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European Nanotechnology Gateway

Sixth Nanoforum Report:

European Nanotechnology Infrastructure and Networks

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European Nanotechnology Infrastructure and Networks

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Table of Contents

About Nanoforum

This European Union sponsored (under FP5) Thematic Network provides a comprehensive source of information on all areas of nanotechnology to the business, scientific and social communities. The main vehicle for the thematic network is the dedicated website www.nanoforum.org. Nanoforum encompasses partners from different disciplines, brings together existing national and regional networks, shares best practice on dissemination of national, EU-wide and Venture Capital funding to boost SME creation, provides a means for the EU to interface with networks, stimulates nanotechnology in underdeveloped countries, stimulates young scientists, publicises good research and forms a network of knowledge and expertise.

Nanoforum aims to provide a linking framework for all nanotechnology activity within the European Community. It serves as a central location, from which to gain access to and information about research programmes, technological developments, funding opportunities and future activities in nanotechnology within the community.

The Nanoforum consortium consists of:

The Institute of Nanotechnology (UK) http://www.nano.org.uk

VDI Technologiezentrum (Germany) http://www.vditz.de/

CEA-Leti (France) http://www-leti.cea.fr/uk/index-uk.htm

CMP Cientifica (Spain) http://www.cmp-cientifica.com/

MalschTechnoValuation (Netherlands) http://www.malsch.demon.nl/

FFG (Austria) http://www.ffg.at/

METU (Turkey) http://www.physics.metu.edu.tr/

Monte Carlo Group (Bulgaria) http://cluster.phys.uni-sofia.bg:8080/

Unipress (Poland) http://www.unipress.waw.pl/

NanoNed (Netherlands) http://www.stw.nl/nanoned/

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Other Nanoforum reports

The Nanoforum consortium has produced a number of reports on Nanotechnology in Europe, all of which are available for download from www.nanoforum.org

General Reports:

- 1st Nanoforum General Report: "**Nanotechnology helps solve the world's energy problems**", first edition published in July 2003, updated in December 2003 and April 2004.
- 2nd Nanoforum General Report: "**Nanotechnology in the Candidate Countries; Who's who and research priorities**", first edition published in July 2003, updated in November 2003.
- 3rd Nanoforum General Report: "**Nanotechnology and its implications for the health of the EU citizen**", first edition published in December 2003.
- 4th Nanoforum General Report: "**Benefits, Risks, Ethical, Legal and Social Aspects of Nanotechnology**", first edition published in June 2004.
- 5th Nanoforum General Report: "**European Nanotechnology Education Catalogue**", first edition published in March 2005.

Series socio-economic reports:

- "**VC Investment opportunities for small innovative companies**", April 2003.
- "**Socio-economic report on Nanotechnology and Smart Materials for Medical Devices**", December 2003.
- "**SME participation in European Research Programmes**", October 2004.

Series background studies to policy seminars:

- "**Nanotechnology in the Nordic Region**", July 2003.
- "**Nano-Scotland from a European perspective**", November 2003.

Others:

- "**Nanotechnology in the EU – Bioanalytical and Biodiagnostic Techniques**", September 2004.
- "**Outcome of the Open Consultation on the European Strategy for Nanotechnology**", December 2004.

Countries detailed in this report

Austria

Belgium

Bulgaria

Czech Republic

Denmark

Estonia

Finland

France

Germany

Greece

Hungary

Ireland

Israel

Italy

Latvia

Lithuania

Luxembourg

Netherlands

Norway

Poland

Portugal

Romania

Slovenia

Spain

Sweden

Switzerland

Turkey

United Kingdom

No nanotechnology infrastructure or networks were found in Croatia, Cyprus, Iceland, Liechtenstein, Malta, or Slovakia.

Summary

This report details the numbers of Nanotechnology and Nanoscience (N&N) infrastructure centres and networks within the EU and associated states. Names of centres and networks with website details and brief descriptions are included along with an introduction to N&N research and development (R&D) in each country. For summary charts, the following broad categories have been used: all technologies; nanomaterials; electronics and systems; fundamental research; nanobiotechnology; analytical and diagnostics; engineering and fabrication; energy. Centres and/or networks were found in all EU and associated states apart from Croatia, Cyprus, Iceland, Liechtenstein, Malta, and Slovakia.

Infrastructure for the purpose of this report is defined as centres which allow external users access to fabrication or analytical facilities, and provide technical support if required, for N&N R&D. Also included are well-equipped research centres for basic research, which are open for cooperations. A total of 241 such centres were identified over 28 different states. 16 centres are classified as major EU research infrastructure (with a further centre being built), which have large-scale facilities (clean rooms, comprehensive equipment), generally have support staff (both for R&D, and for technology transfer and training), and have multi-million (plus) annual budgets. Most of the other centres offer facilities for a number of R&D sectors, however nanomaterials, and electronics and systems represent the most common themes (87 and 68 centres respectively).

A total of 144 networks, which offer support for collaboration and information exchange between members, were identified across 23 EU and associated states. 80 of these are national networks with the remaining 64 involved in international cooperation. 38 networks support all N&N activities, and a further 40 specialize in nanomaterials. There is variation in the distribution of disciplines covered by international and national networks, with over a third of national networks supporting all disciplines (while international networks are more specialized). Of the national networks most (22) are coordinated from Germany, with 9 from the UK, and 4 from each of France, the Netherlands, and Poland.

This report is accompanied by an appendix which can be downloaded from the Nanoforum website and which contains further details on each infrastructure and network. For further information on other European organizations, the reader is directed to the "Institutions" or "Organizations" section of the Nanoforum website.

Introduction and Purpose of Report

Nanotechnology is the manipulation or self-assembly of individual atoms, molecules, or molecular clusters into structures to create materials and devices with new or vastly different properties. This can be achieved by reducing the size of the smallest structures to the nanoscale (e.g. photonics applications in nanoelectronics and nanoengineering) or by manipulating individual atoms and molecules into nanostructures, which more closely resembles chemistry or biology.

The definition of nanotechnology is based on the prefix "nano", which is from the Greek word meaning "dwarf". In more technical terms, the word "nano" means 10^{-9}, or one billionth of something. To illustrate this, a virus is approximately 100 nanometres (nm) in size.

Nanotechnology opens a completely new world of opportunities and solutions in all kinds of areas. An example for daily use is copying the water and dirt-repelling effect of leafs of the Lotus flower, and to use it for applications like newly developed bathroom tiles and surfaces, windows and paints. Apart from the field of diagnostics and analytics, nanotechnology is already appearing in the textile industry, the energy sector, electronics and automotive industry, to name just a few.

Ensuring that scientists and industrialists have access to information and facilities is central to European R&D success in nanotechnologies. This report provides this by listing and describing for the first time in one place, the main European infrastructures and networks for nanoscience and nanotechnology (N&N).

Infrastructure

For the purpose of this report infrastructure is defined as centres which allow external users access to fabrication or analytical facilities. These may also provide technical support if required, for N&N research and development (R&D). Such centres are multi-user facilities, and not single laboratories restricted to a narrow research field. Also included are well-equipped research centres for basic research, which are open for cooperations.

Infrastructure is organized by country (with name of centre, URL and main areas of activity). Further information on each centre can be found in the appendix to this report (available for download from the Nanoforum website) or by consulting the detailed entries available on the Nanoforum website under "Institutions".

Networks

The list of networks includes regional, national and international networks. Such networks offer support for collaboration and information exchange between members, and include both national and EU-funded projects.

Infrastructure

This report presents a review of what N&N facilities are available in Europe using the Nanoforum database, internet searches and through contacting various researchers and institute administrators throughout the EU and associated states. A total of 241 centres have been identified within the EU and associated states that have fabrication and analytical facilities for N&N R&D, and make these facilities available to external users. These range in size and scope from major EU centres of competence (with large scale facilities, several hundred members of staff, and annual budgets of several millions to tens of millions of euros) to smaller facilities located in Institutes or Universities. Sixteen major facilities have been identified (with a further one being built) and these are listed in Table 1 (by order of country). All other facilities are described in the individual country chapters. A more detailed description of each can be found in the appendix to this report, which is available as a separate downloadable document from the Nanoforum website.[1]

The main activities of each infrastructure centre can be described in the following broad categories:

- Nanomaterials
- Electronics and Systems
- Fundamental research (chemistry and physics)
- Analytical and Diagnostics
- Engineering and Fabrication
- Nanobiotechnology
- Energy

Facilities offering R&D infrastructure for nanomaterials, electronics and systems are the most common (88 and 68 centres respectively), with fundamental research (primarily physics and chemistry) being a major activity of 35 centres. Analytical and diagnostic facilities are offered in 39 centres, and engineering and fabrication in 39. In contrast nanobiotechnology facilities are only available in 26 centres, and only 7 operate in the field of energy. While many centres had strengths in more than one sector, 19 centres covered multiple or all sectors. Figure 1 summarizes this data.

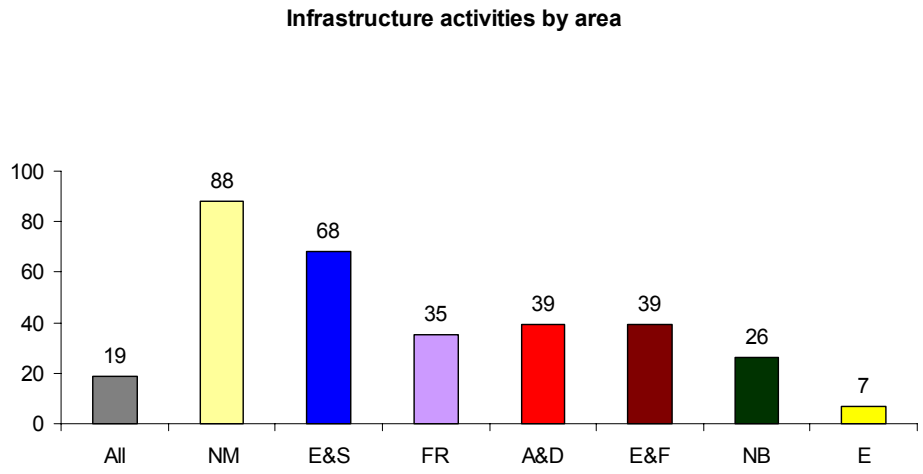

Figure 1. N&N infrastructure in the EU and associated states (by area): **NM** nanomaterials, **E&S** electronics and systems, **FR** fundamental research, **A&D** analytical and diagnostics, **E&F** engineering and fabrication, **NB** nanobiotechnology, **E** energy.

1 http://www.nanoforum.org/index.php?struktur=5&modul=loadin&folder=125&code=1595af6435015c77a7149e92a551338e&userid=1363830&wb=125251&

This analysis fits well with the impression that respondents to the Nanoforum survey (see below) had of N&N infrastructure in Europe. In free-form replies, coherent infrastructures for nanomaterials, electronics, fabrication, analysis, and basic research were mentioned most often, while infrastructures for nanobiotechnology and health R&D were cited most often as lacking.

