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 Denmark

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Summary

With a population of 5.4M, Denmark has a modern market economy with extensive government welfare initiatives, a stable currency (Danish krone, DKK) pegged to the euro and excellent standards of living. Investments in research and development (R&D) amounted to 2.56% of the gross domestic product (GDP) in 2005. This level was above the European average (EU25:1.86%). Moreover, 59.9% of the investment in R&D was carried out by industry.

In the reporting period (2002-2005), the governance structure of the Danish innovation system has undergone important changes, both at the national and at the regional level. At the national level, a reorganisation took place in 2001 with the establishment of the Ministry of Science and Technology which aims to improve the coordination and overall functioning of policy-making bodies in the areas of university education, science, technology and innovation. At the regional level, research and innovation policy have not traditionally been an explicit responsibility of regional and local authorities. However, the restructuring process of the governance system also involves the competences of public bodies at the regional level.

The Danish innovation system has long experience in designing and implementing promotion programmes to promote biotechnology. The Danish research councils have been funding biotechnology research with specific initiatives since 1987. In the 1990s, publicly funded support for biotechnology research activities combined institutional funding and competitive funding. Both types of funding were implemented through bottom-up initiatives (e. g. FØTEK programmes promoting industrial research) and top-down approaches (e. g. BIOTEK programmes). Moreover, these biotechnology initiatives have traditionally targeted research collaboration between university and industry actors.

According to the information available, the main biotechnology funding institutions in the period 2002-2005 were the Danish National Research Foundation, the Danish Councils for Independent Research, the Danish Council for Strategic Research, the Council for Technology and Innovation, the Danish National Advanced Technology Foundation and the Directorate for Food, Fisheries and Agribusiness of the Ministry for Food, Agriculture and Fisheries. We estimate that these institutions have invested 166M EUR in support of biotechnology research and commercialisation in the period 2002-2005. Moreover, charities are important funding bodies in the Danish biotechnology innovation system. We estimate that 24M EUR were invested by charities to promote biotechnology research.

The information available suggests that Denmark has mainly implemented non-policy-directed instruments to promote biotechnology. Non-policy-directed instruments allocated 134M EUR (81% of the total biotechnology funding estimated for the period 2002-2005). However, since there are no data available for institutional funding of public research institutions, the importance of policy-directed instruments for the reporting period is probably underestimated.

Regarding the balance between research and commercialisation, the data give evidence of the strong support of research activities, which received 91% of the total funding (151.8M EUR).

Health biotechnology is the biotechnology sub-field receiving the largest volume of funding, followed by animal biotechnology and plant biotechnology. Environmental biotechnology and ethical, legal and social aspects of biotechnology seem to be important funding gaps in the policy instruments considered in this report.

Basic and applied research, mobility of researchers between academia and industry, and collaborative research between industry and academia are the activities receiving the largest volumes of funding.

Biotechnology will be promoted in the near future in the framework of programmes to support interdisciplinary scientific developments. An example of a policy-directed programme explicitly targeting biotechnology for the next years is the Strategic Programme on the Interdisciplinary Application of Nanotechnology, Biotechnology and IT and Communications Technology launched in 2005 for the next years by the Programme Commission for Nanoscience and Technology, Biotechnology and IT (NABIIT) of the Danish Council for Strategic Research.

With regard to the performance of the Danish biotechnology innovation system, the report considers 4 areas of the innovation system: the knowledge base, knowledge transfer and application, industrial development and market conditions. Denmark shows an outstanding performance in developing the knowledge base. Except for the human capital indicator, the performance indicators of the Danish biotechnology knowledge base (biotechnology publications per million capita (pMC) and citations per biotechnology publication) outperform the EU25 and the USA. The bibliometric indicators reveal two main focuses for the biotechnology scientific activities: health and generic biotechnology. This profile is in line with those of the EU25 and the USA. As regards the indicators for knowledge transfer and application (based mainly on patent applications and company creation), Denmark's performance is outstanding compared to the EU25 and the USA. However, the latest data suggest that patent activity has diminished since the mid 1990s. In terms of company creation per million capita in the time period 2001-2003, Denmark is the best performer in developing the biotechnology industry in terms of biotechnology start-ups per million capita. The set of indicators for industrial development suggest that Denmark has a very strong biotechnology industry in terms of company per capita. However, concerning the amount of venture capital in biotechnology companies, Denmark remains in a good position vis-à-vis the USA and the EU25, even though the trend suggests a negative development in the volume of venture capital invested in biotechnology. Also, the number of IPOs has been very low. Finally, the data available suggest favourable market conditions for health biotechnology while the agro-food biotechnology products seem to have serious problems in reaching the market development stages.

1. Introduction and background

1.1 General introduction

With a population of 5.4M, Denmark has a modern market economy with extensive government welfare initiatives, a stable currency (Danish krone, DKK) pegged to the euro and excellent standards of living. According to EUROSTAT (2006)[1], at the beginning of the reporting period (2002), the gross domestic product (GDP) per capita measured in standard purchasing power (SPP) was 21.4% larger than the European average (EU25). In 2002 economic growth slowed down to a growth rate of 0.5% (measured in terms of real GDP). However, Denmark experienced an economic recovery in the period 2002-2005, reaching 3% growth rate and (GDP) per capita 24% larger than the EU25 average.

Investments in research and development (R&D) amounted to 2.56% of the GDP in 2005. This level was above the European average (EU25: 1.86%). Moreover, 59.9% of the investment in R&D was carried out by industry. According to the Danish National Research Foundation (2005), in the last decade most of the increase in the financial resources directed to research and development activities was caused by increased private investment, while public investment remained stable at a lower level.

1.2 Characteristics of the national S&T and the innovation system[2]

In the reporting period (2002-2005), the governance structure of the Danish innovation system has undergone important changes both at the national and at the regional level.

At the national level a reorganisation took place in 2001 with the establishment of the Ministry of Science and Technology which aims to improve the coordination and overall functioning of policy-making bodies in the areas of university education, science, technology and innovation. The Ministry of Science and Technology thus centralised the responsibilities for research and innovation. According to the European Commission(2005a), in 2005 the Ministry managed approximately 75% of the government expenditures for research and innovation. Other ministries with substantial research budgets are the Ministry of Food, Agriculture and Fisheries, the Ministry of Culture and the Ministry of Education.

Below the Ministry of Science and Technology there is a national system of research advisory and funding councils. This national system is presented in chart 1.1.

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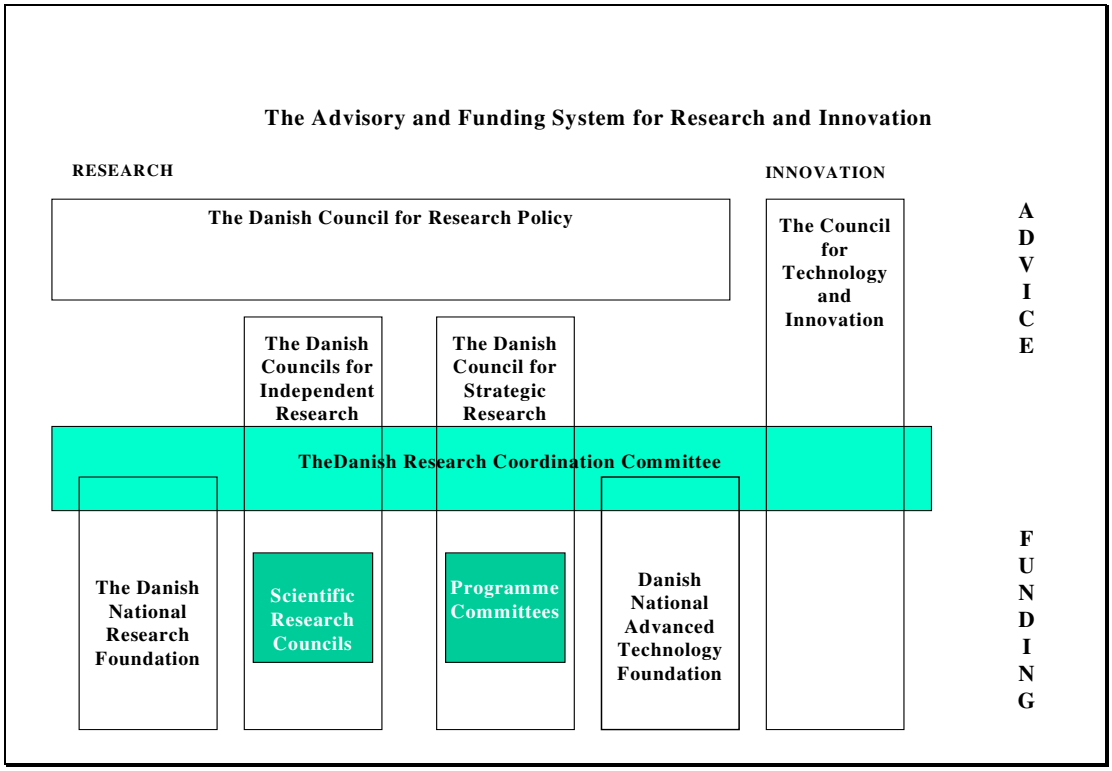
1 EUROSTAT (2006) "General Economic Background and Innovation Indicators". Retrieved October 2006 from http://epp.eurostat.ec.europa.eu

2 This section is largely based on European Commission (2005a) European Trend Chart on Innovation - Annual Innovation Policy Trends and Appraisal Report Denmark 2004-2005. Brussels, European Commission.

In 2005 the two advisory bodies were the Danish Council for Research Policy and the Danish Council for Technology and Innovation.
The Danish Council for Research Policy advises the Minister for Science, Technology and Innovation in matters concerning research policy, such as the general framework conditions for research and research funding, the design of major national and international research initiatives, the development of national research strategies, international research cooperation and issues concerning training and recruitment of researchers.

