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 Malta

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

Malta is a very small country with a population of 400 000 that joined the European Union in 2004. The small size and limited resources of Malta place significant constraints on research. In 2002 Gross domestic expenditure on R&D (GERD) as a percentage of GDP was only 0.28%. In 2005, the Research, Technological Development and Innovation (RTDI) Programme was set up to promote scientific research and innovation and to encourage public-private sector partnerships. In the same year Malta Enterprise launched the START^{plus} Programme, which aims to support knowledge-based start-ups in their first 18 months of operation.

The Malta Council for Science and Technology identified biotechnology as one of its science and technology priorities in 2002 with the aim of achieving a thriving biotechnology industry by 2015. The main centre for research in Malta is the University of Malta where a variety of departments and faculties are involved. Funds for research are provided through the generic RTDI Programme, grants from overseas or the EC's Framework Programmes. Total national funds for biotechnology research and commercialisation amounted to slightly less than 0.25M EUR in 2005 and address a narrow range of policy goals: (1) a high level of biotechnology research; (2) a high level of industry-oriented (and applied) research; and (3) firm creation.

Past lack of investment in research by the Government and the small size of the research community has led to poor performance in terms of biotechnology publications per capita. However, citations per biotech publication are well above the EU average, suggesting that there is expertise in Malta and support from the new RTDI programme may provide the potential for Malta to contribute to the future growth of European knowledge in the field, especially through joint research with other European countries.

1. Introduction and background

1.1 General introduction

Malta joined the European Union in May 2004. It is made up of three islands in the Mediterranean Sea and its population numbers 400 000 people. Gross Domestic Product amounted to 4 500M EUR in 2005 (Eurostat, 2005). The economy is based on tourism and manufacturing industry, with its main exports concentrated mainly in electronics, machinery and transport equipment. It is currently developing its service economy and aims to become a hub for communications in the Mediterranean (European Commission, 2004). Two important characteristics of manufacturing industry are that

a) The lack of natural resources leads to reliance on imported raw materials, and concentration on high value-added products
b) There is an export orientation to compensate for the small size of the local market (Asciak, 2001).

1.2 Characteristics of national S&T and innovation system

The small size and limited resources of Malta place significant constraints on research. In 2002 (the only year for which data is available) Gross domestic expenditure on R&D (GERD) as a percentage of GDP was only 0.28%. In the past, people wishing to pursue a research career had to go abroad for their PhD training. Few returned, because of the lack of research opportunities in Malta. The key to securing local funding was to be one of the first to enter a niche research area, and to excel in it. However, most specialists work alone, and rely on overseas colleagues for knowledge. There is also limited availability of research materials and equipment and long delays when equipment needs to be repaired or in receiving research materials ordered from overseas suppliers (Habeck, 2004).

Until recently, public sector research was only funded through grants provided from the meagre budget of the University of Malta (its total annual budget was around €31 million), together with grants from overseas. An important source of funds in the period 1996-2000 came from the Italian government which granted Malta 12.25M EUR to aid economic and technical development. The university's Faculty of Medicine secured 1.65M EUR of these funds to set up a molecular genetics laboratory (Habeck, 2004). In 2002, gross expenditure on R&D (GERD) amounted to only 0.26% (Eurostat, 2005).

As part of the accession process, Malta had to meet its requirements for implementing the *acquis communautaire.*[1] This had a major impact on Malta's policies for science, research and innovation. Malta joined the EC's Framework Programmes in 2001, and the Maltese government allocated 2 million ECUs to Malta's participation in the 5th Framework Programme. This was followed by two further initiatives announced in 2003/04. The first initiative was the announcement of the establishment of the National Research Technological Development and Innovation (RTDI) Programme in late 2003. Its establishment was directly

[1] *Acquis communitaire* is used to refer to the total body of EU law. In order to be able to implement and enforce the *acquis communitaire*, candidate countries had to align their legislation and adjust their administrative structures.

attributed to the impact of Maltese participation in the EC Framework programmes (Anon, 2003). The RDTI programme, which aims to promote a culture for continuous scientific research and innovation and to encourage public-private sector partnerships" has three Sub-Programmes. They cover capacity-building, scientific research and collaborative research between small and medium-sized enterprises (SMEs) and other public and private sector RTD performers. It is a generic programmes that operates in response mode and, because of the small size of the Maltese scientific community, expert peer review is undertaken by external reviewers nominated by overseas research councils. Its budget for 2005 was 0.7M EUR and there were plans to fund between 8 and 12 proposals (Malta Council for Science and Technology, 2004; 2004a), with an annual call for proposals. The first projects commenced in 2005.

The second initiative, at the beginning of 2004, was the establishment of Malta Enterprise to integrate government policy and enterprise strategy. In order to improve the business environment, Malta Enterprise took over the activities previously handled by three separate agencies: the Malta Development Corporation, Malta External Trade Corporation and the Institute for the Promotion of Small Enterprise (IPSE) (Malta Enterprise, 2004). As part of Malta's strategy to support small and medium-sized enterprises (SMEs) IPSE had opened a Business Incubation Centre programme for innovative start-up firms in 2001. The centre is now operated by Malta Enterprise.