Interestingly there were different strengths between member states. For example, France shows a focus on electronics and nanobiotechnology, while Germany has a broad spectrum of infrastructure covering all areas. Greece supports several different R&D areas (largely based in the National Centre "Demokritos") and also includes some infrastructure for energy. The Netherlands has a number of fabrication facilities and centres for electronics and nanobiotechnology. Poland has a strong base in nanomaterials, electronics, fabrication and analysis. This is also true for the UK, while Switzerland has a number of fabrication and analytical centres, particularly for electronics and systems.

It can be seen from this data that Europe does indeed have a large number of centres for N&N infrastructure. While there may be limited facilities in certain countries and fewer large scale centres in specific technology areas (e.g. nanobiotechnology, energy), much could be achieved through better publicity of existing infrastructure and providing further financial support for access.

Community opinion on EU N&N Infrastructure

Last year Nanoforum hosted an online survey to measure community opinion on a number of N&N issues. This attracted a total of 749 respondents and the outcomes were published online at Nanoforum in December 2004.[2] One section of the survey was devoted to the issue of infrastructure- needs, levels, and specific sectors. When considering existing infrastructure and comparing it with the rest of the world, only 4% thought that Europe competed well. A further 46% thought that European infrastructure was internationally competitive in some disciplines and/or countries. 21% thought that Europe was worse and 29% did not know. Thus there is clearly differing opinion and awareness across Europe as to what infrastructure exists. When considering possible new infrastructure, there is a more definite opinion with 56% of respondents wanting this at EU level and a further 33% at national, regional or local level (only 11% did not know). The need for a critical mass of researchers was identified as the key issue by 90% of respondents.

EU Strategies

The EU has recognized the need to improve the visibility of existing infrastructure and to identify what is required in terms of increasing and widening access to these, and determining any requirements for new centres. A recent survey by the European Commission invited responses from research institutes across Europe to describe their facilities (equipment and staff); funding level, source and duration; numbers of users (internal and external); whether these users were collaborators or paying directly for services; the long-term future of the centre; and the perception of the centre's importance for European R&D. The survey received the following replies: 575 (for existing infrastructure) and 148 (for planned infrastructure in the next two years). Of the existing infrastructures 45 have activities related to N&N R&D. The details of this survey which covered all science and technology sectors can be found at the Cordis website.[3]

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[2] "Outcome of the Open Consultation on the European Strategy for Nanotechnology". To download this report please visit the publications section on the Nanoforum website or follow this link: http://www.nanoforum.org/index.php?moreaction=showcompletemodul&action=showcomplete&imodul=showpub&scid=277&code=329e6581efbc90bd92a1f22c4ba2103d&userid=1216608&wb=152039&

[3] http://www.cordis.lu/infrastructures/survey_factsheets.htm

The European Strategy Forum on Research Infrastructures (ESFRI) at the EC has recently published a document entitled "Towards new Research Infrastructures for Europe: the ESFRI *List of Opportunities*"[4] in which the authors outline "concrete examples of new, large-scale Research Infrastructures which the scientific community in Europe will need in the coming decade." Included in this is the proposed project "Pan-European Research Infrastructure for Nano-Structures" (PRINS) which aims to enhance European research in the area of electronics through improved coordination of European R&D and augmentation of funding and facilities amongst leading European infrastructure centres for electronics. The goal of the project is to enable individual laboratories to participate in coordinated activities at research facilities which would normally be outwith their budget. The PRINS proposal complements the aims of the newly founded European Technology Platform on nanoelectronics (ENIAC).[5]

[4] ftp://ftp.cordis.lu/pub/era/docs/esfri_list_opportunities_290305.pdf
[5] http://www.cordis.lu/ist/eniac/

Table 1. Major EU Infrastructures

Centre	Description of facilities	Staff numbers	Investment/ Budget	Weblink
IMEC (Leuven, Belgium)	World-leading independent research centre in nanoelectronics and nanotechnology, focusing on the next generations of chips and systems, and on the enabling technologies for ambient intelligence. 6,710 m^2 computer room and utilities 24,400 m^2 offices and supporting laboratory space 810 m^2 cafeteria and training facilities cleanroom I 5,200 m^2 total area 1,750 m^2 class 1 silicon pilot line (200mm) cleanroom II (Nanoelectronics Lab - 300mm) 3,200 m^2 total ballroom area 2,200 m^2 vibration controlled waffle table clean subfab & utility fab	1300 (+)	159 M€ in 2004	http://www.imec.be
Minatec (Grenoble, France)	The Minatec gathers Research, Industry and Education in the same placeto foster nanotechnology development. **Research platform** 10,000 sq m of clean rooms in existing CEA-Leti facilities; advanced components: 14,000 sq m of new premises for characterization, photonics and design; Smart devices: 5,000 sq m with MINATEC IDEAs Laboratory, **Industrial development complex** 10,000 sq m of premises and clean rooms for startups in the early stage, joint laboratories and R&D teams from firms involved in Minatec technology transfers; 1,500 jobs in industry are planned to accompany this activity. **Training premises** Initial training: 9,000 sq m of buildings for 1,000 student engineers and 120 faculty members from INP Grenoble **The Maison des Micro et Nano Technologies** (resource center, social and coordination center) 5,000 m² of offices, with meeting rooms, a library and a 300-seat auditorium	4500	200 M€ initial investment	http://www.minatec.com/minatec_uk/index.htm

Centre	Description of facilities	Staff numbers	Investment/ Budget	Weblink
CEA Leti (Grenoble, France) Member of the large clean room facilities network.	One of the largest applied research laboratories in Micro and Nanotechnologies in Europe, it focuses on microelectronics and microsystems on silicon, systems for biology and health, and optoelectronic and components, 10,000 m² of clean room in Grenoble In 2004 opening of 1,500 m² more clean room space for Nanotech 300 and installation of 12 new process tools, taking the number of 300mm instrument up to20. Equipement for characterization, advanced metrology, production of high-K/metal gate transistor module… Total value of equipment amounts to more than 210 million euros, with an annual investment of 40 million euros on new machinesin 2004. Access to other CEA resources, namely nuclear reactors, accelerators, analysis and characterization resources	868 CEA personnel, 558 others	157 M€ in 2004	http://www-leti.cea.fr
MINAS (Toulouse, France) Member of the large clean room facilities network.	Micro and Nanosystems pole (**MINAS**) which is part of the CNRS Laboratoire d'Analyse et d'Architecture des Systèmes **(LAAS)** is a large clean room facility with competences in Micro and Nano electronics. 500m² of clean room (an increase of 1500m² is planned for 2006). It has equipment for photolithography, characterisation, plasma-etching, assembly…	450	2.7 M€ in 2003	http://www.laas.fr
LPN (Marcoussis, France) Member of the large clean room facilities network.	The LPN (Laboratory for Photonics and Nanostructures) is a fully-owned unit of the CNRS with competence in Nanostructure. The LPN has 1000 m² of clean room, 300m² devoted to Epitaxy (III-V materials) and equipment for Epitaxy, optical lithography, plasma-etching, characterisation, electronic lithography, nano-imprint…			http://www.lpn.cnrs.fr/fr/
IEF Member of the large clean room facilities network.	The Institute of Fundamental Electronics is a joint research unit, CNRS / the University Paris-Sud XI, with competences in Nanostructure. A Micro and Nanotechnology Center named CTU IEF-MINERVE with 560 m2 of clean room area (class 100 to 10 000), and 440 m2 of characterization rooms.	200	13.5M€ (4/5 for Micro and nano technology)	http://www.u-psud.fr/IEF/iefuk.nsf/welcomeUK.html!OpenPage
IEMN (Villeneuve d'Ascq, France) Member of the large clean room facilities network.	**IEMN (**Northern Electronic and Microelectronic Institute) has 1600m² of clean room and 20 M€ of equipment (Microelectronic technology and characterization facilities).	314	15 M€ in 2003 (80%for Micro and nano technology)	http://www.iemn.univ-lille1.fr
CFN (DFG-Centre for Functional Nanostructures) (Karlsruhe, Germany)	Interdisciplinary research centre dedicated to fundamental and applied research in nanotechnology set up in 2001, it has 35 groups working on more than 60 different projects. 5 main themes: Nano-Photonics, Nano-Electronics, Molecular Nanostructures, Nanostructured Materials, and Nano-Biology.	200	20 M€ in 2001, with further 20 M€ for 2005 to 2009.	http://www.cfn.uni-karlsruhe.de

Centre	Description of facilities	Staff numbers	Investment/ Budget	Weblink
CNT (Fraunhofer Centre for Nanoelectronic Technology) (Dresden, Germany)	Joint project of the Fraunhofer-Gesellschaft, the industrial partners Infineon Technologies AG and Advanced Micro Devices (AMD), the German Ministry of Education and Research (BMBF), and the Free State of Saxony. The centre will have a total clean room area of up to 800 m² and will use infrastructure provided by Infineon AG immediately adjacent to its chip plant.	100	80 M€ regional and federal funding for equipment with a further 170 M€ from industrial partners for projects. Up to 700 M€ in total.	http://www.fraunhofer.de/fhg/EN/press/pi/2004/11/MediendienstMediendienst112004Thema7.jsp
Institute for New Materials (INM) (Saarbruecken) Germany)	12,500 m² of floor space, offering: nanoceramic technologies, material production, coating technologies, micro and nanostructuring, pilot production plants, technological service packets.	200	15.3 M€ in 2001	http://www.inm-gmbh.de/htdocs/home/frame_en.htm
CRANN (Dublin, Ireland)	Ireland's first purpose-built Research Institute (6000 m^2 building) with a mission to advance the frontiers of nanoscience. Four floors of the building are devoted to purpose-built nanoscience laboratories. Supports projects and investigations from its own budget. Projects are substantial research efforts lasting two years or longer, while investigations are exploratory in nature, aimed at developing a concept in a 6-12 month timeframe. **Opens 2006**.	**Opens 2006**	29 M€ initial investment	http://www.tcd.ie/Physics/Crann/
Tyndall (Cork, Ireland)	Central Fabrication Facility / National Nanofabrication Facility for MEMS, nanosystems, semiconductors, plating technology, EBL, FIB.	200+	Valued at over 120 M€	http://www.tyndall.ie/
CERN (Genève, Switzerland)	The European Organization for Nuclear Research, the world's largest particle physics centre. Founded in 1954, the laboratory was one of Europe's first joint ventures and now includes 20 Member States.			http://public.web.cern.ch/Public/Welcome.html
CSEM (Neuchâtel, Switzerland)	Active in micro/nanotechnology, microelectronics, systems engineering, and ICT. total clean area of 600 m^2 200 m^2 of chemistry laboratories 100 m^2 for characterization	275	34 M€ in 2003	http://www.csem.ch/homepage/