Figure 1.1 Advisory and funding institutions in the Danish Science, Research and Innovation System in 2005



Source: Danish Government (2003a)[3]

On the other hand, the Danish Council for Technology and Innovation advises the Minister of Science, Technology and Innovation regarding issues related to innovation in the business community. More specifically, the Council aims to promote cooperation and knowledge transfer between researchers, research and education institutions, technological service institutes and companies. The establishment and development of technology-based companies as well as international cooperation regarding the utilisation of knowledge and technology are further issues of relevance for the council.

[3] The Danish Government (2003). "The Danish Government's Knowledge Strategy - Knowledge in growth. Background report." Retrieved August 2006, from http://videnskabsministeriet.dk/site/forside/publikationer/2003/the-danish-governments-knowledge-strategy---knowledge-in.

An important task of the council is the funding of the so-called Approved Technology Service Institutes (or GTS-Institutes). By means of 3-year contracts, the council finances the activities of these independent non-profit institutions, which provide technology services for businesses on a commercial basis. In recent years the total funding of the institutes has ranged from 250M DKK to 300M DKK (35M EUR to 40M EUR).

The funding system includes 4 research funding institutions:

1) The Danish National Research Foundation
2) The Danish Councils for Independent Research
3) The Danish Council for Strategic Research
4) The Danish National Advanced Technology Foundation

The Danish National Research Foundation is an independent foundation, which aims to strengthen Danish basic research within the natural sciences, technical sciences, health sciences, social sciences, and humanities. The Foundation's primary policy instrument for research promotion is to set up and fund research centres of the highest international standing – so-called Centres of Excellence – for 5-10 year periods. The Foundation yearly distributes 200-250M DKK to such centres in Denmark. This corresponds to approximately 2% of annual public research spending.

The Danish Councils for Independent Research support research through response mode mechanisms. In other words, funding fields are based on the initiatives – both single-discipline and cross-disciplinary – of researchers themselves. Funding is allocated on the basis of applications for e.g. research networks, research teams, grants, international collaborative programmes, researcher training programmes, etc.

The Danish Council for Strategic Research supports politically prioritised research areas and contributes to strengthening interactions between public and private research. Accordingly, research priorities are set by the councils and promoted through research programmes coordinated by programme committees. In the reporting period, the programme committee NABIIT was responsible for coordinating biotechnology research activities, among other fields.

The general objectives of the Danish National Advanced Technology Foundation are to encourage growth and strengthen employment by supporting strategic and advanced technological priorities within the fields of research and innovation. All projects which are relevant to advanced technological research and/or innovation may apply for grants. The Foundation will pay special attention to applications which fall within the areas of nano-, bio-, and/or information and communication technology, including the interface between these areas.

Finally, at the national level, the Danish Research Coordination Committee is responsible for coordination among all government research funding bodies.

As for the regional level, research and innovation policy have not traditionally been an explicit responsibility of regional and local authorities. However, the restructuring process of the governance system also involves the competences of public bodies at the regional level. According to the European Commission (2005a), the development of regional innovation systems is a main topic of the structural reform introduced in 2005.

In the reporting period (2002-2005), the Danish regions were organised in 14 counties and 271 municipalities. Regional and local authorities (the county and municipality councils) control approximately 60% of total public spending and are responsible for the health system, primary, secondary and higher preparatory education, regional environment, sections of the public transportation system, part of the employment services and regional enterprise policy. In the reporting period two policy strategies were introduced with direct consequences for regional innovation policy in Denmark:

- The Regional Research and Innovation Action Plan (September 2004)
- Regional Growth Strategy (September 2003)

The action plan in particular has policy objectives with explicit consequences for regional innovation policy:

- To put research, technology and innovation on the regional political agenda
- To create strong regional collaborations in research and innovation
- To increase the level of innovation and competence in the regions
- To increase the number of knowledge-based entrepreneurs throughout the country

1.3 National support and framework conditions for biotechnology

After reading the most important policy documents elaborated by the Danish government to design innovation policy in the period 2002-2005, it becomes clear that Danish policymakers are aware of the complexity of innovation processes and use a systems perspective in their political discourse. Moreover, the focus on innovation systems is moving towards a focus on knowledge systems(Danish Government 2003b)[4].

Denmark has long experience of designing and implementing promotion programmes to promote biotechnology. The Danish research councils have been funding biotechnology research with specific initiatives since 1987. In the 1990s public support for biotechnology research activities combined institutional funding and competitive funding. Both these types of funding were implemented via bottom-up initiatives (e. g. FØTEK programmes targeting industrial research) and top-down approaches (e. g. BIOTEK programmes). Moreover, these biotechnology initiatives traditionally targeted research collaboration between university and industry actors (Assouline 1999)[5].

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[4] Danish Government. (2003b) "The Danish Government's Knowledge Strategy - Knowledge in growth. Policy Statement to the Danish parliament." Retrieved August 2006, from http://videnskabsministeriet.dk/site/forside/publikationer/2003/the-danish-governments-knowledge-strategy---knowledge-in.

[5] Assouline, G. (1999) National Report of Denmark. In: Inventory of Public Biotechnology R&D Programmes in Europe. C. M. Enzing, J. N. Benedictus, E. Engelen-Smeets et al. (Eds.) Brussels, DG Research - European Commission**:** DK3-DK43.

With regard to the public acceptance of biotechnology research and applications, according to a survey of public attitudes to new technologies in Europe (European Commission 2005b)[6], 72% of Danish respondents believe that developments in biotechnology and genetic engineering can positively affect our way of life over the next 20 years. However, in terms of specific applications, Danish citizens suggest a mixed picture in their attitude towards the potential applications of biotechnology.

Denmark is stricter than the EU average with regard to human cloning. More specifically, the cloning of human beings so that couples can have a baby, even if one partner has a genetic disease (63% reject it, compared to the EU average of 59%). However, the attitude to the cloning of human embryo stem cells to treat people with diseases is more permissive than the EU average under certain conditions: 18% of Danish citizens believe this should never occur (EU average 22%), 23% of citizens approve it only in exceptional circumstances (EU average of 20%) and 47% accept it only if is highly regulated and controlled (EU average of 41%).

The survey explores public attitudes to several applications of genetics. Interestingly, in most cases the percentage of Danish citizens who would never approve these applications is higher than the EU average:

- 67% will never approve of the use of genetic tests on children to identify talents and weaknesses (EU average 54%)
- 57% will never approve of the use of genetic treatments to prolong our expected life span by 25 years (EU average 42%)
- 45% will never approve of developing genetic tests for everyone to identify diseases they might contract (EU average 34%)
- 40% will never approve of genetic treatments to get rid of bad habits like smoking or alcoholism (EU average 33%)
- 26% are totally opposed to using genetic testing to produce a child that could be a bone-marrow donor for a sibling with a life-threatening disease (EU average 31%)
- 12% are totally opposed to storing everyone's genetic data so that criminals could be more easily caught (EU average 21%) and
- 16% will never approve of storing the population's genetic data to study the causes of human disease (EU average 17%).

The survey also explores public attitudes towards genetic modification. In this application field Denmark is not as critical as the EU average when it comes to the development of genetically modified crops to increase the variety of regionally grown food. 35% of the citizens would never approve of this application of biotechnology (EU average of 37%).
In the case of environmental applications, Danish citizens are more open to biotechnology applications than the EU average. Only 11% of the respondents would never approve of developing genetically modified bacteria to clean up after environmental catastrophes (EU average 19%).

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6 European Commission (2005) "Special Eurobarometer 225- Social Values, Science and Technology." Retrieved 01.08.2006, from http://europa.eu.int/comm/public_opinion/archives/ebs/ebs_225_report_en.pdf

The legal framework conditions pertaining to traceability, labelling and marketing of biotech products are regulated in Denmark in accordance with EU regulations. Moreover, Denmark is a strong proponent of common EU regulations on coexistence. In June 2004, the Danish parliament passed legislation on the coexistence of biotechnology and non-biotechnology crops (including organic agriculture) (GAIN 2006)[7].

Stem cell research and cloning are regulated by the "Act on Artificial Fertilisation" (10.6.1997/460). Stem cell research is only allowed on surplus embryos, while reproductive cloning is not allowed (Norden 2006)[8].

1.4 Main biotechnology research actors in Denmark

Biotechnology research in Denmark is conducted in public institutions and in companies. As far as the public sector is concerned, public biotechnology research and development is carried out at universities, hospitals and other research institutions. According to Bloch (2005), in 2002 78% of public biotechnology R&D was conducted at universities, 7% at hospitals and the remaining 15% in other research institutions and non-profit organisations.

Table 1.1 gives the main universities carrying out biotechnology research and development activities. Most of the university research is located in the Greater Copenhagen Area.

Table 1.1 Main Universities carrying out biotechnology research in 2002

Institute	Location
University of Copenhagen	Copenhagen
University of Aarhus	Aarhus
University of Southern Denmark	
Aalborg University	Aalborg
Technical University of Denmark	Copenhagen
Royal Veterinary and Agricultural University	Copenhagen

Source: Bloch (2005)

Regarding industrial research and development activities, the OECD (2006)[9] uses data from the Danish Centre for Studies in Research and Research Policy to estimate that in 2003 there were 181 core biotechnology firms in Denmark and 86 companies with significant biotechnology activities. Most core biotechnology firms were started in or after 2000. The same source estimates that in 2003 the private sector employed 4,781 full-time equivalent (FTE) R&D personnel (16.5% of total private sector R&D FTEs).

7 GAIN (2006) "Denmark Biotechnology Annual 2006." GAIN Report DA6008 Retrieved 01.10.2006, 2006, from http://www.fas.usda.gov/gainfiles/200607/146208201.pdf

8 Norden (2006) "Legislation on Biotechnology in the Nordic Countries – An overview." TemaNord 2006:506 Retrieved 01.10.2006, from http://www.norden.org/pub/ovrigt/ovrigt/uk/TN2006506.pdf.