1.3 National support and framework conditions for biotechnology

The Malta Council for Science and Technology identified biotechnology as one of its science and technology priorities in 2002, specifically the need for Malta to develop the application of biotechnology to several areas including "medicinal technologies, human and comparative genomes, medicinal and aromatic plants, as well as in the food industry and trhe production of speciality biochemicals, including biofuels" (Malta Council for Science and Technology, 2002).

In 2003, the European Union and the Maltese Government carried out an eFORESEE foresight project to boost the national biotechnology sector. The project sought to understand how to realise a thriving biotechnology industry by 2015. It undertook several tasks including mapping current biotechnology-related activity in Malta and developing a basis for a national biotechnology strategy. As well as identifying strengths such as a well established medical faculty and a good health care system, the foresight initiative identified significant weaknesses including a low number of postgraduates in biotechnology, weak research and development capabilities and lack of public-private partnerships. The report made numerous recommendations to reverse the many weaknesses identified. These recommendations focused mainly, but not exclusively, on improving the number and quality of scientists, public and private research and the exploitation of intellectual property (Galea and Felice, 2003).

A survey of public attitudes to new technologies in Europe (Eurobarometer, 2005) found that Malta was one of the European Member States where the least respondents believed that developments in biotechnology and genetic engineering would be advantageous over the next 20 years (53% compared with an EU average of 65%). Public attitudes in Malta to the cloning of human beings so that couples can have a baby or the cloning of human embryo stem cells to treat people with diseases is similar to the EU average. There is, however, one

significant difference. Only 22% of citizens would approve the latter application if it was highly regulated and controlled; this is far below the EU average of 41%. The survey also examined public attitudes to genetic modification. Malta has the highest approval of the development of genetically modified crops to increase the variety of regionally grown food in Europe (30% compared with EU average of 8%). Malta also has the highest approval in Europe for developing genetically modified bacteria to clean up after environmental catastrophes. The general pictures that emerges from this survey is that, in general, Maltese citizens have a rather positive attitude towards most potential applications of biotechnology and genetic engineering.

Most European legislation controlling genetically modified organisms (GMOs) has been transposed to Maltese law. However, it is highly unlikely that any GMOs will be released into the environment because of the small size of the Maltese Islands (Galea and Felice, 2003). The regulatory regime for biotechnology in Malta indicates some barriers to acceptance of the new technology. Although the EU tentatively approved the importation of a genetically modifed variety of maize in May 2004, one month later "a regulatory committee of member-state representatives from the now-enlarged EU failed to agree on the Commission's proposed approval of a genetically modified rapeseed", and Malta was one of the countries voting against approval. It also voted against approving another variety of genetical modified corn, although the European Commission approved this variety in July 2004 (Shaffer and Pollack, 2004). Opposition to another application of biotechnology was also demonstrated in the presentation to Malta's parliament in July 2005 of a draft regulation on biotechnology that prohibits the creation of embryos for research purposes and cloning (Anon, 2005) although no specific legislation regarding human embryo research had been introduced by February 2006 (Agence de la Biomédicine, 2006). In addition, Malta is part of a minority blocking EU funding for embryonic stem cell research. However, Malta does not object to research using embryonic stem cells derived from naturally aborted embryos or foetuses (Camilleri, 2006).

1.4 The main biotech policy and research actors

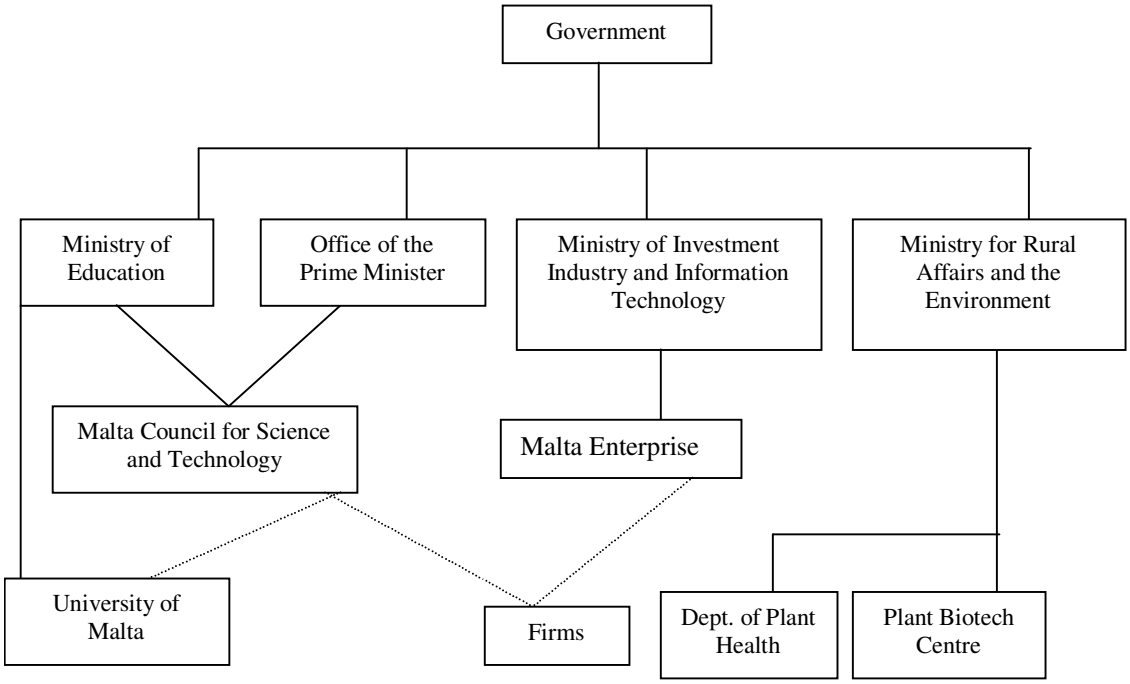
The Malta Council for Science and Technology (MCST) is the responsibility of the Office of the Prime Minister and the Ministry of Education. It manages the RTDI Programme. The MCST has responsibility for advising the Government on science and technology policy, is in charge of identifying and addressing major science and technology challenges and issues of strategic importance for Malta and is also the agency responsible for managing and co-ordinating Malta's participation in the EC Framework Programmes. The MCST is extremely selective in the areas of research it funds and is involved in setting national priority areas. There will be ongoing assessment of these priority areas so they can be re-oriented to take advantage of new opportunities that arise.