Centre	Description of facilities	Staff numbers	Investment/ Budget	Weblink
Rutherford Appleton Laboratory, CCLRC (Chilton, UK)	The Central Microstructure Facility (CMF) provides state-of-the-art microfabrication services and R&D facilities, based on electron-beam and optical lithography, deposition and plasma dry etching systems, nanostructure metrology using a field emission based SEM, and semiconductor equipment, to universities and industry. Silicon surface microengineering and powder blasting. 1200m^2 of class 10 and class 300 clean rooms	1200	£147 M resource, £20 M capital investment in 2005-06 through all CCLRC facilities. Additional £248.7 M from the Large Facilities Capital Fund in 2004.	http://www.cmf.rl.ac.uk/index.html
Daresbury Laboratory, CCLRC (Daresbury, UK)	Services include: Daresbury Analytical Research and Technology Service (DARTS) - Structure and materials characterisation using intense X-ray radiation Medium Energy Ion Scattering Facility (MEIS) - Investigating the surface structure and properties of crystalline materials National Centre for Electron Spectroscopy and Surface Analysis (NCESS) - Solving problems in materials science, surface science and engineering Synchrotron Radiation (SRS)	550		http://www.cclrc.ac.uk/Activity/DL
London Centre for Nanotechnology (London, UK)	200 m^2 clean room, full range of nanocharacterisation and nanofabrication facilities. Equipment includes: FIB, fully equipped clean room, UHV/high field STM, SEM, MBE, PLD, suite of AFM instruments.			http://www.london-nano.ucl.ac.uk/lcn/index2.htm

The following pages summarize the details of each centre (by country). For full details of each centre's activities, the reader is directed to the appendix to this report which is available for download from the www.nanoforum.org, or to the individual infrastructure entries which can be accessed at the "Institutions" section.[6]

[6] The Institutions section of the Nanoforum website is accessible from the home page. Alternatively click on the link below:
http://www.nanoforum.org/index.php?moreaction=showcompletemodul&scc=&imodul=inst&code=c61fbef63df5ff317aecdc3670094472&userid=1191692&wb=161422&

Austria

Population: 8.1 million (UN, 2005)

Capital: Vienna

GDP: $255.9 billion (2004 est.) **GDP per capita**: $31,300 (2004 est.)

Universities: 9

Introduction

In Austria the work programme of the Federal government provides for a number of far-reaching reforms for the areas of science, research and technology. Three ministries are responsible for providing funding for R&D: the Ministry for Education, Science and Culture (basic research, coordination of EU research and international research cooperation in Austria), the Ministry of Transport, Innovation and Technology (applied research, research funds, technology and innovation) and the Ministry for Economic Affairs and Labour (applied research and innovation for industry). The Austrian Science fund provides grants for basic research while the Austrian Industrial Research Promotion Fund provides finances for applied R&D projects. Austrian expenditure on R&D is approximately 1.9% of GDP. In July 2000, the Austrian government passed a 'Declaration of the Federal Government on Current Issues in Research and Technology Policy', with the major objective of increasing GERD to 2.5% by the year 2005. In September 2000 the Austrian government set up an independent "Council for Research and Technology Development" to advise it on RTD policies and implementation strategies.

The Austrian Council has launched a number of initiatives to develop; strengthen and promote emerging technology fields for the future including nanotechnologies. The Austrian NANO Initiative[7] is a multi-annual public funding programme for nanoscale sciences and nanotechnology, with an annual public budget of 15 m euros. Part of this initiative is a NANO forum which provides a platform for publicising and communicating Austrian activities within N&N and promoting new collaborations. In 2004, five outstanding clusters consisting of 39 projects were selected after an international evaluation procedure. 11 Universities, 12 companies and 2 Centres of Competence are leading the clusters.

European integration has contributed significantly to international groups using Austria's advantage as a location. Currently, about 21 percent of research expenditure in Austria is financed from abroad, in particular by European enterprises, which have chosen Austria as their research location.

We have identified three infrastructure centres, one international and three national networks in Austria.

Name of centre	Main areas of activity	Website
NanoScience and Technology Center Linz	Multidisciplinary- Nanomaterials, Nanostructuring, Nanoanalytics and simulation, Nanoapplications	http://www.nanoscience.at/home_en.html
University of Agricultural Sciences Center for Ultrastructure Research and Ludwig Boltzmann Institute of Molecular Nanotechnology	Fabrication and analysis of nanostructures and materials	www.biotec.boku.ac.at/332.html?&L=1
Vienna University of Technology Institute of Solid State Electronics	Supramolecular chemistry involving: Nanoglycobiology, Nano-Biotechnology, Nanostructures.	www.fke.tuwien.ac.at

[7] http://www.asaspace.at/index2.htm

Belgium

Population: 10.3 million (UN, 2005)

Capital: Brussels

GDP: $316.2 billion (2004 est.) **GDP per capita**: $30,600 (2004 est.)

Universities: 15

Introduction

Belgium has two language communities, French and Dutch. Of all research funding sources, only the Interuniversity Attraction Poles programme (IAP) aims at financing teams of excellence in fundamental research in the scope of collaboration between research centres in the two communities. All other funding sources are split. (Source: personal email of Prof. Y. Bruynseraede 7 Feb. 2005). These teams work as part of a network in order to increase their joint contribution to general scientific advances and, where applicable, to international scientific networks. Since 1987 the IAP progamme has been implemented in five year phases. The IAP phase-V (2002-2006) contains 36 networks implicating 261 research teams and spans a wide variety of research fields in the life sciences, exact and applied sciences and the human sciences. The impact of the IAP on basic research is considerable. The programme represents some 300 researchers (full-time-equivalents) paid with IAP funds and over 2 000 publications each year within the programme as a whole. IAP is a programme of the Belgian Science Policy Office. The Office's interventions cover a very broad area. It manages an annual budget of about 533 million euro (www.belspo.be).

At the ministry of the Walloon region (http://mrw.wallonie.be/mrw/), the department of research and energy technologies has a series of mobility programmes, among which the Nanotechnology program BE-NANO (see Networks section).

IWT, the Institute for the Promotion of Innovation by Science and Technology in Flanders (http://www.iwt.be/), funds applied research and technological development, via public R&D activities in generic programmes. For this purpose IWT has different instruments available such as: SBO (Strategic Basic Research); industrial basic research; Sustainable Technological Development in the format of a bonus funding. IWT has BE-NANOTECH3 among its programmes (see Networks section).

In comparison with other European countries, Belgium occupies an intermediate position in terms of domestic spending on R&D. In relation to the objectives set out by the Barcelona Council meeting (i.e. an objective of the High Level Group 3% of GDP for Research), it had already achieved one of them because in 1999 two-thirds of GERD was financed by companies. Moreover, GERD currently represents 2% of GDP, placing Belgium slightly above the European average. Given that the EU has set precise objectives in order to catch up with the United States, it is interesting to note that the financing structure for R&D in Belgium is similar to that found in the United States with a dominant role played by business in terms of a source of financing and implementation. In Belgium, the limited funding provided by the state is partially offset by foreign capital. Although foreign funding plays a significant role in Europe, it is virtually non-existent in America. Nevertheless, it is important to bear in mind that, in the European case, the majority of this financing comes from intra-European flows, which is not taken into account in the United States (source: Belgian Science Policy Office).

We have identified sixteen networks which are headquartered in Belgium. Thirteen of these are international, three are national or regional. The focus of one of these networks is on education, one on physics; three on physics and chemistry; one on electronics and the others on all or many disciplines.

We have identified nine research centres which make available infrastructure for nanotechnology research to outside users. Two are large public research centres in Flanders: IMEC and VITO; two are industrial sectoral research centres; the others are laboratories in five universities in Wallonia, the Free University of Brussels, the Catholic University of Louvain; the University of Liege; the University of Mons-Hainaut and the University Foundation of Our Lady of the Peace.

Name of centre	Main areas of activity	Website
Centexbel	Textile R&D and services.	http://www.centexbel.be/Eng/homepage.htm
FUNDP - LISE	Experimental, condensed, matter physics and chemistry. Focus on synthesis and analysis of nanomaterials.	http://www.fundp.ac.be/lise/welcome.html
IMEC	World leader in nanoelectronics and nanotechnology. Many different facilities offering a bridge between academic and industrial research.	http://www.imec.be
UCL (Université Catholique de Louvain), CERMIN	Multidisciplinary including education and training.	http://www.cermin.ucl.ac.be/
ULB (Université Libre de Bruxelles)	Contains 5 different centres which have N&N facilities open to external users : Polymer Chemistry (CHIMPOLY), Chemical Physics of Materials (CPM), Polymer Physics Lab (POLPHY), Industrial Chemistry, Materials Science & Electro	http://www.ulb.ac.be/facs/sciences/departements.html
ULg (Université de Liege)-CEIB	Nanobiomaterials- e.g. nanoparticles for drug delivery and diagnostics	http://www.ulg.ac.be/ceib/
University of Mons-Hainaut, SMPC	Synthesis, characterization, transformation, processing, and applications of polymeric and composite (nano)materials.	http://morris.umh.ac.be/smpc/
VITO Materials Research	Plasma technology, laser applications, ceramic materials and powder metallurgy, primary and secondary raw materials, materials consultancy, measurements and testing, energy.	http://www.vito.be
WTCM, Scientific Technical Centre for the Metal Industry	Metal and synthetic materials processing, mechanics and mechatronics, electrotechnology and ICT. Technology advice and R&D.	www.wtcm.be

Bulgaria

Population: 7.8 million (UN, 2005)

Capital: Sofia

GDP: $61.63 billion (2004 est.) **GDP per capita**: $8,200 (2004 est.)

Universities: 26

Introduction

Bulgaria is preparing for accession to the European Union in 2007. Bulgaria has recognized the need for new policies in science, technology and innovation and has initiated programmes to:

- increase industrial competitiveness
- support technology transfer
- promote entrepreneurship
- work towards a knowledge-based economy (through the development of new technologies and innovations)

Financially this has meant the establishment of a "National Innovation Fund" and a "Scientific Research and Development Fund" to support R&D. The Bulgarian government is also "streamlining the science and technology sectors" and creating both science and technology parks and competence centres. Among the government priorities are Communications and High Technologies.

The Bulgarian Academy of Science (BAS) has played a critical role in the reorganization of scientific research following the collapse of the communist state. In the late 1990's it established the National Centre on Nanotechnology (NCNT) in Sofia, a national centre for excellence in nanoscience and nanotechnology for both the academic community and manufacturing industries. The main focus at the moment is on nanomaterials and electronics. The NCNT is based at the Central Laboratory of Electrochemical Power Sources (CLEPS) but includes a consortium of Bulgarian research centres (and therefore also functions as a national network). The other major infrastructure centre in Bulgaria is the University of Sofia (Monte Carlo Group, and Group of Nanoparticle Science and Technology).

Name of centre	Main areas of activity	Website
National Centre on Nanotechnology	Multidisciplinary including: nanoparticles and structures, ultrathin films and multilayer nanosystems, molecular and atomic design, nanometrology and applications.	http://www.bas.bg/nano/
University of Sofia	Nanomaterials and quantum physics	http://cluster.phys.uni-sofia.bg http://www.inorg.chem.uni-sofia.bg/labs/lnst/lnst.html

Czech Republic

Population: 10.2 million (UN, 2005)

Capital: Prague

GDP: $172.2 billion (2004 est.) **GDP per capita**: $16,800 (2004 est.)