9 OECD (2006) Biotechnology Statistics, OECD.

Bloch(2005)[10] estimates that in 2003 32% of the core biotech companies belonged to the industrial sector research and development (NACE 73.1), 24% belonged to food processing (NACE 15). In geographic terms, the majority of biotechnology companies in Denmark are located in the Greater Copenhagen Area. In 2003 this area agglomerated 132 core biotechnology companies and 50 companies with significant biotechnology activities. Together with the Skåne region in Sweden, the area of Greater Copenhagen forms the Medicon Valley Cluster. Odensee, Aarhus and Aalborg are the other main biotechnology clusters in Denmark.

[10] Bloch, C. (2005) Biotechnology in Denmark 2005. The Danish Centre for Studies in Research and Research Policy 2006/4.Aarhus, University of Aarhus

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 instruments is presented. Data were collected through desk research (publications, documents, websites of national and regional public funding organisations and/or governmental departments), and a survey among representatives of funding organisations that manage the generic and biotech-specific programmes. The funding organisations contacted and the contact persons who participated in the survey and/or who were interviewed can be found in Annex 3 (List of Contact Persons).[11]

Section 2.1 introduces the definitions of the main terms, such as non-policy-directed funding and policy-directed funding. Section 2.2 presents the data available on biotechnology non-policy-directed funding and section 2.3 the policy-directed funding. Charities and foundations also play an important role in the funding of biotechnology research in Denmark; they will be addressed in section 2.4. The final section provides a short overview of the European funding of biotechnology research in Denmark through the 6th Framework Programme.

2.1 Introduction

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 commercialisation of research, support for start-ups, programmes encouraging mobility of researchers, programmes with open calls, etc. This policy-directed funding can include biotechnology-specific policy instruments and generic policy instruments. Biotechnology-specific policy instruments are instruments that have been specifically established to stimulate biotechnology. Generic policy instruments are instruments that are not dedicated to a specific technology, but which in principle stimulate all technologies, thus also including biotechnology. In the BioPolis project, only those generic instruments are included if a reference is made to (the stimulation of) biotechnology activities in the policy of the funding organisation running the programme, or of the ministry / government department that funds the funding organisations or which runs the programme itself.

[11] The information was gathered by means of a questionnaire designed by the BioPolis team. The questionnaire was circulated by the Danish Agency for Science, Technology and Innovation among the relevant funding agencies and charities in Denmark. This chapter presents the information received from this survey.

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 awarded via 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.

2.2 Non-policy-directed funding of biotechnology research

Table 2.1 presents the information available on the non-policy-directed funding of biotechnology research in Denmark in the period 2002-2005. Unfortunately, the data collected do not cover the institutional funding of public research institutes. Only the response mode programmes of the Danish Councils for Independent Research and the Danish National Research Foundation are considered.

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

Funding Organisation	Public Research Institutions / Response Mode Programmes	Funds 2002-2005 M EUR
Danish National Research Foundation	Centres of Excellence	40.1
Danish Councils for Independent Research	Instruments of the Danish Medical Science Research Council	24.3
Danish Councils for Independent Research	Instruments of the Danish Natural Science Research Council	28.6
Danish Councils for Independent Research	Instruments of the Danish Research Council for Technology and Production Sciences	41.1
Total*		134.2

*without institutional funding of public research institutions
Source: BioPolis Research
1 EUR = 7.4 DKK

2.2.1 Danish National Research Foundation

- Centres of Excellence (since 1991)

The Foundation's primary strategy is to set up and fund centres of excellence. Since 1991, the Foundation has committed itself to support the Danish research environment with more than 3 billion DKK. The Foundation primarily distributes grants to independent groups of scientists to form centres of excellence. Calls for proposals are published every 2-3 years.

Biotechnology funding volume 2002-2005: 297M DKK (40.1M EUR)

2.2.2 Danish Councils for Independent Research

- The Danish Medical Science Research Council

The Danish Medical Research Council provides support to Danish medical research based on the initiatives – both mono-disciplinary and inter-disciplinary – of researchers themselves. Funding is allocated on the basis of applications for e.g. research networks, research teams, grants, international collaborative programmes, researcher training programmes, etc.
Policy goals, activities and biotech areas are not defined a priori. The applications set the policy goals, the activities and the biotech areas to be funded.

Biotechnology funding volume 2002-2005: 180M DKK (24.3M EUR)

- The Danish Natural Science Research Council

The Danish Natural Science Research Council provides support to Danish natural science research based on the initiatives – both from single disciplines and across disciplines – of researchers themselves. Funding is allocated on the basis of applications for e.g. research networks, research teams, grants, international collaborative programmes, researcher training programmes, etc.
Policy goals, activities and biotech areas are not defined a priori. The applications set the policy goals, the activities and the biotech areas to be funded

Biotechnology funding volume 2002-2005: 212M DKK (28.6 M EUR)

- The Danish Research Council for Technology and Production Sciences

The Danish Research Council for Technology and Production Sciences provides support to Danish technical and production science research based on the initiatives – both from single disciplines and across disciplines – of researchers themselves. Funding is allocated on the basis of applications for e.g. research networks, research teams, grants, international collaborative programmes, researcher training programmes, etc.
Policy goals, activities and biotech areas are not defined a priori. The applications set the policy goals, the activities and the biotech areas to be funded

Biotechnology funding volume 2002-2005: 304M DKK (41.1M EUR)

2.3 Policy-directed funding of biotechnology research and commercialisation

This section presents the policy-directed instruments promoting biotechnology research and commercialisation identified in Denmark for the period 2002-2005. Table 2.2 shows an overview of the instruments. Since there is no explicit regional research and innovation policy, the table gives national programmes only. The main funding bodies involved in policy-directed instruments are:

- The Danish National Advanced Technology Foundation
- The Danish Agency for Science, Technology and Innovation
- The Danish Council for Technology and Innovation
- The Danish National Research Foundation
- The Ministry for Food, Agriculture and Fisheries - Directorate for Food, Fisheries and Agribusiness

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

Instrument	Funding Agency	M EUR	% of total
National Instrument			
Generic			
(i) Large advanced technology ventures and (ii) Projects for small and medium-sized enterprises	The Danish National Advanced Technology Foundation	8.3	26%
Strategic Research Programme for Interdisciplinary Applications of Nanotechnology, Biotechnology, IT and Communications Technology	Danish Council for Strategic Research	2.5	8%
Innovation Consortia	Council for Technology and Innovation	9.5	30%
Future livestock breeding	Directorate for Food, Fisheries and Agribusiness	0.9	3%
The Innovation Law	Directorate for Food, Fisheries and Agribusiness	4.6	14%
Biotech-specific			
National Platform for Systems Biology	Danish National Research Foundation	1.6	5%
Biotechnology and applied genetics in plant breeding	Directorate for Food, Fisheries and Agribusiness	2.4	7%
Biotechnology in food research	Directorate for Food, Fisheries and Agribusiness	2.3	7%
Total National		32.1	100%

Source: BioPolis Research

1 EUR = 7.4 DKK

2.3.1 The Danish National Advanced Technology Foundation

- i) Large advanced technology ventures and ii) Projects for small and medium-sized enterprises (2005-2006)

The programme promotes collaboration between businesses and research institutions within nanotechnology, biotechnology and information and communications technology (ICT). The funding follows co-financing principles (the total costs are not completely subsidised) for a period of 1-3 years for (i) and 3-5 years for (ii) respectively.

Biotechnology funding volume 2002-2005: 61.4M DKK (8.3M EUR)

Danish Council for Strategic Research

- Strategic Research Programme for Interdisciplinary Applications of Nanotechnology, Biotechnology, IT and Communications Technology (2005-2008)

The programme was launched by the Programme Commission for Nanoscience and Technology, Biotechnology and IT (NABIIT) of the Danish Council for Strategic Research. Funding is awarded to those research activities which by their use of nanotechnology, biotechnology, IT and communications technology will help to identify and develop future opportunities for commercial innovation and solutions to societal problems. Support is given to quality research of international standing that takes an interdisciplinary approach to established knowledge areas and includes close collaboration between research institutions, companies and other research stakeholders.

Biotechnology funding volume 2002-2005: 18.7M DKK (2.5M EUR)

2.3.2 The Danish Council for Technology and Innovation

- Innovation Consortia (since 1995)

The programme supports research and development projects performed by consortia. A project thus integrates company research and development activities and generic research conducted at public research organisations (PROs).

Biotechnology funding volume 2002-2005: 70.5M DKK (9.5M EUR)

2.3.3 Danish National Research Foundation

- The Danish National Research Foundation's National Platform for Systems Biology

The aim of this initiative is to establish a platform for developing a Danish infrastructure integrating large amounts of biological data. The core of the platform is network biology and systems biology, focusing on protein-protein interaction data.

This initiative is an integrated joint project involving three research groups at the Technical University of Denmark, University of Southern Denmark and Aarhus University. The Centre for Experimental BioInformatics and the Centre for Biological Sequence Analysis are affiliated to this network.

The platform is a long term-initiative. The Danish National Research Foundation presently supports the platform with a 3-year grant of 18M DKK from 1st of September 2003 to 31st of December 2006.

Biotechnology funding volume 2002-2005: 12M DKK (1.6M EUR)

2.3.4 Ministry for Food, Agriculture and Fisheries – Directorate for Food, Fisheries and Agribusiness

- Biotechnology and applied genetics in plant breeding (2002-2006)

The aim of the programme is to promote the product-oriented breeding of barley, wheat and rye to improve disease resistance, nutrient utilisation and feed value, including the generation of knowledge and development of tools in plant genetics and molecular biology.