The agency responsible for implementing the government's commercialisation strategies is Malta Enterprise. It is the responsibility of the Ministry for Investment, Industry and Information Technology and focuses on attracting inward investment and supporting enterprises and SMEs in Malta.

The main centre for research in Malta is the University of Malta where a variety of departments and faculties are involved. Research is calso carried out in several laboratories of

the Departments of the Ministry for Rural Affairs and the Environment, including the Department of Plant Health and the Plant Biotechnology Centre.

Figure 0.1: Malta's policy and research actors in biotechnology



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

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

Non-policy-directed funding of research includes funding which is part of the structural governmental support for scientific education, research and research infrastructure. This type of funding is mainly given through block grants to universities and (government) research institutes, the open-call system of research councils *et cetera*. 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 system of research councils are included.

In this chapter the funding of biotechnology research through policy and non-policy-directed instruments and of biotechnology commercialisation through policy-directed instruments is presented. Data were collected through desk research (publications, documents, websites of national public funding organisations and/or governmental departments), surveys completed by representatives of funding organisations that manage the generic and biotech specific programs and information from representatives of organisations that are involved in non-policy-directed and policy-directed funding. The websites of the funding organisations and their programs and the names of contact persons that have participated in the survey and/or who have been interviewed can be found in Annex 3 (List of Contact Persons) and Annex 4 (References). Section 2.2 presents the non-policy-directed funding and section 2.3 the policy-directed funding. The final section provides a short overview of the European funding of biotechnology research in Malta through the 6th Framework Program.

2.2 Non-policy-directed funding of biotechnology research

Two government laboratories of the Department of the Ministry for Rural Affairs and the Environment, the Department of Plant Health and the Plant Biotechnology Centre, have some involvement in biotechnology. The majority of biotech-related work involves the application of biotech tools and techniques rather than research itself; relevant research is usually carried out by students at the University of Malta. It was not possible to get any estimate of the budget allocated to non-policy-directed biotech research by these labs for the period 2002-05.

2.3 Policy-directed funding of biotechnology research and commercialisation

There are no specific programmes to fund biotechnology research; it is funded from the generic programmes described below.

2.3.1 Malta Council for Science and Technology

The generic National RDTI Programme, which funded its first projects in 2005, has several core objectives. It aims to promote "a culture for continuous scientific research and innovation as well as providing the technical support for Malta to meet its requirements for the implementation of the Acquis Communautaire … [and] to encourage public-private sector partnerships and cross-sectoral synergies, involving all parties in the take-up of science and technological research and development" (Malta Council for Science and Technology, 2004). The three sub-programmes had a total budget of 0.7M EUR in 2005:

a) Sub-programme 1 – the Capacity-Building Funding Scheme – is directed at academic institutions and other public sector research units and provides funds to upgrade research facilities and access scientific information sources including publications and databases. In 2005, 0.028M EUR was allocated to biotechnology projects.
b) Sub-programme 2 – the Scientific Research Funding Scheme – is open to public or private institutions or individuals that have the capacity to carry out scientific research in Malta. It provides grants for research in any are of the natural and social sciences, and well as making small awards to promote international collaboration. It allocated 0.172M EUR to biotechnology projects in 2005.
c) Sub-programme 3 – SME Collaborative Research Funding Scheme – is directed at SMEs and supports quality applied research to meet the research needs of a specific SME or a cluster of SMEs. The scheme is open to SMEs collaborating with public or private RTD performers. It also funds the development of local facilities or competences for a cluster of SMEs. It allocated 0.038M EUR to biotechnology projects in 2005.