Universities: 14

Introduction

Following its accession to the EU Czech R&D policy changed towards a system of grants and public tenders. The Ministry for Education, Youth and Sports is the ministry covering research, but other departments also fund research. A special Deputy Prime minister is responsible for R&D. The Research and Development Council of the government is another key player shaping the R&D system. There are five national grant agencies, which fund research. Traditionally, the institutes of the Academy of Sciences of the Czech Republic (ASCR) carry out the research, and the universities are more responsible for higher education. As part of the change, university departments are now more involved in research. (Source: www.czechrtd.info - this web site provides a "gateway" to the Czech RTD landscape, providing useful information and relevant links.)

In an attempt to effectively reorganise financing of oriented/targeted research (as opposed to fundamental research) the Czech Government adopted a strategic policy document, National Research and Development Policy, on the basis of which the first technology Foresight exercise was launched in 2000. This recommended including nanotechnologies and nanomaterials research in the emerging technologies sub-programme of the thematic programme on "Competitiveness and Sustainable Development".

The outcome saw nanotechnologies ranked as important for medicine and health, advanced materials, instruments and equipment (particularly for the creation and analysis of micro- and nanostructures), process technologies. Seven of the fourteen thematic panels identified strategic key technologies through which the Czech Republic might establish itself in the international market.[8] This included "the preparation and characterisation of new substances and gene therapy methods resulting from gene engineering methods"; "nanotechnologies aimed at controlling material structure (both organic and inorganic) in nanodimensions and utilising completely new phenomena in electronics, chemistry, medicine and pharmaceutics, power engineering, mechanical engineering, etc"; "nanotechnologies - synthesis of thin organic layers (material protection, medicinal compatibility, membranes, composites), preparation of new skeletons of polymers (supramolecular chemistry)"

According to Dr. Jitka Kubatova of the Technology Centre, basic nanoscience research in the Czech Republic focuses on: "nanoparticles, nanocrystals, nano coatings, nanolayers, nanostructures, quantum dots, biomaterials, nanocomposites and nanodiagnostics." Applied research and applications are in: "micro and opto electronics, holography, electron microscopy, electron lithography, biomaterials, sensors and coatings." (Presentation at European Research conference, Brussels, 11 November 2002, http://www.airi.it/minatech/atti/brus021111/progbru.htm)

The National Research and Development Policy document 2004-2008 was published in March 2004. (http://www.msmt.cz/_DOMEK/default.asp?CAI=2974) The subprogramme on New Materials, Processes and Technologies includes "nanostructures and components for information and communication technologies" and "methods and apparatuses for nanodiagnostics". The document also outlines a policy for research infrastructure in accordance with the Action Plan for Europe.

[8] Publication: "Proposal of the National Research Programme" http://www.foresight.cz/dokums/BROZURA-NPV-ANGL-KOMPLET_9.pdf

We have found ten centres which make available research infrastructure for nanotechnology to outside users and four networks headquartered in the Czech Republic: three national and one European. One network specialises in physics; one in electronics engineering and materials science; one in physics and chemistry; one in physics, electronics engineering and chemistry and one integrates all disciplines.

Name of centre	**Main areas of activity**	**Website**
Brno University of Technology, Institute of Materials Science, Faculty of Mechanical Engineering	Materials (metallic and ceramics)	http://ime.fme.vutbr.cz/
Charles University, Faculty of Science	Various facilities in different departments offering low temp experiments (http://www.fzu.cz/departments/lowtemp/); analytical techniques (http://www.natur.cuni.cz/~anorchem/about_us.php); self-assembly and nanobio (http://www.natur.cuni.cz/pmc/).	http://www.natur.cuni.cz/english_version/index.php
Czech Metrological Institute	National measurements institute, with equipment available for users.	www.cmi.cz
Institute for Macromolecular Chemistry, Academy of Sciences of the Czech Republic	Specialises in inorganic-organic nanocomposite materials preparation and characterization; nanoelectronics; and nanobiotechnology.	http://www.imc.cas.cz/en/imc/index.html
Institute of Chemical Technology, Department of Solid State Engineering in the Faculty of Chemical Technology	Nanomaterials, nanoelectronics, thin films.	http://www.vscht.cz/main/english/
Institute of Inorganic Chemistry AS CR	Nanomaterials and nanocomposites (eg photocatalysts for environmental applications, lamellar pigments based on mica coated with metal oxide layers)	http://www.iic.cas.cz/
Institute of Physics, Faculty of Mechanical Engineering, CTU Prague	Deposition and analysis of surface coatings.	http://www.cvut.cz/en/
ISI Brno	Nuclear Magnetic Resonance, Electron Microscopy and Coherent Optics. Focusing on optical trapping of nanoparticles, nanometrology through interferometry; SEM, EBL, and using nanocomposite coatings as lubricants.	http://www.isibrno.cz/
MOVPE laboratory	Electronics and optoelectronics.	http://www.fzu.cz/departments/semiconductors/movpe/index.php
University of West Bohemia, Faculty of Mechanical Engineering	Thin films and surface engineering.	http://rko.zcu.cz/leon/detail_depart.php3?id=31

Denmark

Population: 5.4 million (2005 est)

Capital: Copenhagen

GDP: $174.4 billion (2004 est.) **GDP per capita**: $32,200 (2004 est.)

Introduction

Today, Denmark offers a highly modern and innovative research environment. The expenditures on research are comparatively high and well above the European average as is the case in most Scandinavian Countries. GERD accounted for 2.60 % of the GDP in 2003.

Danish research is regulated by the Danish Research Agency, an independent institution under the Ministry of Science, Technology and Innovation. In Denmark, public research funds are allocated by either a fixed core funding provided to universities and government research institutions or by external funding mainly distributed by so called "Research Councils". In 2004, the Danish Research Agency was reorganized; today there are three research councils, the council for strategic research, the council for independent research and the Danish research Coordination Committee. The councils have been formed under the administration of the Danish Research Agency.

Similar to other countries, hitech research centres have sprouted in the last couple of years near university sites. The Nano-Science Centre was founded in 2001 at the University of Copenhagen. It was formed as a joint effort of the Niels Bohr Institute and the department of chemistry and offers the whole range of disciplines in nanotechnology.

The research collaboration "iNano" is maintained by Aalborg University and the University of Aarhus, where it was founded in 2002. iNano has a strong focus on scanning probe microscopy (SPM).

The nanotechnological research at the Technical University of Denmark (DTU) in Lyngby has been concentrated in a fairly large collaboration called "Nano@DTU". Furthermore, DTU houses "Danchip", the national cleanroom facility. In 2004, "NanoBic", a center for NanoBio at the Odense University, came into existence.

Besides these university related research activities, Denmark is planning to create a national network for nanotechnology, called NaNet.

We have identified twelve infrastructure centres and one international network (specializing in nanobio) in this report.

Name of centre	Main areas of activity	Website
Center for Interdisciplinary Studies of Molecular Interactions (CISMI)	Nanomaterials- polymers, self-assembly, thin films. Synthesis and analysis.	http://www.cismi.dk
Center for Individual Nanoparticle Functionality (CINF)	Fundamental studies of nanoparticles.	http://www.cinf.dtu.dk
Danchip	National facility for cleanroom processing of micro- and nanotechnology	www.danchip.dtu.dk
Danish Technological Institute, Microtechnology Center	Surface analysis and laser technologies.	http://microtechnology.teknologisk.dk
Danish Fundamental Metrology (DFM)	Danish national institute for measurements.	http://www.dfm.dtu.dk

Name of centre	Main areas of activity	Website
iNANO	Interdisciplinary Nanoscience Centre funded by University of Aarhus and Aalborg University.	www.inano.dk
Interdisciplinary Research Center for Catalysis (ICAT)	Multidisciplinary with a focus on catalysis.	http://www.icat.dtu.dk
MIC, Department of Micro and Nanotechnology	MEMS, NEMS, and lithography techniques.	http://www.mic.dtu.dk/
NanoBiC: NanoBioCentrum	Nanobio centre with focus on membrane biophysics, bioinformatics, proteomic analysis, supramolecular materials.	http://www.sdu.dk/Nat/nanobic/index.php
Nano-Science Center	Multidisciplinary including fabrication and analytical facilities.	http://www.nano.ku.dk/
Research Center COM	Optoelectronics and nanophotonics.	http://www.com.dtu.dk/
Risø National Laboratory	Nanomaterial R&D and analysis (including the Danish Polymer Centre).	http://www.risoe.dk/

Estonia

Population: 1,4 million (Eurostat, 2002)

Capital: Tallinn

GDP: € 6.73 billion (2002) **GDP per capita**: ca. € 4940 (2002)

Universities: 6

Introduction

In Estonia, the GERD reached 0.77% of GDP in 2003 with annual growth rates of more than 10% from 1998 to 2003. The Estonian government has prepared a strategy for research and development named "Knowledge-based Estonia" (2002-2006). It aims at increasing the expenditures for research, development and innovation (RDI) to 1.5% of GDP in 2006. On its basis annual RDI action plans are compiled which define specific programmes and measures for promoting RDI according to the strategy objectives. The key areas for Estonian RDI are the following: user-friendly IT and development of the information society, biomedicine and materials' technology. In the latter nanotechnologies are explicitly mentioned as a field, where Estonian researchers have global competitiveness. Enterprise Estonia (www.eas.ee) is the main governmental funding body for applied and industrial research and development in Estonia. The Ministry of Education and Research (www.hm.ee) is the main funding body for basic and targeted research.

The focuses of Estonia's nano-related research are nanomaterials, nanotools (including nanoanalytics and nanometrology) and biotechnology. Related to nanotechnology is the national Gene Bank Project which collects data from the majority of the Estonian population. (Estonian Genome Foundation)

Nanotechnology centres in Estonia are located in two places. The most important one is the region around Tartu with Estonia's largest university and two technology parks: the Tartu Science park (see http://park.tartu.ee/eng/) and the Tartu Biotechnology park (see http://www.biopark.ee/en/front.html), providing support for the development and commercialization of research-based and high technology oriented companies and institutions in the region. Two research centres in the region, Estonian Biocentre and the Institute of Physics (www.fi.tartu.ee) of the Tartu University, have been selected as European Centres of Excellence under the European Commission's Fifth Framework Programme for R&D. The Tartu University Institute of Technology founded in 2001 aims at connecting research and development results with industry and business in general. It also performs most of the applied bio-related nanotechnology research at Tartu University. Applied nanotechnological research in materials science is mainly performed by the Estonian Nanotechnology Competence Center (see www.encc.ee) which was established in 2004 and currently links research interests of several companies with extensive intellectual and infrastructure resources of the Tartu University, especially of the Institute of Physics. The centre is mainly funded by the Ministry of Education and Research and partly funded by Ministry of Economy and Communication through its founding agency Enterprise of Estonia. The research is currently focussed on thin film and scanning probe technologies.