Biotechnology funding volume 2002-2005: 17.47M DKK (2.4M EUR)

- Biotechnology in Food Research (1999-2003)

The research programme aims to improve the use of molecular and cell biological methods in food research. The programme has four main areas:

- Food quality and food safety in production and processing
- Implementation and development of molecular biological methods and tools
- Interaction between host and micro-organism
- Social acceptance and ethics

Biotechnology funding volume 2002-2005: 16.7M DKK (2.3M EUR)

- Future Livestock Breeding (1998-2003)

Research programme with four main issues:

- Identification and use of genetic markers and candidate genes
- Conservation of biodiversity and the genetic resources for livestock
- Immunological competence in relation to livestock breeding
- Embryo technology

Biotechnology funding volume 2002-2005: 6.5M DKK (0.9M EUR)

- The Innovation Law (since 2000)

The Innovation Law Focuses on international competitiveness, product and process quality, environmental considerations, organic/biological production, food safety and consumers interests.
Especially aimed at small and medium-sized enterprises (SME), it promotes

- innovation in farming,
- development and research in fishery
- innovation of new products and processes in the food manufacturing sector

Biotechnology funding volume 2002-2005: 34.0M DKK (4.6M EUR)

2.4 Charities and foundations

Table 2.3 shows the main biotechnology-relevant activities identified for the purpose of the project carried out by Foundations at national level in the period 2002-2005.

Table 2.3 Overview of biotechnology-stimulating instruments by Foundations

Instrument	Foundation	Budget in M EUR
Lundbeck Foundation Centres for Neurological Research	Lundbeck Foundation	3.24
Bioinformatics	Aarhus University Research Foundation	1.08
The Danish Cancer Society's Scientific Committee Programme	Danish Cancer Society	20.3
Total		24.35

Source: BioPolis Research

1 EUR = 7.4 DKK

2.4.1 Lundbeck Foundation

- Lundbeck Foundation Centres for Neurological Research (2005-2010)

The Lundbeck Foundation is engaged in the establishment of Danish centres of excellence within the field of neuroscience. The aim of this action is to support collaborative research of the highest international standard in centres that are involved in innovative research and have strong framework conditions for research education and recruitment.

Biotechnology funding volume 2002-2005: 24M DKK (3.24M EUR)

2.4.2 Aarhus University Research Foundation

- Bioinformatics (2001-2004)

The funding covered the initial establishment costs of founding the Bioinformatics Research Centre, University of Aarhus (BiRC)

Biotechnology funding volume 2002-2005: 7M DKK (1.08M EUR)

2.4.3 Danish Cancer Society

- The Danish Cancer Society's Scientific Committee Programme (ongoing)

The Danish Cancer Society's Scientific Committee Programme supports research projects related to cancer. Scientists working in cancer research within the scope of medical and scientific research can apply for funding of senior or junior fellowships, scientific and technical assistance, equipment, consumables etc. in connection with their projects.

Biotechnology funding volume 2002-2005: 61.4M DKK (20.3M EUR)

2.4. Instruments at the sub-national level

As already mentioned in section 1.2, traditionally and in the reporting period promoting biotechnology has not been an explicit responsibility of the regional and local authorities. However, the restructuring process the governance system is currently undergoing foresees an increasing involvement of the sub-national policy bodies in promoting the development of the knowledge base and the industrial application of research results.

For the reporting period (2002-2005), no information on regional policy-directed initiatives concerning biotechnology is available.

2.5 Participation in 6th Framework Programme

Table 2.4 shows the participation of Danish research groups in the 6th Framework Programme in those thematic priorities relevant for biotechnology. The information shows the number of groups involved as coordinators and participants in the projects.

Table 2.4 Involvement of Denmark in biotechnology/life sciences programmes of the 6th Framework Programme

Sixth Framework Programme[1] Thematic priority	**Participation as project manager in # of projects (% of total)** [2]	**Participation as member of the project team in # of projects (% of total)** [2]
1. Life sciences, genomics and biotechnology for health	26 (3%)	284 (3%)
2. Nanotechnologies, section bio-nanotechnology	0 (0%)	9 (8%)
5. Food quality and safety	5 (7%)	69 (4%)

[1] First and second call, all types of projects

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

Source: BioPolis Research

The thematic priority "Food Quality and Safety" displays the largest participation rate for the Danish researchers: 7% of the projects were managed by a Danish coordinator and 4% of the projects had a Danish team in the consortium. Compared to other European countries, the participation share is not very high. The UK and Germany reach 18% and 10% respectively. The thematic priority "Nanotechnology" displays an 8% participation rate for Danish research teams. Germany and France are the leading countries in terms of participation in this field, reaching 25% and 15% respectively. Finally, in the thematic priority "Life Sciences" Denmark played a minor role in participation and coordination terms. Again Germany (18%), the United Kingdom (15%) and France (13%) reach the highest participation rates.

3. Performance of the national biotechnology innovation system

3.1 Introduction

This chapter analyses the performance of the Danish biotechnology innovation system for different periods – depending on data availability – as shown by a range of indicators for scientific and commercialisation performance. [12] National trends are benchmarked against the performance of the EU25 Member States and the USA.

The presentation of the performance is structured along the four main areas of the innovation system: the knowledge base, processes of knowledge transfer and application, industrial development and markets for biotechnology-based products. For each area, the different indicators for Denmark, the USA and EU25 will be shown. In order to establish a comparison, the values attained by EU25 have been chosen as reference in each indicator. The absolute figures are presented in Annex 5. Data are presented for three periods for each indicator. Each time period includes several years, in order to avoid capturing erratic trends. Depending on the data availability, the periods chosen can vary considerably between the indicators; Table A.5.1 presents the specific years for each period for each indicator.

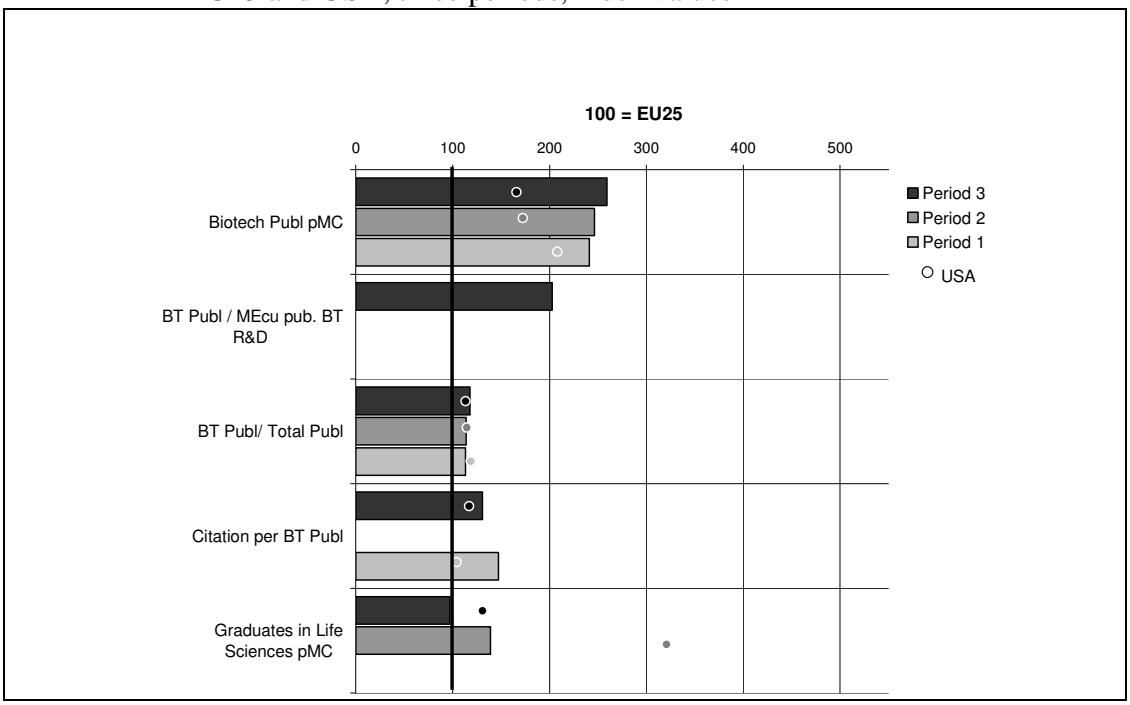
3.2 Performance in creating a knowledge base and supporting the availability of human resources

The indicators chosen to assess the overall performance in creating a knowledge base and supporting the availability of human resources are given in Chart 3.1.

Denmark shows an outstanding performance in developing the knowledge base. Except for the human capital indicator, the performance indicators of the Danish biotechnology knowledge base outperform the EU25 and the USA. The decreasing number of graduates in life sciences pMC vis-à-vis EU25 suggests a relative weakness in the ability of Denmark to train human resources with biotechnology-related skills.