The RTDI programme covers 75% of the costs of projects for Maltese SMEs and 100% of the costs of projects for academic institutions, public bodies or non-profit organisations (Malta Council for Science and Technology, 2004).

2.3.2 Malta Enterprise

Malta Enterprise developed the generic START^{plus} Programme as one of its instruments to promote entrepreneurship. The START^{plus} Programme, which was launched in 2005, has been designed specifically for knowledge-based start-ups in their first 18 months of

operation. It had a total budget of 55 000 Maltese lira (Mtl) in 2005 (0.128M EUR) and provides 1 000 Mtl per accepted enterprise to cover 50% of the cost of recommended training, or as part of the cost of secondments for knowledge transfer or capability development. It allocated 3 500 Mtl in 2005 (0.008M EUR) for biotechnology training or secondments.

The START^{plus} programme also gives start-ups access to the SME Loan Guarantee Scheme, launched in March 2005. It has a total budget of 550 000 Mtl (1.28M EUR) and provides loan guarantees of 50% (75% for first time entrepreneurs) of the total loan up to a maximum of 50 000 Mtl (0.116M EUR) for up to 10 years. Selected start-ups also have the option to be located at a Business Incubation Centre where they can benefit from a variety of business assistance services. The programme will be revised after December 2006 (Malta Enterprise, 2005).

In January 2005, new rules were announced to allow tax credits to be set against R&D expenditure. The aim is to stimulate R&D by SMEs in Malta. The R&D tax credit scheme is administered by Malta Enterprise, and will run for 4 years. It is a generic programme with a budget of 1M Mtl for 2005 (2.3M EUR), with no specific budget for biotechnology.

Table 2.1 summarises the instruments used in Malta to support policy-directed funding of biotechnology research and commercialisation .

Table 0.1 National public policy-directed biotechnology stimulating instruments during the period 2002 – 2005

Instrument	Funding organisation	Budget €K	% of total	Use of DF/SF*
Generic				
RTDI (1)	Malta Council for Science and Technology	28	11.3	None
RTDI (2)	Malta Council for Science and Technology	172	70.0	None
RTDI (3)	Malta Council for Science and Technology	38	15.4	None
START ^{plus}	Malta Enterprise	8.14	3.3	None
Total		246.14	100	

*DF/SF = Development Funds/Structural Funds
Source: BioPolis Research

2.4 Participation in 6th FP and use of development funds

Malta did not act as a coordinator of any European Commission 6th Framework Programme projects. However it was a partner in one project under Life Sciences for Health (0.01% of all participations) and 3 projects in the Food Quality and Safety (0.2% of all participations) thematic priorities.

The new generic research programmes described in section 2.3 above do not benefit from EU Structural Funds or from other international development funds.

3. Performance of the Maltese Biotechnology Innovation System

3.1 Introduction

This section analyses the performance of the Maltese biotechnology innovation system for two or three time periods (depending on data availability) as shown by a range of indicators for scientific performance. Each time period includes several years, to avoid capturing erratic trends. National trends are benchmarked against the performance of the EU25 Member States and the US. The presentation of performance covers only one of the four main areas of the Innovation System: the knowledge base. Lack of data availability prevents the analysis of processes of knowledge transmission and application, biotechnology commercialisation or markets for biotechnology based products. Various indicators of the knowledge base compare Malta's performance with the USA and EU25. To establish a comparison, the values of EU25 have been chosen as a reference for each indicator. The absolute figures that are used to calculate the values for the indicators presented in this chapter and the sources for the data can be found in Annex 5. The periods chosen can vary considerably between the indicators; table A.5.1 presents for each indicator the specific years for each period.