Several nanotechnology related research projects are active at the Institute of Materials Science and Physics (www.ttu.ee/?id=1860) and at the Centre of Materials Research of Tallinn University of Technology in the capital. The Institute of Materials Science and Physics is nominated as a European Union Centre of Excellence in PV Materials and devices. They are carring out research about complicated semiconductor materials for solar cells.

Furthermore, Estonian researchers are participating in a number of European FP5/FP6 and other projects and networks (e.g. ScanBalt, Nanotribo, MolSimu etc.) with close relation to nanotechnologies.

Future infrastructure for Nanotechnology R&D will most likely centre around the above-mentioned two sites. However, for the purpose of this report we have identified one centre and no networks that are headquartered in Estonia.

Name of centre	Main areas of activity	Website
Estonian Nanotechnology Competence Center	Nanometrology, nanotools and nanosensors.	http://www.encc.ee/

Finland

Population: 5,223,442 (July 2005 est.)

Capital: Helsinki

GDP: $151.2 billion (2004 est.) **GDP per capita:** $29,000 (2004 est.)

Universities: 21

Introduction

GERD accounted for 3.46% of GDP in 2003. It is comparatively high and well above the European average (1.85%).

The Technology Agency of Finland, Tekes launched the FinNano technology programme on 1st January 2005. The total duration of the programme is five years, 2005 – 2009. The costs of the programme are €45 million, including €25 million in research funding, and €20 million in corporate financing.

Tekes' programme forms one part of the Finnish national nanotechnology programme. Tekes and the Academy of Finland have planned to spend €55 million to ensure that Finnish industry can study and exploit nanosciences and nanotechnologies. Industry is expected to invest €25 million to projects in the FinNano programme.

The FinNano technology programme will fund industry, universities and other research organisations. The idea of the nanotechnology programme is to study, exploit and commercialise nanoscale systems and phenomena occurring on a nanoscale. Nanotechnology is horizontal and enabling and is associated with a minimum of three things: scale, functionality and the controllability of nanostructure. The approach is multidisciplinary. It will focus in three areas:

1. Innovative nanostructured materials
2. Nanosensors and nanoactuators
3. New nanoelectronics solutions

The core objectives of the FinNano technology programme are to: 1) strengthen existing research in the field; 2) step up the economic utilisation of research data by transforming research results into technology and products and to strengthen and accelerate the commercial development of nanotechnology; 3) support national and international networking and researcher mobility; 4) promote participation by Finnish researchers, research institutions and enterprises in the European Union's nanotechnology research and development programmes; and 5) foster efficient and synergetic use of resources and infrastructures.

In addition to funding promising research projects, the goals are to encourage enterprises to see the potential of nanotechnology and ensure that there emerge good prerequisites for exploiting nanotechnology applications.

Further information about the programme and the call for proposals can be obtained on the website www.tekes.fi/ohjelmat/nano or by contacting the Programme Manager, Dr Markku Lämsä (e-mail: markku.lamsa@tekes.fi).

MICRONOVA is the leading research centre for micro- and nanotechnology in Finland, containing research groups from the Helsinki University of Technology (TKK) and Technical Research Centre of Finland (VTT). VTT and TKK share a common state-of-the-art infrastructure, which allows scientists at MICORONOVA to concentrate fully on their research. MICRONOVA's modern facilities were completed in 2002 and include 2600m^2 of cleanrooms, processing lines for silicon BiCMOS, MEMS, III-V optoelectronics and thin film processing, in addition to extensive laboratories for electrical and optical measurements and various types of materials characterisation.

We have identified one international and one national network headquartered in Finland and five major centres which make infrastructure for nanotechnology research available to outside users.

Name of centre	Main areas of activity	Website
Helsinki University of Technology: Materials Physics Laboratory	Theoretical and experimental physics- nano-optics and micro-optics, polymer physics, bulk and surface acoustic waves, and theoretical materials physics.	http://focus.hut.fi/
Helsinki University of Technology: Kylmälaboratorio (Low Temperature Laboratory)	European Large Scale Facility (LSF) in both low temperature and brain research.	http://boojum.hut.fi/
University of Jyväskyla: Department of Physics	Theoretical and applied physics. EC-recognized large scale facility for the training and mobility of researchers (TMR).	http://www.phys.jyu.fi/
Tampere University of Technology - TUT	Provides R&D and consultation services in various disciplines.	http://www.tut.fi/public/
VTT Technical Research Centre: Micronova	Electronics- cleanroom facilities. Offers technology transfer.	http://www.vtt.fi/tte/research/tte6/micronova.htm

France

Population: (Jan. 2003 est.): 61.4 million

Capital: Paris

GDP: (2003 estimate, PPP): 1.26 trillion EUR **GDP per capita**: 21,050 (2003).

Universities: 85

Introduction

R&D expenditures in France represented 33 billion euros in 2002. 55% of French R&D expenditures come from private investments. The main objectives of French government are to favour interaction between academic research and business, and to develop investment structures. In 1998, Research and Technological Innovation Networks were created by the French Ministry for Research to promote technological transfer between basic public research and industry in government marked priority fields.

Public research funding primarily comes from the state: at the national level through the ministries of Youth, National Education and Research (but also Defence, Health, and Agriculture). The Ministry for Research prepares and implements the major orientations of national policy; and at the regional level through the Regional Research and Technology Delegations (DRRT), Regional Consultative Committees on Technological Research and Development (CCRRDT), Regional Innovation and Technology Transfer Centres (CRITT)

Research activities are carried out by state research institutions:

- Public scientific and technological establishment (EPST): CNRS, INRA, INSERM…
- Public industrial and commercial establishments (EPIC): ANVAR, CEA, CNES…
- 85 Universities
- Major establishments (Engineer School …)
- Non profit Institutions: Institut Pasteur, Institut Curie

Industrial R&D is supported by the Ministry of Industry. The Anvar (Innovation Agency) supports innovation in SMEs-SMIs. Private R&D investments (GERD) are increasing but the level is still low, which is the reason why the government has launched measures to strengthen research activities in companies.

History of Nanotechnology Research in France

1999: Creation of the Micro and Nano Technology Network (RMNT), one of the Research and Technological Innovation Networks. This network is described later in the report.

2000: Launch of the Incentive Concerted Action (ACI) "nanostructures" (2.25M€)

2001: Creation of the large clean room facilities network micro and nanotechnologies (a network of 7 "Grandes centrales").

Creation of a network named "specific centrals", which gathers other more specific centres.

Establishment of a national coordinating committee for nanosciences (Ministries, CNRS, and CEA) to support and coordinate French researchers and laboratories

Creation of the OMNT: Observatory for Micro and Nanotechnology.

New Incentive Concerted Action (ACI) "nanostructures" (3.25M€)

Launch of Minatec project

2002: Initiatives to favour "nano" in Education.

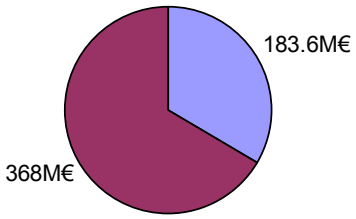
Launch of the Nanosciences National Programme (Ministry for research, CNRS, CEA) aimed to coordinate research in Nanosciences (10M€ budget in 2002; 12M€ in 2003 and 14M€ in 2004.)

2005: Launch of the Nanosciences-Nanotechnologies programme and creation of the National network for Nanosciences and Nanotechnologies (R3N).

Launch of "pole of competitiveness" policy which will very probably lead to the creation of a nanotechnologies pole.

b) Past investment

It is difficult to make a separation between investment completely devoted to nanotechnologies and those which include microtechnologies. In 2003, public investments in these two categories represented 551.6M€ with the following repartition:



Source : "Financement des nanotechnologies et des nanosciences, l'effort des pouvoirs publics en France", Alain Billon, Jean Ghys. Ministry for Education and Research. January 2004

c) Strategy: Nanosciences-Nanotechnologies programme

The French National Research Agency (ANR) was created at the beginning of 2005 to support French R&D projects selected on the basis of excellence criteria. In 2005, its 350 M€ budget will focus on 3 thematic priorities, including 70 M€ for the nanosciences and nanotechnology programme.

This programme coordinated by the new national Networks for Nanosciences and Nanotechnologies (R3N), plans a 210M€ investment for 3 years, from 2005 to 2007. It represents a strong increase in Ministry for research investments for nanotechnologies.

The R3N mission will consist in supporting:

- The large clean room facilities network ("Grandes centrales"): these centres (established in Grenoble, Lille, Lyon, Toulouse, Besançon, and Ile de France) have their own specificities and form a network to take into account the complementarities of their research. This network is opened to scientific projects from other laboratories (15% of time of equipments use is devoted to this project).

- The best academic projects (gathering academic laboratories),

- The best projects involving partners from public laboratories, private research centres (from large firms) and SMEs.

We have identified seventeen major infrastructure centres and thirteen networks (nine international and four national) covering a number of different sectors.

Name of centre	**Main areas of activity**	**Website**
MINATEC	Major infrastructure which brings together research, industry and education. Multidisciplinary with fabrication and analytical facilities, technology transfer and innovation support, facilities for pilot schemes and SME support.	http://www.minatec.com/minatec_uk/index.htm

The large clean room facilities network named "Grandes centrales" (15% of time of equipments use is devoted to exterior projects).

Name of centre	**Main areas of activity**	**Website**
LAAS	Multidisciplinary associated with three institutes. Large fabrication and analytical facilities.	http://www.laas.fr
IEMN	Materials (both inorganic and organic)-deposition and analysis, with a focus on electronics and optoelectronics.	http://www.iemn.univ-lille1.fr

Name of centre	Main areas of activity	Website
CEA-LETI	Integration of micro- and nanotechnologies into systems for biology and health, optoelectronic and components, microelectronics and microsystems on silicon. Innovation support and technology transfer.	http://www-leti.cea.fr
IEF (Institute of Fundamental Electronic)	Focus on electronics, optoelectronics and photonics.	http://www.u-psud.fr/IEF/iefuk.nsf/welcomeUK.html!OpenPage
LPN (Laboratory for Photonics and Nanostructures)	Focus on electronics and optoelectronics.	http://www.lpn.cnrs.fr/fr/
FEMTO "MIMENTO"	Fabrication of micro and nano systems, biomedical engineering, time frequency systems and telecommunications, energy and the environment.	http://www.femto-st.fr/
FMNT (the Micro and Nanotechnology Federation)	Federation of 6 CNRS Rhône-Alpes laboratories: IMEP, LEOM, LMGP, LPM, LTM and SPINTEC. Covers all technologies with focus on: 1.) Microelectronics and nanoelectronics (Coordination, IMEP) 2.) Microsystems (Coordination, LPM) Photonics (Coordination, LEOM) 3.) Spintronics (Coordination, SPINTEC) 4.) Ultimate technologies and innovative characterization techniques (Coordination, LTM)	http://fmnt.online.fr/

The "specific centrals"

Name of centre	Main areas of activity	Website
LEOM	Electronics, optoelectronics, photonics, Microsystems.	http://leom.ec-lyon.fr/index.html
LPM (INSA Lyon)	Electronics and photonics (fabrication and analysis).	http://www.insa-lyon.fr/Laboratoires/LPM/
Nanofab platform – CRTBT Grenoble	Nanofabrication by electronic and ionic lithography, deposition and etching.	http://crtbt.grenoble.cnrs.fr/
INSA Rennes – LENS	Optoelectronic and electronic device and material fabrication and analysis.	http://www.insa-rennes.fr/l-phys/l-phys-eng/eindex.html
CEM2 Montpellier	Electronics and optoelectronics.	http://www.cem2.univ-montp2.fr/index.php
CRMCN Marseille	Nanophysics, nanochemistry, nanoelectronics, interfaces with life sciences.	http://www.crmcn.univ-mrs.fr/indexe.html

Other nanotechnology infrastructures.