[12] For a detailed discussion of 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 Danish biotechnology knowledge base indicators, comparison with EU25 and USA, three periods, index values



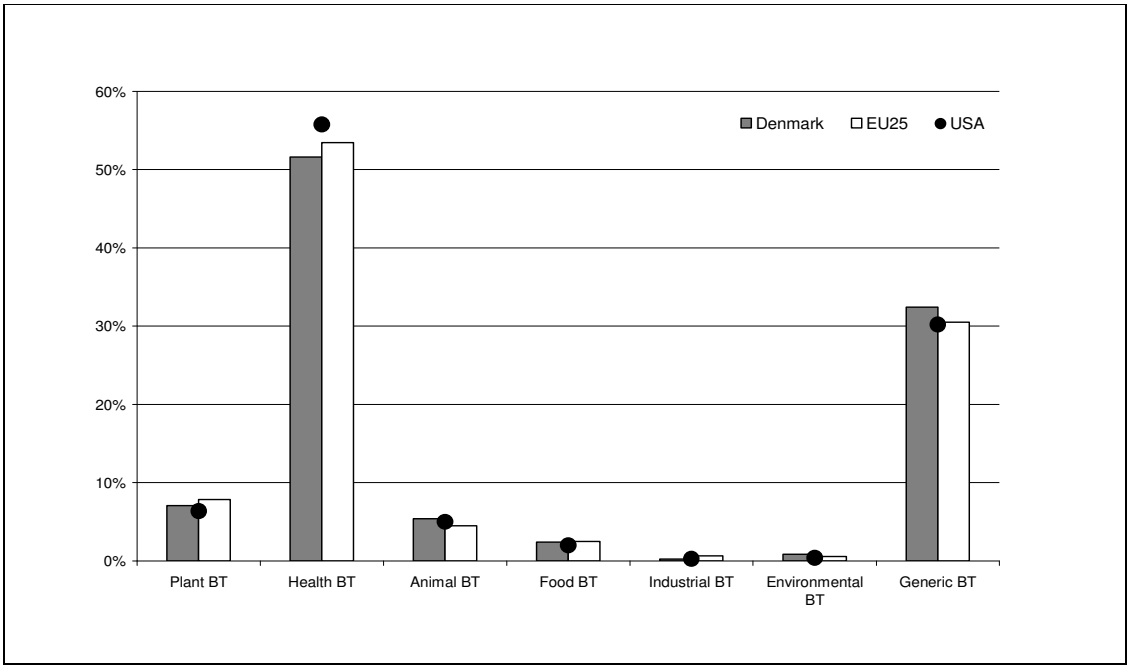
Source: BioPolis Research
Data: Science Citation Index, OECD Education Database, European Commission 1999
Note: the European reference region for indicator 2 (BT Publ./MEcu pub. BT R&D) is EU15.

Chart 3.2.1 shows a set of bibliometric indicators for the period 1994-1996 which aims to present the profile of the biotechnology scientific output in Denmark. For 7 biotechnology research fields the chart gives the share of publications within the total biotechnology output. The set of indicators gives a simple specialisation profile. Chart 3.2.2 shows the same set for the period 2002-2004 and Chart 3.4 the growth rates between the two periods.

The indicators reveal two main focuses for the biotechnology scientific activities: health and generic biotechnology. In both time periods these biotechnology areas seem to produce the largest volume of biotechnology publications. This profile is in line with those of the EU25 and the USA. However, Denmark has a slightly lower share of publication in health biotechnology than the other two regions. Especially in the period 2002/2004, the shares of biotechnology publications in the fields of plant, animal and food biotechnology are higher than the USA and EU25.

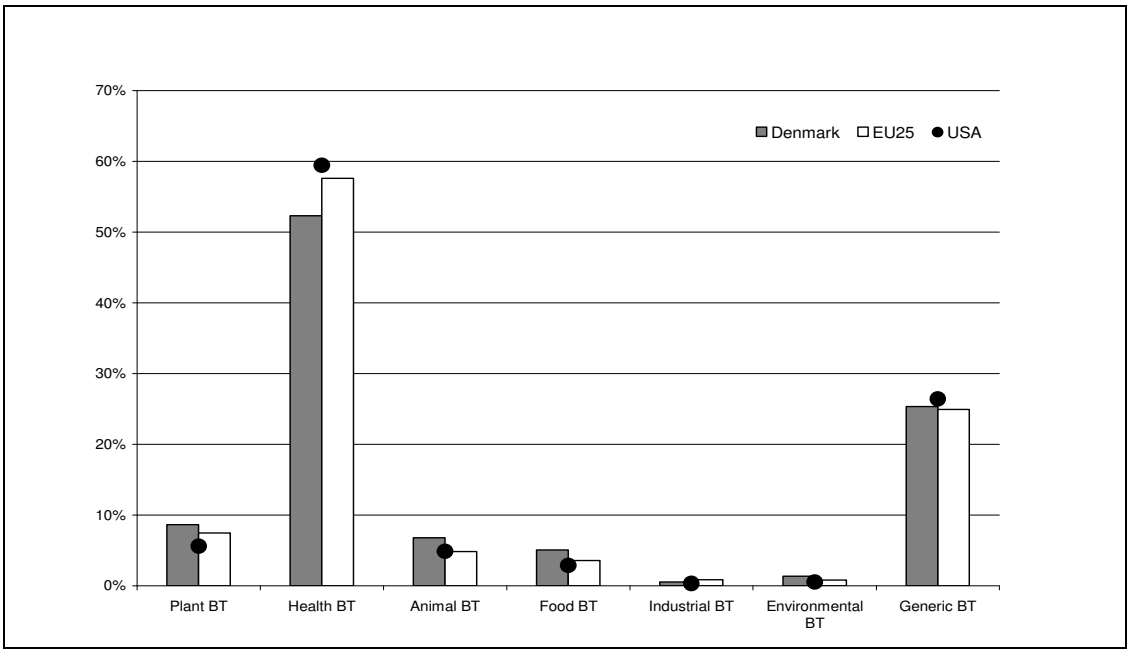
With regard to the growth rate between 1994/96 and 2002/04 shown in Chart 3.3, Denmark experienced the most pronounced increases of publication activities in the subfields of industrial and food biotechnology.

Chart 3.2.1 Share of sub-fields (in %) of total biotechnology publication for Denmark in comparison with the EU25 and USA (1994-1996)



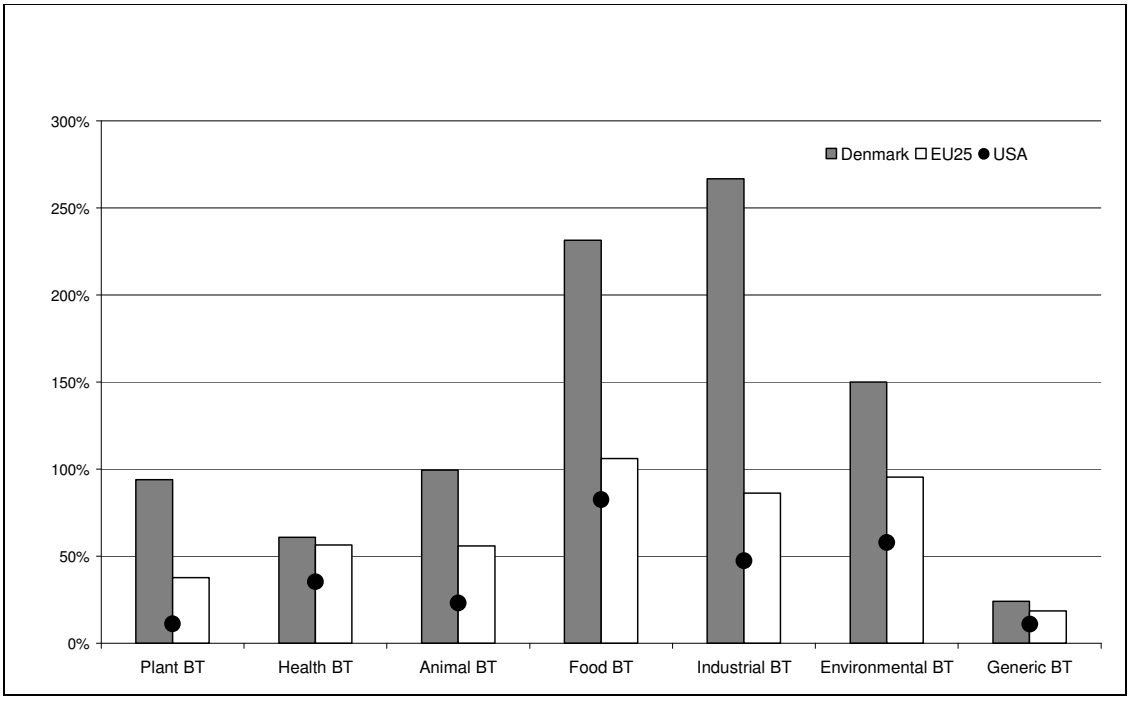
Source: BioPolis Research
Data: Science Citation Index

Chart 3.2.2 Share of sub-fields (in %) of total biotechnology publication for Denmark in comparison with the EU25 and USA (2002-2004)



Source: BioPolis Research.
Data: Science Citation Index

Chart 3.3 Biotechnology sub-fields growth rates for Denmark in comparison with the EU25 and USA (1994-1996 and 2002-2004)



Source: BioPolis Research, Data: Science Citation Index

3.3 Performance in knowledge transfer and application

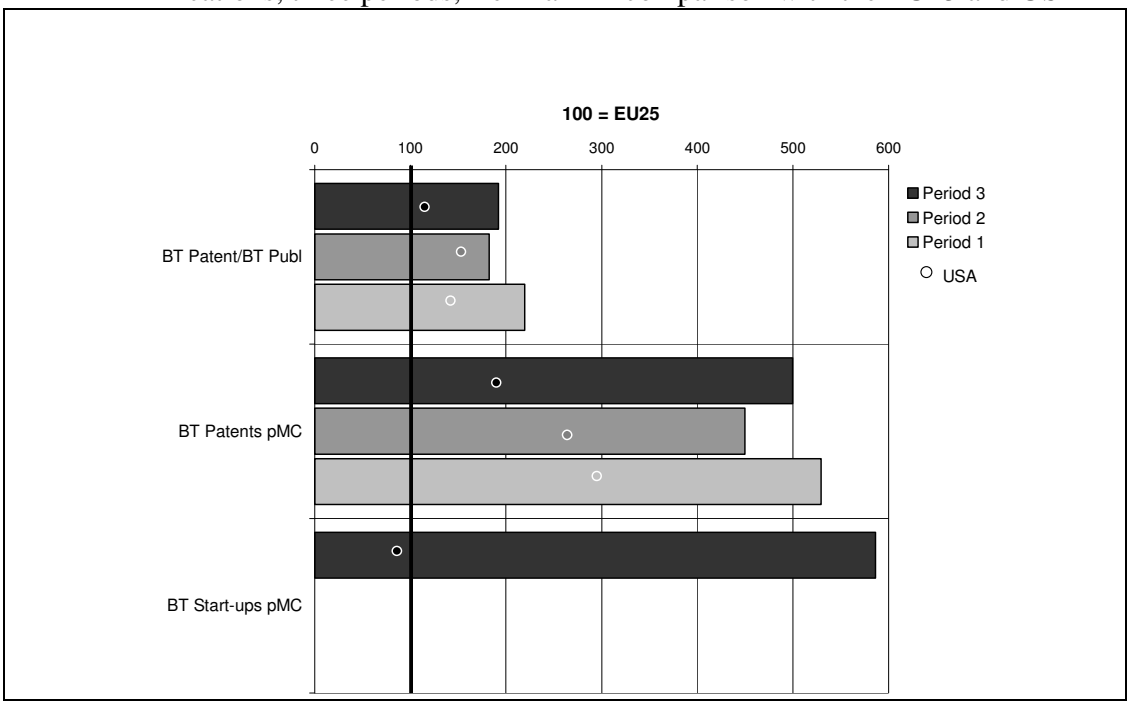
The indicators chosen for the assessment of the overall performance in knowledge transfer and application are given in Chart 3.4.