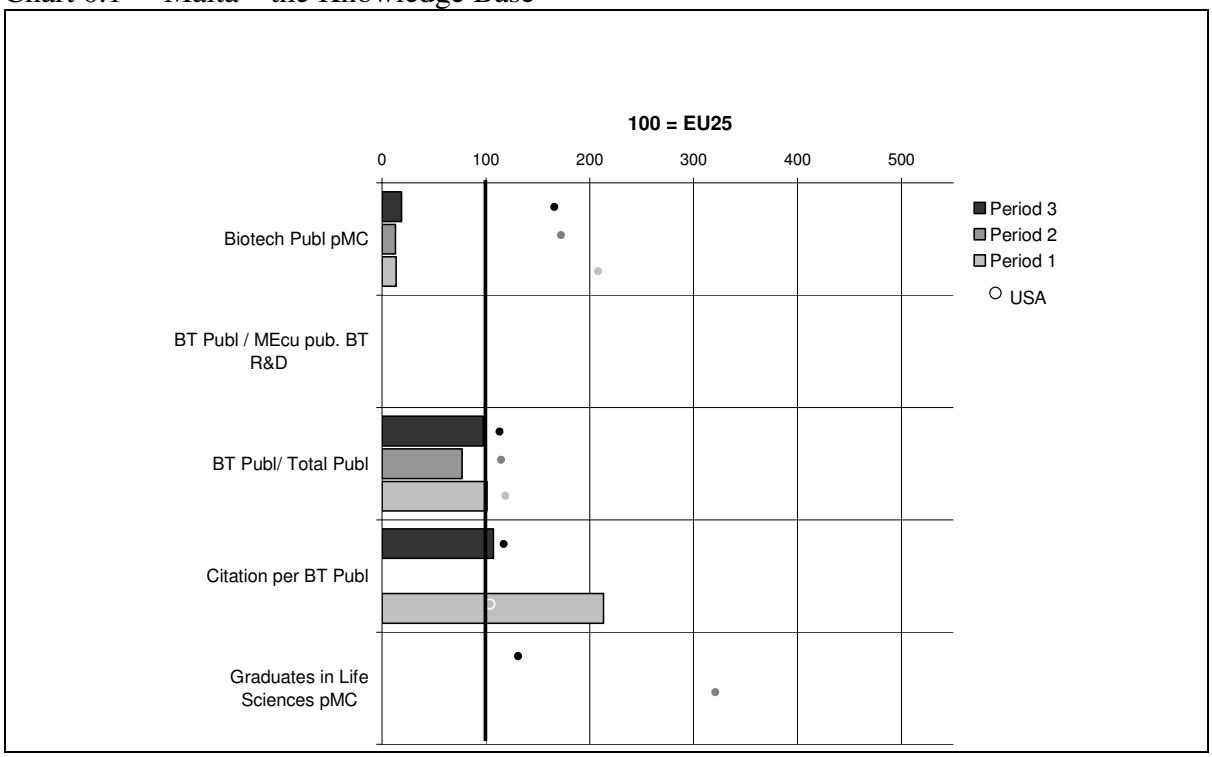
3.2 Performance in creating a knowledge base and supporting the availability of human resources

The low production of Maltese biotech publication pMC shown in Chart 3.1 reflects the lack of national investment in public sector research, including biotech research until 2004. However, citations per biotech publication are well above those of EU25 and the US (323 for 1994-98 and 197 for 2000-2004).[2] This result may be due to one paper with a very high impact from the earlier period, and this would be consistent with the high, but declining number for the second period.

In the period 1994-98, almost three-quarters of publications were generic and the remaining 27% were in the area of health biotechnology (See Chart 3.2.1). There has been a dramatic change to the focus of publications for the period 2002-2004, when the proportion of publications in the area of health biotechnology rises to 82% (see Chart 3.2.2). This change is probably due to the setting up a molecular genetics laboratory in the University of Malta's Faculty of Medicine in 1997. The remaining papers are equally divided between the generic area and animal biotechnology but, as shown by Chart 3.3, publications in generic biotechnology have declined over the period.

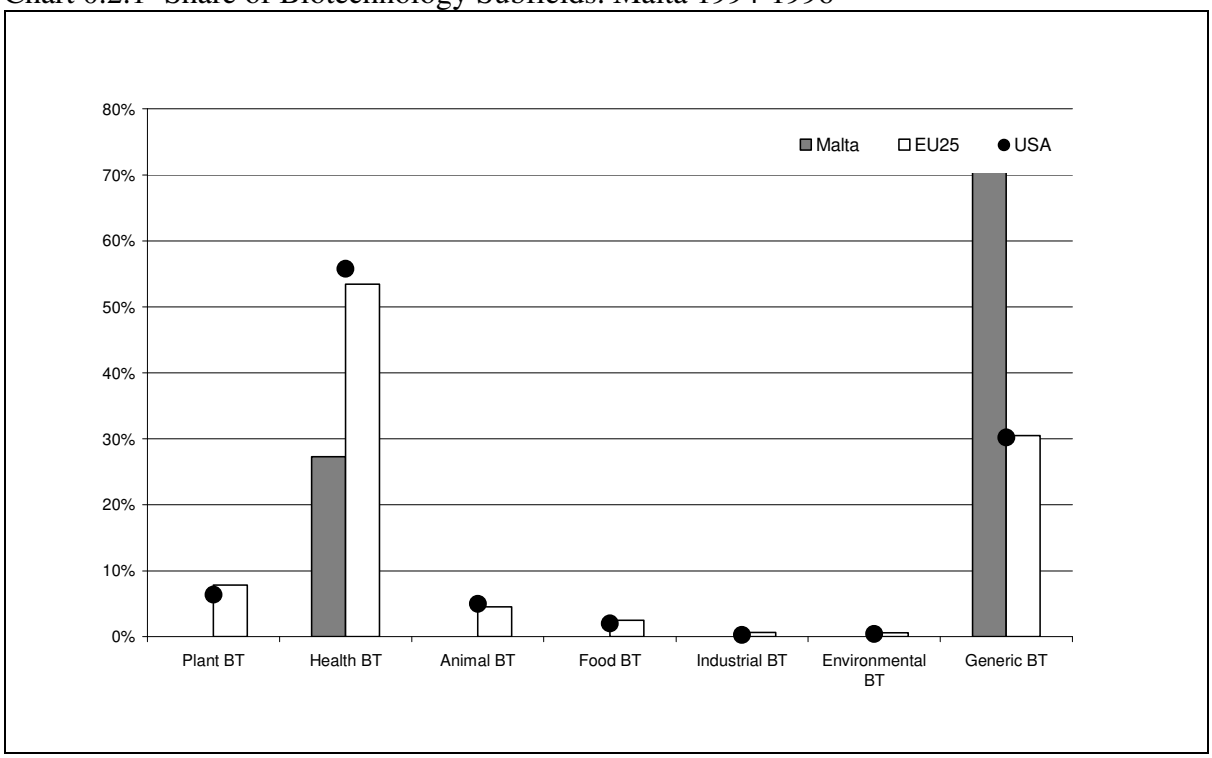
[2] There seems to be a "small country effect" bias for this indicator. Small countries show a relatively high citation rate. We propose this explanation: Large countries in terms of number of publications usually have a large "middle quality" share of research results (in terms of impact) while small countries usually have "low in number but good in quality" publications. This can be explained through the concentration of resources in small countries towards selected research groups. Small countries may concentrate resources in outstanding research units. Accordingly, a lower number of publications may have greater impact.