Name of centre	Main areas of activity	Website
Nanobio	Nanobiotechnology based at CEA-Leti.	
CEMES (Toulouse)	Nanomaterials (electronic, magnetic and optical) fabrication and analysis.	http://www.cemes.fr/r7_english/index.htm
Nanoptec	Fabrication and study of fundamental properties (in particular optics) of different kinds of nano-structures and materials. Engineering of photonics devices for microelectronics applications.	http://nanoptec.univ-lyon1.fr/

Germany

Population: 82.5 million

Capital: Berlin

GDP: $2.362 trillion (2004 est.) **GDP per capita**: $28,700 (2004 est.)

Universities: 365 institutions of higher education (100 universities and comprehensive universities, six colleges of education, 16 colleges of theology, 52 colleges of art, 162 general universities of applied sciences and 29 colleges of public administration)

Introduction

Since the late 1980s, the German Federal Ministry of Education and Research (BMBF) has been funding nanotechnology research activities in the context of its Materials Research and Physical Technologies programmes. Initial core topic areas included the production of nanopowders, the creation of lateral structures on silicon and the development of nanoanalytical methods. BMBF support was later expanded to also include other programmes with relevance to nanotechnology, for instance in the Laser Research and Optoelectronics programmes. Today, many projects related to nanotechnology are supported through a considerable number of specialized programmes. Examples include Materials Innovations for Industry and Society (WING), IT Research 2006, the Optical Technologies Sponsorship Programme and the Biotechnology Framework Programme. From 1998 to 2004, the volume of funded joint projects in nanotechnology quadrupled to about 120 million Euro.

In addition to BMBF-funded research, project-related investments are also financed by the Ministry of Economics and Employment (BMWA) in the Physikalisch-Technische Bundesanstalt (PTB - the national metrology institute) and the Federal Institute for Materials Research and Testing (BAM), as well as nanotechnology-related projects in the PRO INNO innovation competency programme for SMEs. These projects are funded to the tune of about 25 million Euro annually. In 1998, the BMBF established six competence centres with an annual funding of approx. 2 million Euro. In Phase 3, starting in the autumn of 2003, nine competence centres have begun or continued their work as nationwide, subject-specific networks with regional clusters in the most important areas of nanotechnology.

Besides the competence centres that are directly supported by the BMBF, several other networks have evolved that pursue different goals and are therefore differently structured. In contrast to networks with a (virtual) structure that is generally nationwide, several universities and research centres have consolidated their nanotechnological basic research activities through local - in some cases even internal - networks.

In Germany, institutional research in nanotechnology outside the universities is pursued by the four large research associations: MPG, FhG, HGF and WGL. These associations maintain numerous research establishments or working groups whose range of activities includes nanotechnology research. What´s more, these partners are also integrated into many collaborative research programmes and priority programs of the DFG.

Nearly all German universities with a technical and scientific programme of studies are conducting R&D related to nanotechnology. At the same time, growing emphasis is given to developing an interdisciplinary understanding of the relationships in various areas of this field. At several universities, nanotechnology courses of study have already been established that are closely linked to current research topics.

In addition to the aforementioned institutes, the strongly diversified R&D system in Germany also includes other establishments involved with nanotechnology, such as the NMI in Reutlingen, AMICA Aachen, IMS-Chips in Stuttgart, FBH Berlin, Bessy II Berlin, PTB Brunswick, CAESAR in Bonn and IPHT in Jena.

The players in the nanotechnology field in Germany also include several hundred industrial companies. Research programmes in many large corporations such as Infineon, DaimlerChrysler, Schott, Carl Zeiss, Siemens, Osram, Degussa, BASF, Bayer, Metallgesellschaft and Henkel include open questions in nanotechnology. For example, nearly all major chemical companies are working with nanoscale materials. While large companies tend to be interested mainly in system solutions with prospects of large sales volumes, small and mid-sized enterprises are mainly concerned with production, analysis and equipment-related technologies.

Not counting the industry's own contribution, Germany's public expenditures for nanotechnology funding in 2004 total about EUR 290 million. This does not include the Federal States expenditures on the universities basic budgets, nor the industry's own funding of nanotechnology research apart from public funding. The main part of the basic research is funded by the German Research Foundation (DFG). The DFG is the central, self-governing research organisation that promotes research at universities and other publicly financed research institutions in Germany. Some of the important instruments used by the DFG are Collaborative Research Centres (SFBs). SFBs are long-term university research centres in which scientists and researchers work together within a cross-disciplinary research programme. They are installed with the purpose to create core research areas at universities by establishing temporary centres of excellence, to promote interdisciplinary cooperation and to advance young researchers. As a rule the funding duration is up to 12 years.

In this report we have identified fifty-seven centres of competence and thirty-two networks (twenty-two national and ten international).

Name of centre	**Main areas of activity**	**Website**
Advanced Mask Technology Centre (AMTC)	Development of lithography masks for the semiconductor industry.	http://www.amtc-dresden.com
BAM - Federal Institute for Materials Research and Testing	Material technology and analysis, including surface, tribology, non-destructive.	http://www.bam.de/english/index4.htm
Bayreuth Centre for Colloids and Interfaces	Colloids and interfaces. Also offers troubleshooting service to industry.	http://www.bzkg.de
BESSY	Synchotron radiation source.	http://www.bessy.de
BINAS - Bielefeld Institute for Biophysics and Nanoscience	Analytical centre – surfaces, thin films and solids.	http://www.binas.info
Caesar	Major centre with multidisciplinary approach including materials, nanobio, electronics, microrobotics.	http://www.caesar.de
CeNS - Centre for NanoScience	Multidisciplinary- materials, electronics, nanobio, fabrication techniques.	http://www.cens.de
CeNTech - Centre for NanoTechnology	Multidisciplinary centre which also offers technology transfer and support to start-ups.	http://www.centech.de
Centre for Microchemistry, Nanochemistry, and Microsystem Technology (Cμ)	Fundamental chemistry which is applied to MEMS and NEMS technologies.	http://www.cu.uni-siegen.de
Centre for Microtechnologies (ZFM)	Electronics and Microsystems from design to prototyping.	http://www.zfm.tu-chemnitz.de
Centre of Nanophotonics	Photonics - dry etching, plasma deposition, optical lithography.	http://sol.physik.tu-berlin.de/npz/

Name of centre	Main areas of activity	Website
Centre for Nanostructure Technology and Molecular Biological Technology	Nanostructures and nanobio, including lithography and surface analysis.	http://www.nbz.uni-kl.de/index2_e.htm
CeOPP - Centre for Optoelectronics and Photonics Paderborn	Optoelectronics - material research, device and system development.	http://www.ceopp.de
CFN - DFG-Centre for Functional Nanostructures	Multidisciplinary with a focus on: nano-photonics, nano-electronics, molecular nanostructures, nanostructured materials and nanobio.	http://www.cfn.uni-karlsruhe.de
CINSaT - Centre for Interdisciplinary Nanostructure Science and Technology	Multidisciplinary fundamental research and analysis.	http://www.cinsat.de
CNI - Centre of Nanoelectronic Systems for Information Technology	Nanoelectronics. Fundamental research focusing on quantum-electronics, magneto-electronics, ferro-electrics, molecular nanostructures, Terahertz-electronics and bio-signal processing.	http://www.cni-juelich.de
CNT - Fraunhofer Centre for Nanoelectronic Technology	Nanoelectronics- applied research.	http://www.fraunhofer.de/fhg/EN/press/pi/2004/11/Mediendienst112004Thema7.jsp
Collaborative Research Centre 513 - Nanostructures at interfaces and surfaces	Nanostructure production and investigation of their fundamental properties and impact on the fields of electronics, mechanics, optics, fluidics, and sensor technology.	http://www.uni-konstanz.de/FuF/Physik/Forschung/sfb_www.htm
Collaborative Research Centre 551 - Carbon from the gas phase: elementary reactions, structures, materials	Research into the use of carbon fibre to strengthen and reinforce other materials via chemical vapour deposision and infiltration.	http://www.sfb551.uni-karlsruhe.de/
Collaborative Research Centre 631: Solid State Based Quantum Information Processing: Physical Concepts and Materials Aspects	Solid state based quantum information processing from fundamental physics to material and technology applications.	http://www.wmi.badw-muenchen.de/SFB631/
Collaborative Research Centres 445 - Nano Particles from the Gasphase: Formation, Structure, Properties	Nanoparticles- particularly ceramic, semiconductor and magnetic. Variously for sensors, data storage, ferro fluids and catalysts.	http://sfb445.uni-duisburg.de/
Collaborative Research Centres 486 - Manipulation of Matter at the Nanometer Length Scale	Fundamental research into nanofabrication and manipulation of matter at the nanoscale.	http://www.nanoman.physik.uni-muenchen.de/