As for the first of the three indicators – biotechnology patents per biotechnology publication – Denmark outperforms the EU25 and USA. However, performance has been losing momentum over time. In terms of this indicator the data suggest an outstanding ability of Denmark in knowledge transfer vis-à-vis the EU25 and the USA, however, in recent periods patent applications have been growing at a slower rate than publications.

As regards the second indicator (biotechnology patents pMC), the results support the good performance in knowledge transfer. In all three periods Denmark outperforms the EU25 and the USA, but again the latest data suggest that, even though the trend is recovering, patenting activity has diminished since the mid 1990s.

Finally, in terms of company creation per million capita, Denmark performs extremely well compared to the USA and EU25. With 45 biotechnology start-ups (8.4 pMC) in the time period 2001-2003, Denmark is the best performer in developing the biotechnology industry in terms of biotechnology start-ups per million capita.

Chart 3.4 Performance indicators for biotechnology knowledge transfer and applications, three periods, Denmark in comparison with the 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.

All in all, Denmark's performance in knowledge transfer and application is outstanding compared to the EU25 and the USA.

3.4 Industrial development

The indicators chosen to assess the overall performance in biotechnology industrial development are given in Chart 3.5.

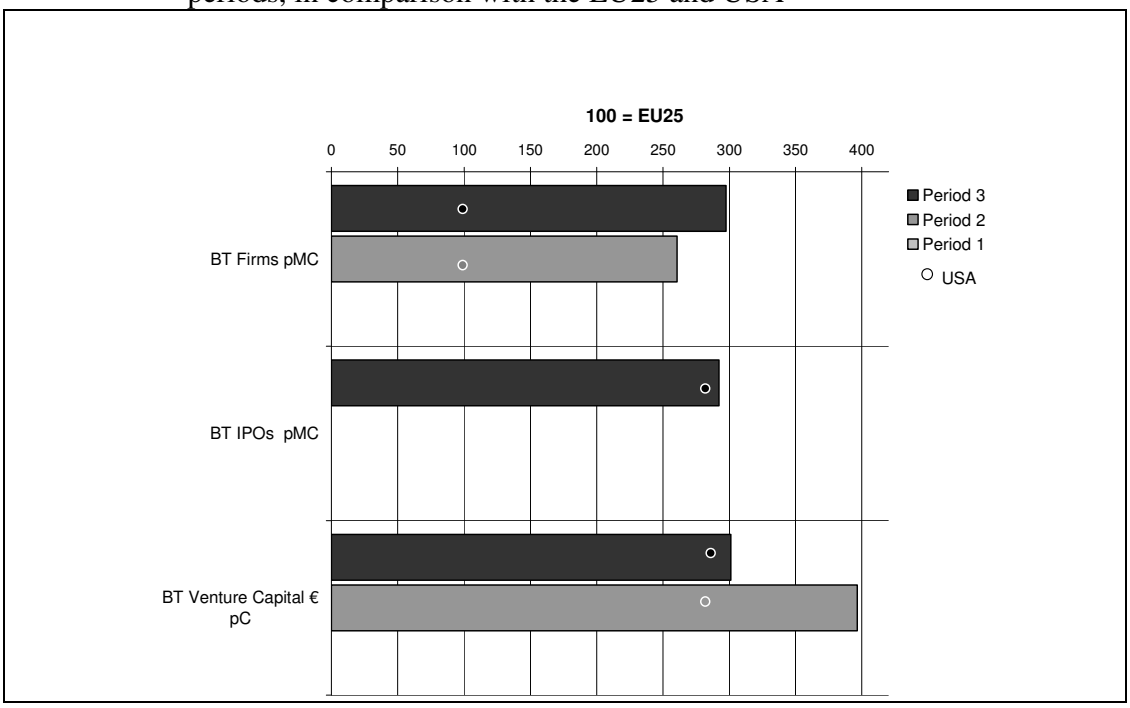
Again, Denmark's performance in this area is quite impressive compared to the EU25 and USA.. The first indicator (biotechnology companies pMC) suggests that Denmark has a very strong biotechnology industry in per capita terms.

With regard to the second indicator focusing on industrial development, in the period 2002-2005 Denmark outperforms EU25 and USA in terms of IPOs pMC. However, in absolute terms Demark was able to bring 1 biotechnology company to the stock market. In the same period the UK and the USA brought 15 and 52 companies, respectively.

Concerning the amount of venture capital in biotechnology companies, Denmark remains in a good position vis-à-vis the USA and the EU25 levels in both time periods. However, the trend over time points to a negative development.

All in all, Denmark's performance in biotechnology industrial development is strong.

Chart 3.5 Performance indicators for industrial development in Denmark in three periods, in comparison with the EU25 and USA



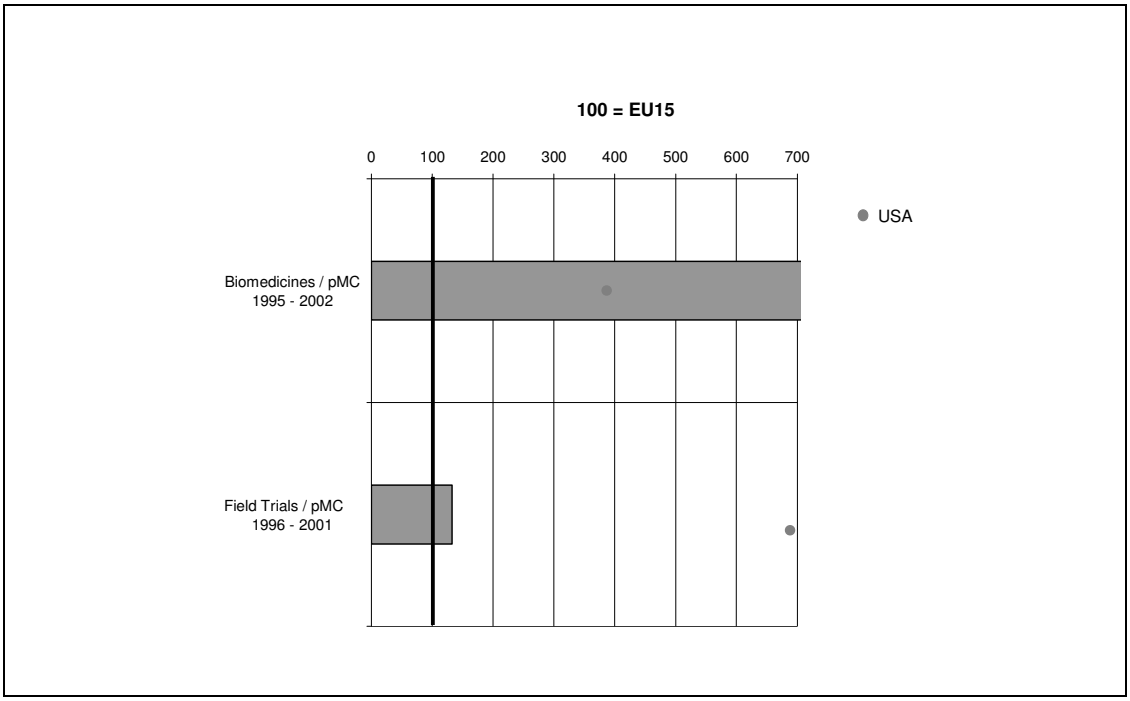
Source: BioPolis Research
Data: Ernst &Young Beyond Borders (report 2002, 2003, 2004, 2005), Websites of the London Stock Exchange, the Frankfurt Stock Exchange, Euronext, Nasdaq, Burril & Company

3.5 Market conditions

The indicators chosen to assess the overall performance in biotechnology industrial development are given in Chart 3.6.

During the time period 1995 – 2002, 11 biomedicines were reported from Denmark. As given in Chart 3.6, in per capita terms the performance lies well above the EU15 average. Together with the UK, Denmark is the strongest country in the production of biomedicines. However, the results are very disappointing in the case of field trials. Between 1996 and 2001, Denmark reported a total number of 25 field trials. The data available suggest favourable market conditions for health biotechnology while the agro-food biotechnology products seem to have serious problems in reaching the development stage.

Chart 3.6 Performance indicators for Market Conditions in Denmark in comparison with the EU25 and USA



Source: Benchmarking of public biotechnology policy 2005, Biotechnology Innovation Scoreboard 2002

4. Conclusions

4.1 Introduction

This chapter aims to provide 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 Denmark in the period 2002-2005. The key aspects of the Danish biotechnology policy approach considered in the analysis are:

- Funding volume per type of policy instrument
- Target groups of the policy instruments and co-financing conditions
- Policy goals addressed by the policy instruments in terms of funding
- Biotechnology research fields covered by the policy 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

Table 4.1 provides information on public funding of biotechnology through non-directed, generic and specific policy-directed instruments for the period 2002-2005.[13] Moreover, the funding information available has been classified according to the policy goals of the instruments implemented to allocate the funding. The table thus gives funding information on "research"[14], "commercialisation"[15] promotion and "other"[16] policy goals.