Chart 0.1 Malta – the Knowledge Base



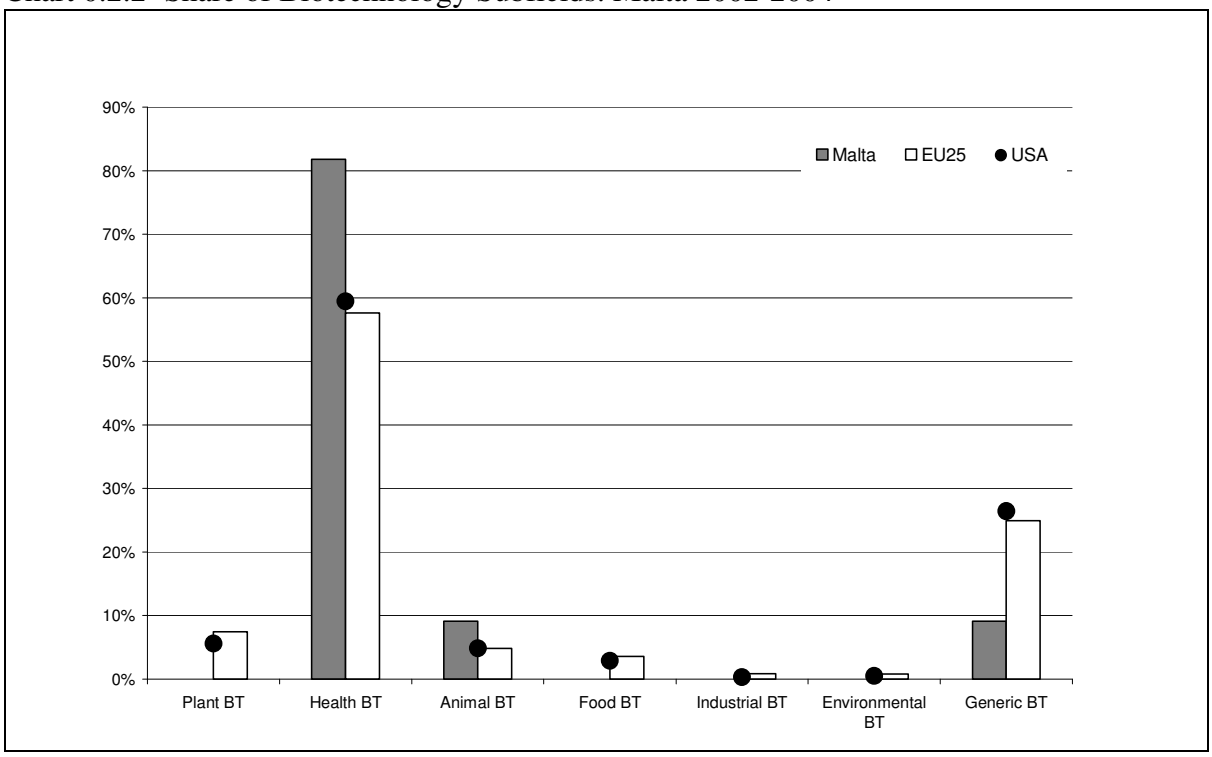
Source: BioPolis Research
Data: Science Citation Index, OECD Education Database