Name of centre	Main areas of activity	Website
Collaborative Research Centres 491 - Magnetic Heterostructures: Structure and Electronic Transport	Nanostructures for ICT including metals, semiconductors, ferromagnets, antiferromagnetic oxides, superconductors, and insulators.	http://www.ep4.ruhr-uni-bochum.de/sfb/
Collaborative Research Centres 508 - Quantum Materials - Lateral Structures, Hybrid Systems and Clusters	Fundamental research on quantum effects in novel materials.	http://www.physnet.uni-hamburg.de/iap/group_h/SFB508/
Collaborative Research Centres 569 - Hierarchic Structure Formation and Function of Organic-Inorganic Nano Systems	Fundamental research on nanostructures and mesoscale phenomena.	http://www.uni-ulm.de/sfb569/
Collaborative Research Centres 602 - Complex Structures in Condensed Matter from Atomic to Mesoscopic Scales	Fundamental research into mesoscale phenomena (in particular magnetic properties).	http://www.sfb602.uni-goettingen.de/index.htm
Collaborative Research Centres 622 Nanopositioning- and Nanomeasuring Machines	The design and production of nano-positioning and measuring machines, with applications in semiconductors, lithography, nanoimprinting, nanofabrication, and nanobio.	http://www.maschinenbau.tu-ilmenau.de/mb/sfb622/index.htm
Collaborative Research Centres 625 - From Single Molecules to Nanoscopically Structured Materials	Fundamental research on nanostructures and mesoscale phenomena.	http://www.uni-mainz.de/Organisationen/sfb/625/
DESY	Synchrotron radiation, particle accelerator, free electron laser source.	http://www.desy.de
Ernst Ruska-Centrum für Mikroskopie und Spektroskopie mit Elektronen	Analytical centre offering electron microscope and e-beam microcharacterisation of materials.	http://www.er-c.org
Forschungszentrum Jülich	Multidisciplinary with focus on fundamental material research (structure and properties) and applications in thin films and interfaces.	http://www.fz-juelich.de
Forschungszentrum Karlsruhe	Multidisciplinary with forcus on two areas: "Electron transport in nanoscale systems" and "Nanostructured materials and low dimensional systems with new functionalities"	http://www.fzk.de http://www.fzk.de/stellent/groups/nano/documents/published_pages/en_nano_index.php#TopOfPage
Forschungszentrum Rossendorf	Major analytical research centre with the Radiation Source ELBE, providing beams of electrons, photons, neutrons and positrons as well as coherent infrared photons from a free-electron laser, and the Ion Beam Centre with its large selection of equipment for modification and analysis of solid surfaces.	http://www.fz-rossendorf.de

Name of centre	Main areas of activity	Website
Fraunhofer Institute for Ceramic Technologies and Sintered Materials IKTS	Nanoceramics - development of advanced materials, technologies and components concerning inorganic non-metallic systems.	http://www.ikts.fraunhofer.de/index_en.html
Fraunhofer-Institut für Angewandte Optik und Feinmechanik IOF	Optical coatings, optical measurement systems, micro-optical and integrated optical systems including laser assemblies, and components for precision mechanics assemblies and systems.	http://www.iof.fraunhofer.de/index_e.html
Fraunhofer-Institut für Fertigungstechnik und Angewandte Materialforschung IFAM	Nanomaterials with focus on powders – prototyping, adhesion and interface research, training.	http://www.ifam.fhg.de/
Fraunhofer-Institut für Silicatforschung ISC	Surface technologies (in particular for glass) with applications in automotive, energy, microsystem and life science industries.	http://www.isc.fraunhofer.de/index_e.html
Fraunhofer-Institut für Werkstoff- und Strahltechnik IWS	Material and beam technology R&D with focus on thin films, nano-optics and electronics.	http://www.iws.fraunhofer.de
Fritz Haber Institute of the Max Planck Society	Fundamental research investigating the physics and chemistry of interface processes.	http://www.fhi-berlin.mpg.de/
Institute for New Materials (INM)	Major European centre for chemical nanotechnology for material innovations. Also provides technology transfer and support for SMEs.	http://www.inm-gmbh.de/htdocs/home/frame_en.htm
IFOS - Institut für Oberflächen- und Schichtanalytik GmbH	Chemical, structural and topographic analysis of surfaces, thin films and solids.	http://www.uni-kl.de/IFOS
Leibniz Institute for Solid State and Materials Research Dresden IFW	Fundamental and applied R&D, with particular emphasis on the fields of solid state and materials research (both bulk solids and thin films).	http://www.ifw-dresden.de/eindex.htm
Leibniz Institute for Surface Modification IOM	Basic and applied research on the interaction of radiation with matter and their technological applications.	http://www.iom-leipzig.de/index_e.cfm
Leibniz Institute of Polymer Research Dresden IPF	Polymers – synthesis, functionalization and characterization of surfaces and interfaces.	http://www.ipfdd.de/index_nojava.html
Max Planck Institut für Metallforschung	Materials – synthesis and analysis.	http://www.mf.mpg.de/en/index.html
Max Planck Institute for Solid State Research	Fundamental solid state research and development of novel materials.	http://www.fkf.mpg.de/start.html
Max-Planck-Institut für Kolloid- und Grenzflächen-forschung	Colloidal systems and interfaces.	http://www.mpikg-golm.mpg.de/
NanoCentre - Centre of Excellence "Nanostructures and Nanomaterials"	Nanomaterials - design and analysis.	http://www.nanocentre.ruhr-uni-bochum.de/centre_en.html

Name of centre	Main areas of activity	Website
nanoMA - Centre for nanostructured materials and analytics	Nanomaterials - design and analysis especially organic/inorganic hybrid materials on the nanometer scale.	http://www.nanoma.de/
Nanotronics	Nanoelectronics and energy.	http://www.creavis.com/site_creavis/en/default.cfm?content=nanotronics/s2b
nanoTUM	Multidisciplinary including materials and nanobio.	http://www.nanotum.org
Norddeutsches Service-Zentrum für Nanoanalytik	Nanoanalytical services based on SPMs and spectroscopy.	http://www.nanoanalytik-hamburg.de/shtml/nszn.shtml
PDI - Paul Drude Institute for Solid State Electronics	Materials research, solid state physics, and nanofabrication.	http://www.pdi-berlin.de/
Physikalisch-Technische Bundesanstalt	National metrology institute.	http://www.ptb.de/index_en.html
WMtech	Material research, development and technology transfer.	http://www.wmtech.de
Zentrum für Mikro- und Nanotechnologien (ZMN)	Nanomaterials- basic and applied research including pyro- and piezoelectric semiconductors for sensor applications, polymers for solar cells and transistors, ceramics for hybrid-technology and the Si-technology for fluidics, sensors and MEMS.	http://www.zmn.tu-ilmenau.de
Zentrum für Mikrostruktur-forschung	ICT, medical technologies and biotechnology.	http://www.physnet.uni-hamburg.de/institute/IAP/angew.html

Greece

Population: 11 million (UN, 2005)

Capital: Athens

GDP: $226.4 billion (2004 est.) **GDP per capita**: $21,300 (2004 est.)

Universities: 20

Introduction

The main actor of the R&D policy in Greece is the General secretariat for Research and technology (GSRT), which comes under the Ministry of Development. Other ministries that are involved in R&D projects, include the Ministries of Education, Agriculture, and National Defence. Government Budget Appropriations or Outlays for R&D (GBAORD, which includes EU funds for R&D) represented 391,64M€ in 2002.

The National R&D strategy has focused on the improvement of Greek research facilities and industrial research supporting. These efforts are illustrated by the increase in expenditure on R&D from 0.2% of GDP in 1980 to 0.7% in 1999 and by the doubling of business involvement in R&D. However, Greece must still reduce the gap between expenditures on R&D from public and private sectors, as the public share (National and EU) is more than 70% of R&D expenditures. Greek policy for R&D in the coming year period will be focused on redressing this balance.

The following table gives the % of R&D expenditure by sources of fund in 1999.

Total R&D Expenditure (GERD) (%) by Source of Funds (1999)	
Government	49,94
Industry	24,01
Abroad	25,76 (16,61: CSF/EU)
Other	0,28

Source: GSRT

The Greek policy in R&D is based on 6 directions:

- Increasing the demand for new knowledge and research results in Greece
- Reorganisation of the research system and provision of knowledge in Greece
- "Freeing-up" the Greek research system and opening it further to the international field
- Development the technological infrastructure in the context of a policy for science and technology
- Thematic/sector priorities for a policy on science and technology
- Quantification of goals

The thematic priorities are the following : renewable energy sources; food and hydroculture; knowledge-intensive culture and tourism; sport; sea transport; health, biomedical, diagnostic and therapeutic methods; natural environment (atmospheric, sea, water dynamic, forest fires, recycling etc.); structured environment and earthquake protection; new forms of organisation for businesses; labour and training; e-learning; e-business.

Research activities in Greece are carried out mainly in higher education institutions and in government research centres. We have identified seven infrastructure centres (four of these within the NCSR Demokritos), two national networks (one multidisciplinary, the other focused on electronics) and one international network (semiconductors) devoted to nanotechnologies.

Name of centre	Main areas of activity	Website
CERTH Chemical Process Engineering Research Institute (Cperi)	Applied materials research in processes, hydrocarbons, polymers, energy, nanoparticles, environment, catalysts.	http://www.cperi.certh.gr/en/index.shtml
FORTH Institute of Electronic Structure and Laser (IESL)	Basic and applied research in: lasers, materials (polymers, electronic and photonic materials), microelectronics, environment, theoretical and computational physics and chemistry. Offers support for technology transfer and spin-offs.	http://www.iesl.forth.gr/
Institute of Materials sciences (part of NCSR Demokritos)	Materials - magnetic, superconducting, electronic, and composites for both basic and applied research.	http://www.ims.demokritos.gr/index_en.htm
Institute of Microelectronics (part of NCSR Demokritos)	Fabrication – lithography and patterning for semiconductors, sensors. Also offers training and technology transfer.	http://www.imel.demokritos.gr/
Institute of Nuclear Physics (part of NCSR Demokritos)	Fundamental nanophysics research.	http://www.inp.demokritos.gr/index.html
Institute of Physical Chemistry (part of NCSR Demokritos)	Nanochemistry with focus on supramolecular nanostructured materials, environment, energy and nanobio.	http://ipc.chem.demokritos.gr/index.html
LTFN: Lab of "Thin Films - Nanosystems & Nanometrology	Analysis, metrology and deposition of thin films also offered as a service to industry. Offers short courses and training.	http://skiathos.physics.auth.gr/thinfilmslab/

Hungary

Population: 9.8 million (UN, 2005)

Capital: Budapest

GDP: $149.3 billion (2004 est.) **GDP per capita**: $14,900 (2004 est.)

Universities: 27

Introduction

Due to political changes in Hungary, funding has undergone important changes and developments during the past 10 years. Government expenditure for Research & Development as a percentage of GDP is still fairly low compared to most OECD (Organisation for Economic Co-operation and Development) countries. As a result of the substantial economic and financial challenges that accompanied the country's transition to a market economy, GERD dropped significantly during the 1990s.

In 2001, GERD was 0.94% of GDP. In absolute figures, the total R&D expenditure surpassed 140 billion HUF (approx. 600 million euro). Since then industrial R&D expenditures have grown by 23%, while government investments have shown a 45% increase. From 2003 on, expanding R&D tax and other incentives for innovation promise further increases in business research and development spending. R&D funds for the higher education sector have also grown significantly (by 43%), whereas the funds for government institutions have also experienced a larger increase (32%), and are well over the rate of inflation. The Government's main goal is to reach the EU average by 2006.

In 2004, the Parliament adopted the new "Hungarian Innovation Act", outlining the governments policy and responsible ministers, departments and agencies for carrying out the policy on R&D and innovation.[9]

There are five National Research and Development Programmes (NRDPs): improving the quality of life; information and communication technologies; environmental and materials research; research on agribusiness and biotechnology; and research on national heritage and contemporary social challenges. Nanotechnology, in particular manufacturing and analysis of materials on the molecular level, is part of program 3 on environmental and materials research. Program 2 on ICT includes application of molecular level information technologies. (Source: Research and Development, http://www.om.hu/english).