[13] The data included in the table correspond with the information presented in chapter 2. Data have been gathered by circulating a standardised questionnaire among the responsible policy-makers.

[14] Refers to funding targeting the following policy goals: (i) to stimulate a high level of biotechnology research, (ii) to stimulate a high level of industry-oriented (and applied) research, (iii) to stimulate knowledge flow and collaboration among scientific disciplines, (iv) to guarantee the availability of human resources.

[15] Refers to funding targeting the following policy goals: (i) to stimulate the transfer of knowledge from academia to industry and its application to industrial resources (ii) to promote the adoption of biotechnology for new industrial applications, (iii) to stimulate firm creation, (iv) to promote business investment in R&D.

[16] Refers to funding targeting the following policy goals: (i) to stimulate social acceptance of biotechnology and (ii) to promote bio-safety research and risk assessment.

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

	Funding M EUR 2002-2005
RESEARCH	
1. *Non-policy-directed*	
Public Research Institutions	NA
Response Mode	134.2
Total Non-policy-directed	134.2
2a. *Policy-directed Generic*	
National	11.5
Regional	-
Total 2a.	11.5
2b. *Policy-directed Biotech-specific*	
National	6.1
Regional	-
Total 2b.	6.1
COMMERCIALISATION	
3a. *Policy-directed Generic*	
National[2)]	13.1
Regional	-
Total 3a.	13.1
3b. *Policy-directed Biotech-specific*	
National	0.00
Regional	-
Total 3b	0.00
4. OTHER	
National	1.19
Regional	-
Total other	1.19
TOTAL Policy-directed (2+3+4)	32.1
Grand Total (1+2+3+4)	166

Source: BioPolis Research

1 EUR = 7.4 DKK

The information given in table 4.1 suggests that Denmark has mainly implemented non-policy-directed instruments to promote biotechnology in the period 2002-2005. Non-policy-directed instruments allocated 134M EUR to promote biotechnology (81% of the total biotechnology funding estimated for the period 2002-2005). However, since there are no data available for institutional funding of public research institutions, the importance of policy-directed instruments for the reporting period is probably underestimated.

Concerning the balance between research and commercialisation, the data give evidence of the strong support for research activities, which received 91% of the total funding (151.8M EUR).[17] If we consider policy-directed instruments only, 55% of the funding

[17] The data should be interpreted with caution. The activities of the Danish Ministry of Economic and Business Affairs have not been included in the analysis.

allocated through policy-directed instruments was invested in the promotion of research, while 41% was invested in promoting commercialisation activities.

Regarding the distribution of funding between generic and biotechnology-specific instruments, 77% of the funding allocated through policy-directed instruments reached the funding recipients through generic instruments. In other words, generic policy-directed instruments were more important than biotechnology-specific policy instruments in terms of funding.

All in all, research promotion by means of non-policy-directed instruments and generic instruments was the main policy approach in terms of funding in the period 2002-2005.

4.3 Specific features of the instruments

Table 4.2 includes the national policy-directed instruments per type according to the categories 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 4.2 Participants/recipients and co-financing requirements of policy-directed programmes that fund biotech activities in the period 2002-2005

Instrument	Funding agency	Co-financing	Participants/ Recipients		
			LF	PRO	SME
National Policy Instruments					
Generic (non biotechnology-specific)					
(i) Large advanced technology ventures and (ii) Projects for small and medium-sized enterprises	The Danish National Advanced Technology Foundation	√		√	√
Strategic Research Programme for Interdisciplinary Applications of Nanotechnology, Biotechnology, IT and Communications Technology	The Danish Council for Strategic Research	√		√	√
Innovation Consortia	The Danish Council for Technology and Innovation	√		√	√
Future livestock breeding	Directorate for Food, Fisheries and Agribusiness			√	
The Innovation Law	Directorate for Food, Fisheries and Agribusiness	√		√	√
Biotechnology-specific					
Biotechnology and applied genetics in plant breeding	Directorate for Food, Fisheries and Agribusiness			√	
Biotechnology in food research	Directorate for Food, Fisheries and Agribusiness			√	
National Platform for Systems Biology	Danish National Research Foundation			√	

Source: BioPolis Research

4.4 Policy goals

Table 4.3 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 a high level of biotechnology research
2. To stimulate a 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 transfer 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

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.

The gaps in funding for company creation should be interpreted with caution since the activities of the Danish Ministry of Economic and Business Affairs have not been included in the analysis. According to the information available, the lack of instruments to support human resources in biotechnology, bio-safety research and risk assessment were the main policy gaps in the Danish policy profile for the period 2002-2005.

Table 4.3 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										
Generic										
(i) Large advanced technology ventures and (ii) Projects for small and medium-sized enterprises	√	√	√		√	√		√	√	
Strategic Research Programme for Interdisciplinary Applications of Nanotechnology, Biotechnology, IT and Communications Technology	√	√	√		√	√			√	
Innovation Consortia	√	√			√	√			√	
Future livestock breeding	√	√								
The Innovation Law		√			√					
Biotechnology-specific										
Biotechnology and applied genetics in plant breeding		√								
Biotechnology in food research	√									
National Platform for Systems Biology	√									
Grand Total in M EUR	7.41	8.69	1.69	0.00	5.89	3.60	0.00	1.19	3.60	0.00
Total in %	23%	27%	5%	0%	18%	11%	0%	4%	11%	0%

Source: BioPolis Research
1 EUR = 7.4 DKK
*

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 Transfer 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

4.5 Biotechnology research application areas

Table 4.4 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

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

	Biotech application areas							
	1*	**2**	**3**	**4**	**5**	**6**	**7**	**8**
National								
Generic								
Innovation Consortia [1)]	✓			✓				
Future livestock breeding		✓						
The Innovation Law	✓	✓						
Interdisciplinary Applications of Nanotechnology, Biotechnology, and ICT						✓		
Technology ventures and R&D at SMEs	✓			✓				
Total	1.1	4.9		7.8		2.5		
Biotech-specific								
National Platform for Systems Biology							✓	
Biotechnology and applied genetics in plant breeding	✓							
Biotechnology in food research					✓			
Total	2.4				2,3		1,6	
Grand Total[2)]	3.5	4.9	0	7.8	2.3	2.5	1.6	0

1) Funding data not available per biotechnology research areas.

2) Does not include data for innovation consortia

1 EUR=7,4 DKK

Source: BioPolis Research

*

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

According to the data available, health biotechnology was the biotechnology sub-field receiving the largest volume of funding, followed by animal biotechnology and plant biotechnology. Environmental biotechnology and ethical, legal and social aspects of biotechnology were funding gaps in the policy instruments considered in this report.

4.6 Stimulation of biotechnology activities through the instruments

Table 4.5 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) Setting 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 actively engaged in it
17) Grants for industrial research
18) Other incentives for business investment and public research organisations
19) Support for public discourse activities

Basic and applied research, mobility of researchers between academia and industry, and collaborative research between industry and academia were the activities receiving the largest funding volumes.
.

Table 4.5 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																			
Generic																			
(i) Large advanced technology ventures and (ii) Projects for small and medium-sized enterprises	√	√					√	√											
Strategic Research Programme for Interdisciplinary Applications of Nanotech., Biotech., ICT[1)]																			
Innovation Consortia		√		√		√		√								√			
Future livestock breeding[1)]	√																		
The Innovation Law		√						√											
Biotechnology-specific																			
Biotechnology and applied genetics in plant breeding	√	√					√	√											
Biotechnology in food research	√																		
National Platform for Systems Biology	√																		
Grand Total in M EUR[2)]	7.42	6.87		1.91		1.91	2.66	6.87								1.91			

Source: BioPolis Research

1 EUR = 7.4 DKK

[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
2 Applied research
3 Centres of excellence
4 Research network
5 Mobility of researchers
6 Biotechnology training
7 Mobility of researchers between academia and industry
8 Collaborative research between industry
9 Setting 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 actively engaged in it
17 Grants for industrial research
18 Other incentives for business investment and public research organisations
19 Support for public discourse activities

4.7 Dynamics: comparison with period 1994-1998[18]

Table 4.6 Comparison of biotechnology research funding through non-policy-directed and policy-directed instruments in the periods 1994-1998 and 2002-2005

Funding	Average total funding per annum for biotechnology research in 1994-1998	Average total funding per annum for biotechnology research in 2002-2005
National	27.4	41.5
Regional	n.a.	n.a.
Total	27.4	41.5

Source: BioPolis Research

Table 4.6 gives a comparison of the annual average biotechnology research funding in the periods 1994-1998 and 2002-2005 through non-policy-directed funding and policy-directed instruments. The data suggest that the annual budget for the promotion of biotechnology has increased by more than 50% in these two periods.

Table 4.7 Coverage of policy goals by the policy-directed instruments in the periods 1994-1998 and 2002-2005

Presence of instruments					
Policy areas	**Policy goals**	**1994-1998**		**2002-2005**	
		G	**S**	**G**	**S**
1. Creation of knowledge base and human resources	1. To promote a high level of biotechnology basic research	√	√	√	√
	2. To promote a high level of industry-oriented (and applied) research	√	√	√	√
	3. To support knowledge flow and collaboration among scientific disciplines			√	
	4. To assure availability of human resources				
2. Knowledge transfer and application	5. To facilitate transfer of knowledge from academia to industry and its application for industrial purposes	√		√	
	6. To stimulate the adoption of biotechnology for new industrial applications	√		√	
	7. To assist firm creation	√.	.	n.a.[19]	
3. Market	8. To monitor and improve the social acceptance of biotechnology		√	√	
4. Industrial development	9. To encourage business investment in R&D	√.	.	√	

G = Generic instruments; S= Biotechnology-specific instruments,

18 The information for the period 1994-1998 draws on Assouline, G. (1999) National Report of Denmark. Inventory of Public Biotechnology R&D Programmes in Europe. C. M. Enzing, J. N. Benedictus, E. Engelen-Smeetset al. Brussels, DG Research - European Commission: DK3-DK43.

