6	12
USA	454	492	529	208	172	166

* data for 2003 is used

Source: BioPolis Research

Publications: SCI

Population: EUROSTAT and OECD

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

	BT 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.		
Turkey	2711	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
USA	154402				n.a.		n.a.

Source: BioPolis Research

Publications: SCI

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

Raw data for Chart 3.1. 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
Turkey	420	1156	2711	9020	17492	36857
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

Turkey	5%	7%	7%	41	53	56
USA	13%	14%	15%	119	115	113

Source: BioPolis
Publications: SCI

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

	Citations to BT publications		Index EU25=100	
	94-98	00-04	94-98	00-04
EU25	6.14	7.28	100	100
Turkey	5.02	4.00	82	55
USA	6.39	8.54	104	117

Source: BioPolis Research
Data source Citation: SCI

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

	Graduates in Life Sciences		Population (million)	
	1998 / 1999	2002	1998 / 1999	2002
EU17	46859**	81316	552**	431
Turkey	2230*	3164	65*	70
USA	75253*	70950	276*	288
	Graduates pMC		Index EU17=100	
	1998 / 1999	2002	1998	2002
EU17	91**	189	100	100
Turkey	34*	45	37	24
USA	273*	246	321	131

* data for 1998; ** data for 1999

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

Source: BioPolis Research
Population source for US OECD
OECD Education Database

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%
Turkey	100%	7%	54%	2%	4%	4%	2%	26%
USA	100%	6%	56%	5%	2%	0%	0%	30%

Source: BioPolis Research
Publications: SCI

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%
Turkey	100%	7%	58%	3%	6%	7%	2%	18%
USA	100%	6%	59%	5%	3%	0%	1%	26%

Source: BioPolis Research
Publications: SCI

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

	1994-1996							
	Total	Plant	Health	Animal	Food	Industrial	Environmental	Generic
EU25	97217	7629	51944	4375	2434	624	576	29635
Turkey	440	32	237	9	19	19	8	116
USA	111686	7118	62274	5580	2230	296	459	33729

Source: BioPolis Research
Publications: SCI

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

	2002-2004							
	Total	Plant	Health	Animal	Food	Industrial	Environmental	Generic
EU25	140984	10494	81220	6821	5017	1162	1126	35144
Turkey	2687	193	1569	73	154	176	44	478
USA	141680	7910	84234	6872	4070	436	724	37434

Source: BioPolis Research
Publications: SCI

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

	1994-1996/2002-2004						
	Plant	Health	Animal	Food	Industrial	Environmental	Generic
EU25	38%	56%	56%	106%	86%	95%	19%
Turkey	503%	562%	711%	711%	826%	450%	312%
USA	11%	35%	23%	83%	47%	58%	11%

Source: BioPolis Research
Publications: SCI

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

	BT patents			Population (million)		
	94-96	98-00	01-03	1996	2000	2003
EU25	4924	8921	10119	447	451	455
Turkey	4	4	8	63	67	71
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
Turkey	0	0	0	1	0	1
USA	33	52	42	295	264	190

Source: BioPolis Research
Publications: SCI
Patents: Questel Orbit

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

	BT patents			BT publications		
	94-96	98-00	01-03	94-96	98-00	01-03
EU25	4924	8921	10119	97521	128716	140219
Turkey	4	4	8	420	1156	2214
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
Turkey	0.01	0.00	0.00	19	5	5
USA	0.07	0.11	0.08	142	153	115

Source: BioPolis Research
Publications SCI
Patents Questel Orbit

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

	BT companies				Population in T			
	2001	2002	2003	2004	2001	2002	2003	2004
Europe	1879	1878	1861	1815	452016	452641	454580	456863
EU Available	1643	1650	1782	1605	319337	319484	408602	322210
Turkey	n.a.	n.a.	n.a.	n.a.		69626	70712	70690
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
Turkey	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
USA	5.11045	5.1122	5.066	4.95	99	99	116	99

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

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

Raw data for Chart 3.5. BT start-ups pMC for 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	
Turkey	n.a.	n.a.	70712	
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
Turkey	n.a.	n.a.	n.a.	n.a.
USA	1,2	86	0,29	79

Source: BioPolis Research

Start-ups: EuropaBio

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

	BT IPO	Population T				
	2002-2005	2002	2003	2004	2005	2002-2005
EU Available	29	452927	454869	457154	461593	456636
Turkey	0	69626	70712	70690	71607	70343
EU Available	29	452927	454869	457154	461593	456636
	IPO /pMC	Index				
	2002-2005	2002-2005				
EU Available	0,00	100				
Turkey	0,00	0				
USA	0,00	282				

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

Source: BioPolis Research

IPO data: E&Y 2002-2005, London Stock Exchange, Frankfurt Stock Exchange, Euronext, Nasdaq, Buriril & Company

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

	Venture capital in biotechnology companies M€			Population in T		
	2002	2002	2002	2002	2003	2004
Europe	1100	920	2800			
EU Available	890	883	1111	315584	319663	325131
Turkey	n.a.	n.a.	n.a.	69626	70712	70690
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
Turkey	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
Turkey	n.a.	70	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
Turkey	n.a.	70	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
Turkey	n.a.	n.a.

*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

<i>Abbreviation</i>	<i>Turkish name</i>	<i>English name</i>
ARDEB	Arařtırma Destek Programları Bařkanlıđı	Research Support Programmes Directorate
BIDEB	Bilim İnsanı Destekleme Daire Bařkanlıđı	Directorate of Human Resources Development
BTYK	Bilim ve Teknoloji Yüksek Kurulu	The Supreme Council of Science and Technology
GMBAE	Gen Mühendisliđi ve Biyoteknoloji Arařtırma Enstitüsü	Research Institute for Genetic Engineering and Biotechnology
KOSGEB	Küçük ve Orta Ölçekli Sanayi Geliřtirme ve Destekleme İdaresi Bařkanlıđı	Small and Medium Industry Development Organization
MARA		The Ministry of Agriculture and Rural Affairs
SPO		State Planning Organisation
TEYDEB	Teknoloji ve Yenilik Destek Programları Bařkanlıđı	Technology Monitoring and Evaluation Board
TIDEB	Teknoloji İzleme ve Deđerlendirme Başkanlıđı	Technology and Innovation Support Programmes Directorate
TTGV	Türkiye Teknoloji Geliřtirme Vakfı	Technology Development Foundation of Turkey
TUBITAK	Türkiye Bilimsel ve Teknolojik Arařtırma Kurumu	Scientific and Technical Research Council of Turkey
TUBA	Türkiye Bilimler Akademisi	The Turkish Academy of Sciences

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