Chart 0.2.1 Share of Biotechnology Subfields. Malta 1994-1996



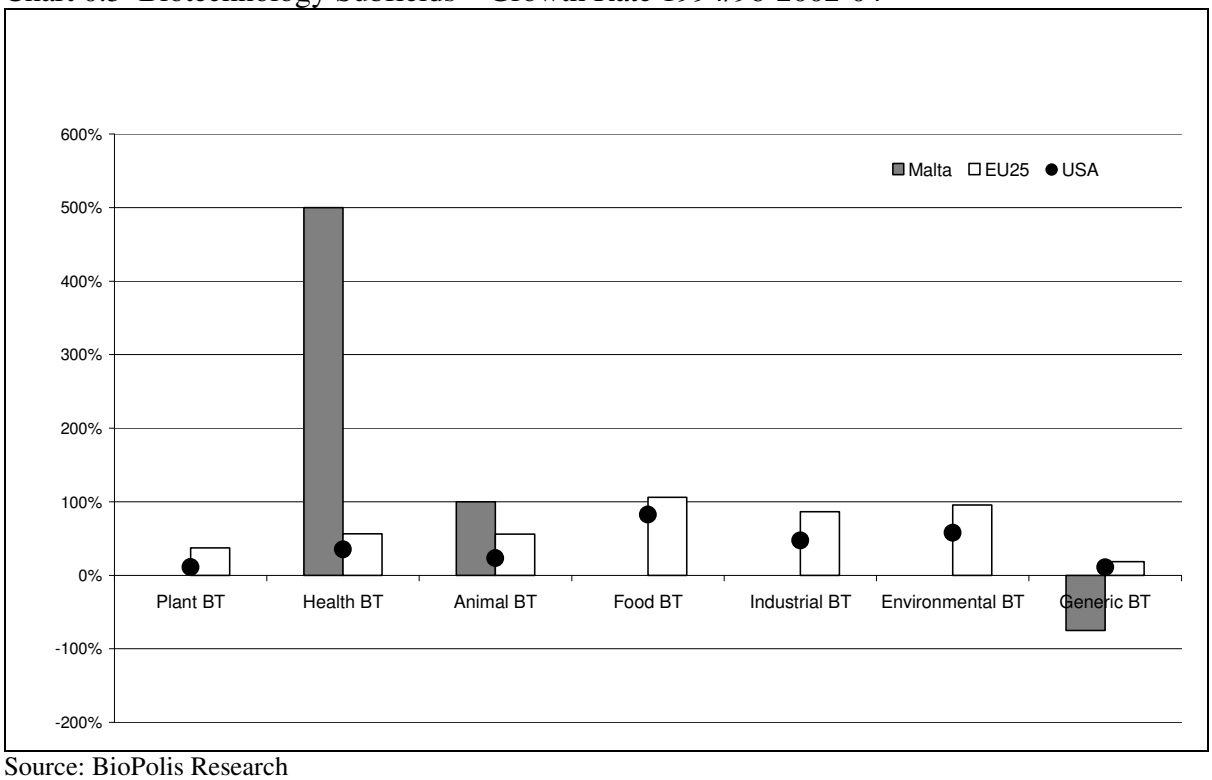
Source: BioPolis Research
Data: Science Citation Index

Chart 0.2.2 Share of Biotechnology Subfields. Malta 2002-2004



Source: BioPolis Research
Data: Science Citation Index

Chart 0.3 Biotechnology Subfields – Growth Rate 1994/96-2002-04



Source: BioPolis Research
Data: Science Citation Index

Past lack of investment in research by the Government and the very small size of the country explains its limited performance. However, the citation indicator suggests that there is

expertise in Malta and support from the new RTDI programme may provide the potential for Malta to contribute to the future growth of European knowledge in the field, especially through joint research with other European countries.

To date, indicators for knowledge transmission and application[3], biotechnology commercialisation[4] or market conditions[5] do not record any achievements for Malta. The absence of data on biotech companies is caused by absence of comparable official biotechnology statistics, based on a common definition, for European countries. The only comparative data on biotech firms in Europe is provided by Ernst & Young reports which do not cover Malta. However, a Maltese Biotechnology Foresight project identified six small biotechnology firms in Malta in 2003 (Galea and Felice, 2003); subsequently there were press reports of the activities of a seventh firm (Anon, 2005a).

[3] Measured by biotech patents and biotech start-up firms per million capita (pMC)
[4] Measured by number of biotechnology companies pMC (Ernst & Young data), biotech Initial Public Offerings pMC and Venture Capital in € pC
[5] Measured by field trials and approved biomedicines

4. Conclusions

4.1 Introduction

The chapter contains tables that summarise information about Malta's funding of biotechnology, in terms of the types of policy instruments used, the policy goals addressed, the research applications areas funded and the activities that are stimulated.

4.2 Public funding of biotechnology through policy instruments

Table 0.1 Public funding of biotechnology through non-policy-directed and policy-directed instruments in the period 2002-2005 (in M EUR)

	2002	2003	2004	2005	Total
RESEARCH					
1. *Non-policy-directed*					
Public Research Institutions					
Response Mode	0	0	0	0	0
Total					
2a. *Policy-directed Generic*	0	0	0	0.2	0.2
2b. *Policy-directed Biotech-specific*	0	0	0	0	0
COMMERCIALISATION					
1a. *Policy-directed Generic*	0	0	0	0.05	0.05
1b. *Policy-directed Biotech-specific*	0	0	0	0	0
GRAND TOTALS	0	0	0	0.25	0.25

Source: BioPolis Research

4.3 Specific features of the instruments

Table 4.2 provides further informations about the organisations responsible for specific instruments, the recipients of grants, and the proportion of the grants provided by public authorities.