19 There is no information available on policy instruments targeting firm creation. However, since the Ministry of Economic and Business Affairs has not been included in the analysis for the period 2002-2005, information can be missing.

In Table 4.7 the periods 1994-1998 and 2002-2005 are compared in terms of policy instruments targeting selected policy goals. According to the information available, in both periods basic and applied research are promoted through both generic and biotechnology-specific instruments. The promotion of human resources for biotechnology is a policy gap in both periods. In the period 2002-2005 measures have been implemented to support knowledge flow and collaboration among scientific disciplines while the social acceptance of biotechnology has not been promoted by biotechnology-specific measures.

As regards the funding of biotechnology application areas, promotion programmes in the period 2002-2005 concentrate on health biotechnology. The next application area in terms of funding was animal biotechnology, followed by plant biotechnology. In the period 1994-1998 human health and veterinary biotechnology were also the most important funding areas. However, interestingly, in the mid 1990s (after health biotechnology) industrial biotechnology (cell factory, food and paper) and non-technical ??? areas of biotechnology were the areas with a relatively large number of programmes promoting the research activities. In terms of number of programmes targeting biotechnology application fields, the funding profile seems to have moved slightly away from industrial biotechnology towards animal and plant biotechnology.

5. Future developments

The information available suggests that the main political concerns in Denmark in 2006 are the globalisation strategy, reform of the governance system for regional development, and the ICT sector. Biotechnology remains a secondary policy focus in Denmark in the mid term.

The main issue addressed in the government's globalisation strategy is how to safeguard Danish society in a world characterised by ever increasing globalisation (Danish Government 2006)[20]. According to the European Commission (2006)[21], the strategy contains a total of 350 concrete initiatives which together compound substantial reforms of Danish education at all levels, research and marked improvements in the framework conditions for growth and innovation in all parts of Danish society.

At the regional level, the structural reform introduced in 2005 foresees the reduction of the number of local authorities: 5 regions will replace the 14 counties. The year 2006 was foreseen as a transition period. The new structure will be fully implemented in 2007. These regions will be responsible for the development of regional trade and industry (European Commission 2005a)[22].

Biotechnology will be promoted in the near future in the framework of programmes to support interdisciplinary scientific developments. An example of a policy-directed programme explicitly targeting biotechnology for the near future is the Strategic Programme on the Interdisciplinary Application of Nanotechnology, Biotechnology and IT and Communications Technology launched in 2005 for the next years by the Programme Commission for Nanoscience and Technology, Biotechnology and IT (NABIIT) of the Danish Council for Strategic Research. The programme aims to strengthen and contribute to new research at the interface between nanotechnology, biotechnology and information and communication technology. As introduced in section 2, in the 2005 call, the programme prioritised projects involving collaboration between Danish research groups covering two or more of the actual research areas and/or collaboration between industry and public research groups. In 2006 these priorities were reformulated. Now the programme will fund strategic networks and minor, strategic research projects. Prioritised are projects that identify and develop future possibilities for innovation and solving social problems and which cut across established knowledge areas.

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[20] The Danish Government (2006) "Progress, Innovation and Cohesion - Strategy for Denmark in the Global Economy." Retrieved October 2006, from http://www.globalisering.dk/page.dsp?area=52

[21] European Commission (2006) "ERAWATCH." Retrieved October 2006, from http://cordis.europa.eu/erawatch/

[22] European Commission (2005) European Trend Chart on Innovation - Annual Innovation Policy Trends and Appraisal Report Denmark 2004-2005. Brussels, European Commission.

Annex 1 List of tables

Annex 2 List of figures and charts

Annex 3 List of contact persons

The information was gathered with a questionnaire designed by the BioPolis team and circulated by the

Danish Agency for Science, Technology and Innovation
Gunvor Nielsen

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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

	Indicator	Chart	Comments	Time periods
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[23]	2005
Ind. 16	Biomedicines	3.6	Source: BT Policy Benchmarking 2005 Index: Reference Region EU15 =100 US data for	1995-2002

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

	Indicator	Chart	Comments	Time periods
			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
Denmark	2760	3748	4463	5	5	5
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
Denmark	526	703	827	241	246	259
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 publi-cations	**Non-policy-directed funding**	**Policy-directed funding**		**Total public spend-ing on BT (M Ecu)**	**BT publications/ M Ecu BT public expenditure**	**Index**
			Biotech specific	**Generic**			
	2002-2004	**1994-1998**	**1994-1998**	**1994-1998**	**1994-1998**	**2002-2004/ 1994-1998**	
EU25	145646				n.a.		
Den-mark	4463	39.8	42.4	54.87	137	33	203
USA	154402				n.a.		n.a.

Source: BioPolis Research
Publication data: Science Citation Index (through online database vendor STN International)
BT public expenditures in research: Inventory Project, Table 3.4 Executive Summary

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

	BT publications			Total publications		
	94-96	**98-00**	**02-04**	**94-96**	**98-00**	**02-04**
EU25	97521	128716	145646	860652	1024327	1117392
Denmark	2760	3748	4463	21551	26176	29039
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
Denmark	13%	14%	15%	113	114	118
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
Denmark	9.05	9.52	147	131
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
Denmark	627	984	5	5
USA	75253*	70950	276*	288
	Graduates pMC		**Index EU17=100**	
	1998 / 1999	**2002**	**1998 / 1999**	**2002**
EU17	91**	189	100	100
Denmark	118	183	139	97
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**	**Indus-trial**	**Environ-mental**	**Generic**
EU25	100%	8%	53%	5%	3%	1%	1%	30%
Denmark	100%	7%	52%	5%	2%	0%	1%	32%
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**	**Indus-trial**	**Environ-mental**	**Generic**
EU25	100%	7%	58%	5%	4%	1%	1%	25%
Denmark	100%	9%	52%	7%	5%	0%	1%	25%
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**	**Indus-trial**	**Environ-mental**	**Generic**
EU25	97217	7629	51944	4375	2434	624	576	29635
Denmark	2776	196	1433	150	67	6	24	900
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**	**Indus-trial**	**Environ-mental**	**Generic**
EU25	140984	10494	81220	6821	5017	1162	1126	35144
Denmark	4404	380	2304	299	222	22	60	1117
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**	**Environ-mental**	**Generic**
EU25	38%	56%	56%	106%	86%	95%	19%
Denmark	94%	61%	99%	231%	267%	150%	24%
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
Denmark	306	474	599	5	5	5
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
Denmark	58	89	111	529	450	500
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
Denmark	306	474	599	2760	3748	4322
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
Denmark	0.11	0.13	0.14	220	182	192
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
Denmark	72	75	83	80	5349	5368	5384	5398
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
Denmark	13.41	13.97	15.4	14.8	261	271	354	298
USA	5.110	5.112	5.065	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 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 (EU15 - Cyprus - Greece + Norway + Switzerland)	523	132	367051	
Denmark	45	10	5384	
USA	355	83	290789	
	Biotech start-up/pMC	**Index**	**Biotech start-up/pMC**	**Index**
	2001-2003	**2001-2003**	**2003**	**2003**
Europe (EU15 - Cyprus - Greece + Norway + Switzerland)	1.4	100	0.36	100
Denmark	1.86	517	8.4	587
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 Availiable	29	452927	454869	457154	461593	456636
Denmark	1	5368	5384	5398	5411	5390
USA	52	287941	290789	291685		290138

	IPO /pMC	Index
	2002-2005	2002-2005
EU Availiable	0.00	100
Denmark	0.00	292
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 biotech-nology companies M EUR			Population in T		
	2002	2002	2002	2002	2003	2004
Europe	1100	920	2800			
EU Availiable	890	883	1111	315584	319663	325131
Denmark	60	46	56	5368	5384	5398
USA	2288	2498	2855	287941	290789	291685
	Venture capital in EUR/pC			Index		
	2002	2003	2004	2002	2003	2004
Europe						
EU Availiable	2,8	2,8	3,4	100	100	100
Denmark	11	9	10	396	313	301
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
Denmark	11	5	2.05	1988
USA	115	289	0.40	387

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

Source: BioPolis Research
Number of medicines: Benchmarking of public biotechnology policy 2005

Raw data for Chart 3.6. Number of field trials pMC

	Field trials	Population in M	Field trials pMC	Index
	1996-2001	2001	1996-2001	1996-2001
EU15	1334	379	4	100
Denmark	25	5	5	133
USA	6745	278	24	688

Note: EU15 is the result of the sum of the 15 old EU Member States
Source: BioPolis Research
Field trails: Biotechnology Innovation Scoreboard 2002

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

BT acceptance index 2002		
	Index average	N (sample size)
EU15*	100.29	16828
Denmark	101.18	997

*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
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Burril & Company	http://www.burrillandco.com/
EuropaBio	http://www.europabio.org/
EUROSTAT	http://epp.eurostat.cec.eu.int/
OECD Education Database	http://www.oecd.org/
OECD Statistics	http://www.oecd.org/
STN International	http://www.stn-international.de/
Questel Orbit	http://www.questel.orbit.com/index.htm

Annex 6 Abbreviations

BiRC	Bioinformatics Research Centre, University of Aarhus
BT	Biotechnology
DKK	Danish krone
FTE	full-time equivalent
GDP	Gross Domestic Product
ICT	Information and Communications technology
LF	Large Firm
M EUR	Million Euro
pMC	per million capita
PRO	Public Research Organisation
Publ	Publications
R&D	research and development
SME	Small and Medium sized Enterprises
SPP	Standard Purchasing Power