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

Instrument	Funding agency	Participants/Recipients			Financial contribution required	
		PRO's	SME's	LFs	Recipients	Other Public authorities
National						
Generic						
RTDI 1	Malta Council for S&T	√				
RTDI 2	Malta Council for S&T	√				
RTDI 3	Malta Council for S&T		√		√	
START^{plus}	Malta Enterprise		√		√	

Source: BioPolis Research

4.4 Policy goals

Table 4.3 shows the policy goals that are covered by directed instruments and funding by policy goal for the period 2002-2005. The majority of funding is allocated to achieving a high level of biotechnology research.

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

	Policy goals*								
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
National									
Generic									
RTDI 1	√								
RTDI 2	√								
RTDI 3	√	√							
START^{plus}							√		
Grand Total	0.22	0.02					0.008		
% of GrandTotal	88.7	8.1					3.2		

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

Source: BioPolis Research

4.5 Biotech research application areas

Table 4.4 shows the application areas of biotechnology funded by each policy instrument as far as this information was provided. Only four application areas are funded and basic biotechnology and health biotechnology research receive higher proportions of this funding than either plant or animal biotechnology.

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

	Biotech application areas							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
National								
Generic								
RTDI 1							0.028	
RTDI 2	0.043	0.043		0.043			0.043	
RTDI 3				0.04				
START^{plus}								
Total	0.043	0.043		0.083			0.071	

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

Source: BioPolis Research

4.6 Stimulation of biotech activities through the instruments

Table 4.5 shows the type of activities that were stimulated for the period 2002-2005 through the various policy-directed instruments. There are many activities that can be stimulated by policy instruments, mentioned below the table. Table 4.5 shows only the activities that were stimulated by Maltese policy instruments in the period.

Table 0.5 Coverage and funding of biotech activities in the period 2002-2005 through policy-directed instruments

	Biotech activities*						
	1	**2**	**6**	**8**	**13**	**14**	**17**
National							
Generic							
RTDI 1	√	√					
RTDI 2	√	√					
RTDI 3		√		√			√
START^{plus}			√		√	√	

*Many different types of activities are supported by biotech instruments:

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 and public research organisations
9 Set up research institute/centre of industrial interest
10 Technology transfer office
11 Science and technology park
12 Protection of IPR in public research organisations
13 Financial support for start-ups
14 Non-financial support for start-ups
15 Creation of incubators
16 Awareness of biotech by companies not yet active in it.
17 Grants for industrial research
18 Other incentives for business investment
19. Support for public discourseactivities

Source: BioPolis Research

5. Future Developments

In 2006, the National Strategic Plan for Research and Innovation 2007-2010 was published. It identifies health biotechnology as one of the main areas, focusing on human genetics, bio-informatics for the support of clinical trials including pharmacogenetic ones and bio-technology for transition of generic pharma. The MCST's RTDI programme was reformed into the Research and Innovation Programme and a call for proposals was issued in August 2006. The intention is to focus more funds towards Malta's needs.

Malta Enterprise plans to revise its START^{plus} programme after 31 December 2006. It has also applied to become the national contact point for the Eureka network and, if successful, plan to provide financial support local enterprises that participate in Eureka projects. The result of the application will be made known in July 2006.

Annex 1 List of tables

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Annex 2 List of figures and charts

Annex 3 List of contact persons

Professor Alex Felice, Laboratory of Molecular Genetics, University of Malta and Dept. of Pathology, St. Luke's Hospital
Michael Refalo, Malta Council for Science and Technology
Dr. Gordon Pace, Malta Council for Science and Technology
Ray Muscat, Malta Enterprise
Karl Herrera, Malta Enterprise

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Annex 5 Performance data

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	omments	ime 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	T 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	omments	ime 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	rowth 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	002
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[6]	005
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	996-2001

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

	Indicator	Chart	omments	ime periods
			US data for comparison	

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

Only data from the charts used in Chapter 3 of this report are presented.

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
Malta	11	14	24	0.4	0.4	0.4
USA	119802	135508	154402	264	276	292
	BT publications/pMC			Index EU25=100		
	94-96	98-00	02-04	94-96	98-00	02-04
EU25	218	285	319	100	100	100
Malta	28	35	60	12	12	19
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, 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
Malta	11	14	24	96	145	189
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
Malta	11%	10%	13%	101	77	97
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
Malta	13.09	7.80	213	107
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 3.2.1 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%
Malta	100%	0%	27%	0%	0%	0%	0%	73%
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%
Malta	100%	0%	82%	9%	0%	0%	0%	9%
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
Malta	11	0	3	0	0	0	0	8
USA	111686	7118	62274	5580	2230	296	459	33729

Source: BioPolisResearch
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
Malta	22	0	18	2	0	0	0	2
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%
Malta	0%	500%	100%	0%	0%	0%	-75%
USA	11%	35%	23%	83%	47%	58%	11%

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

Websites:

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

EC	**European Commission**
FP	Framework Programme
IPSE	Institute for the Promotion of Small Enterprise
MCST	Malta Council for Science and Technology
n.a.	not available
RTDI	Research, Technological Development and Innovation
SMEs	Small and medium-sized enterprises