There are three major sources of funding competitive R&D programmes. The aim of the NRDPs is to support research, development and innovation projects, focusing on interdisciplinary research. Special attention is given to large integrated projects implemented by consortia comprising the higher education sector, other public R&D institutions and industry. The National Scientific Research Fund (NSRF) was first established in 1986 to support scientific research, to establish conditions necessary for performing these activities and to publish results. Funding concentrates on thematic programmes with a special focus on young researchers, on scientific equipment and for post-doc support (for projects in Hungary only). The National Technology Development Fund (NTDF) supports technological innovation, the development of R&D infrastructure and the dissemination and economic application of research results.

In connection with these objectives the government intends to bring the state and the business sectors closer to each other since they have a role in ensuring that research, development and production are closely intertwined and placed in the service of the country's economic advancement. To achieve this, an attempt has been made to establish co-ordinated education, research and innovation policies, as well as measures to stimulate R&D activities of the private sector.

The Hungarian Science and Technology Foundation is a non-profit public foundation, which was established by the Ministry of Foreign Affairs in 1994. The Foundation's aims and activity areas are to support scientific and R&D activities by distributing funding to a variety of national and international co-operative research efforts (www.tetalap.hu).

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[9] http://www.nkth.gov.hu/main.php?folderID=907&articleID=3988&ctag=articlelist&iid=1

Hungary is a member of most European and Euro-Atlantic research organisations and programmes. According to the Hungarian Central Statistical Office, about 10% of total GERD in Hungary came from abroad in 2001, mainly from the Framework Programmes. The Hungarian contribution to the Framework Programme has been about 5% of the total budget of the Ministry of Education.

We have found seven research centres which make infrastructure for nanotechnology research available to outside users and one network headquartered in Hungary (which specializes in nanochemistry).

Name of centre	**Main areas of activity**	**Website**
Institute for Materials Science and Technology Bay Zoltan Foundation on Applied Research	Nanomaterials - nano-structured soft magnetic materials, nanocomposites, nano-powder-metallurgical and composite base materials and products, nano structured steels.	http://www.bayati.hu/
KFKI Research Institute for Particle and Nuclear Physics, HAS	Physics- theory and analysis. Plasma, particle, thin films, biological samples.	http://www.rmki.kfki.hu/
MFA Nanostructures Laboratory	CNT production and analysis.	http://www.mfa.kfki.hu/int/nano/index.html
Nanolaboratory, dept Surface Modification & Nanostructures, Chemical Research Centre, HAS	Materials – surface analysis, CNT production, thin films.	http://www.chemres.hu/eng/ic/depts/surfacer/index_e.html
Research Institute of Solid State Physics and Optics, HAS	Physics and materials including optical thin films, laser applications, crystal growing technologies and metallurgy.	http://www.szfki.hu/general.html
University of Miskolc Faculty of materials and metallurgical engineering	Materials with focus on CNT and nanocrystalline materials.	http://www.uni-miskolc.hu/e_index.php
University of Szeged, Department of Applied & Environmental Chemistry	Nanomaterials with focus on CNT, zeolites and nanoporous materials.	http://www.sci.u-szeged.hu/appchem/akkt

Ireland

Population: 4 million (UN, 2004)

Capital: Dublin

GDP: $126.4 billion (2004 est.) **GDP per capita**: $31,900 (2004 est.)

Universities: 8

Introduction

Ireland's investment in R&D is lower than many other EU countries (1.17% GERD as a percentage of GDP in 2001), however Ireland identified nanotechnology as the next wave in technology revolution at a very early stage. The Irish Government launched the Nanoscale Science and Technology Initiative in 1999 with a substantial increase in funding and focusing on electronics but not excluding the nexus of nanotechnology with photonics. Most of the projects are commissioned for a long term initiative in order to ensure a higher and measurable return on investment. Ireland keeps a centralized management on nanotech research though various departments that fund the projects. Of these departments Enterprise Ireland leads with 40 projects, followed by The Irish Research Council for Science, Engineering and Technology, the European Union and Science Foundation Ireland (SFI) with 22, 16 and 15 projects respectively. According to the Irish Council for Science, Technology and Innovation (ICSTI) which heads the whole initiative along with Higher Education Authority (HEA) 114 full time nanotech researchers and 10 internationally recognized groups are working on N&N in Ireland. The progress is clearly visible in the field of nanomaterials and nanotools with more training programmes for professionals and more than 250 post graduate students undertaking research. Ireland is far ahead of many other European countries in commercializing nanotechnologies, with more than 4 multinational companies developing nanoproducts and another 40 in the pipeline. The whole technology initiative has been developed with a strategy to exploit the sector specific nanotechnologies to be utilized for the existing and developing companies' growth. The National microelectronics centre (now the Tyndall Institute) is one of the most important nanotechnology research centres in Ireland with an international reputation and is the home to some of the significant Nanotechnology startups such as Ntera.

ICSTI has identified the following sectors of the Irish economy where nanotechnology is going to play an important role:

- Information and Communications Technology – Electronics & Photonics
- Healthcare – Pharmaceuticals, Medical Devices
- Agriculture-Food
- Polymers and Plastic
- Construction

We have identified the four most important centres in Ireland which have enough infrastructure facilities that can boost nanotechnology research. These are the Nanotechnology Centre for Research on Adaptive Nanostructures and Nanodevices (CRANN) which has interactions with various universities and industries, the Tyndall Institute (NMRC at Cork) and the National Centre for Laser Applications (NCLA) at Galway. Ireland has two international networks and the national Irish Nanotechnology Association, which highlights the state-of-the-art research ongoing in Ireland and promotes technology transfer.

Name of centre	Main areas of activity	Website
CRANN	Multidisciplinary with focus on: the membrane-fluid interface, nanoscale contacts and transport, nanoscale organization and self-assembly, spin transport and nanomagnetic applications	http://www.tcd.ie/Physics/Crann/
Materials and Surface Science Institute (MSSI)	Materials and surface science with focus on catalysis, active materials, structural materials, interfacial science. Also offers training.	http://www.ul.ie/~mssi
NCLA (National Centre for Laser Applications- National University of Ireland, Galway)	Laser technologies and surface analysis. Also offer technology transfer, training and subcontracting services.	http://www.physics.nuigalway.ie/ncla/index.html
Tyndall Institute- NMRC	Fundamental and applied research in electronics, quantum computing, advanced lithography, DNA-based self-assembly of optoelectronic integrated systems.	http://www.tyndall.ie/

Israel

Population: 6.7 million (UN, 2005)

Capital: Jerusalem (most embassies in Tel Aviv)

GDP: $120.9 billion (2003 est.) **GDP per capita**: $19,800 (2003 est.)

Universities: 7

Introduction

R&D in Israel is carried out primarily in seven universities, dozens of government and public research institutes and hundreds of civilian and military enterprises. Israel has one of the highest expenditures on R&D (GERD equal to 4.73% of GDP in 2002) and has recognized the need for developing a strong infrastructure to meet the needs of its burgeoning nanotechnology industry. To this end the Israeli government set up a committee to investigate the current level of R&D and has developed a long-term plan for a national nanotechnology strategy which focuses on key areas of Israeli strength. The committee recommended launching a collaborative government/academia/industry initiative to allow Israel to effectively reach critical mass and global leadership in Nanotechnology. The main recommendations from the committee's report were:

- a five year Israel Nanotechnology plan
- this should involve both academic institutes and industry
- at least $100 million US devoted to academic and $25 million US to industry infrastructure
- at least $15 million US devoted to research project and $75 million US to technology development
- at least $100 million US devoted to a shared prototyping facility
- funds to come from government, industry and private donors

Out of this action the Israeli National Nanotechnology Initiative (INNI) was born, along with the Israel Nanotechnology Trust (INT)[10]. The INT promotes the establishment of a local nanotechnology industry, which will make an impact on the economic growth of Israel. The Trust raises, manages and distributes funds dedicated to the advancement of research and development in nanotechnology in Israel, in accordance with national goals and priorities set by the INNI. The funding sources of the Trust include philanthropic organizations, foundations and individuals with commitment to the success of Israel as a centre of scientific and technological excellence.

This report identifies eight Israeli centres that can be classified as "infrastructure", however there are many more research groups and companies active in N&N. We have not identified any networks that are coordinated from Israel.

[10] http://www.nanotrust.org.il/default.asp

Name of centre	Main areas of activity	Website
Bar-Ilan Center for Advanced Materials and Nanotechnology (BICAMN)	Physics, chemistry and life sciences.	
Center for Nanoscale Systems (at the Ilse Katz Center)	Analytical and fabrication facilities.	http://www.bgu.ac.il/nanocenter/
Braun Center for Submicron Research (Weizmann Institute)	Nanoelectronics. Centre selected for Transnational Access (TA) funding under FP6	http://www.weizmann.ac.il/physics/wissmc/
Helen and Martin Kimmel Center for nanoscale science (Weizmann Institute)	Nanomaterials with a focus on nanobio.	http://www.weizmann.ac.il/kimmel-nano/
Nanotechnology Research Center	Analytical and fabrication facilities with training for graduate level students available.	http://www.huji.ac.il/cgi-bin/mm/new/data/ihoker/MOP-DEPARTMENT_DESCRIPTION_LINK?department_no=01030&Save_t=nano
TAU Research Institute for Nanoscience and Nanotechnology	First interdisciplinary university research institute for N&N in Israel. Has extensive industrial collaborations.	http://nanotau.org.il/
Technion Microelectronics Centre & Nanoelectronics Centre	Nanoelectronics- characterization and fabrication.	Nanoelectronics: http://www.ee.technion.ac.il/labs/nano/ Microelectronics: http://www.ee.technion.ac.il/Labs/MicroElectronics/
Wolfson Applied Materials Research Centre	Provides analytical facilities and R&D in materials: electronic and opto-electronic, energy, structural, biological, and environment.	http://www.tau.ac.il/institutes/wamrc/index.html

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Italy

Population: 57.2 million (UN, 2005)

Capital: Rome

GDP: $1.609 trillion (2004 est.) **GDP per capita**: $27,700 (2004 est.)

Universities: 67

Introduction

In 2000 Italian investment in R&D was only 56% of the EU average (1.07% GERD as a percentage of GDP). However, Italy has recently reformed its National Research System to create the climate for a knowledge-based economy. This involved establishing a governing structure for the research system, reforming the public research institutions network, and strengthening the efficacy of the initiatives in support of industrial research. The net result of this was an increase in R&D funding of 80% (or almost 1 billion euros) from 2001 to 2002. Within these reforms the Italian government has identified nanotechnology as a potential area of growth, and it has been included as a priority area in its R&D strategy since 2002. Most of the funding for Italian Nanotechnology comes from the National Research Council, Ministry of Scientific Research and National Institute of Physics for Matter. The research is managed by framework programmes related to microelectronics and advanced materials. The National Research Council funded activities in nanotechnology with focus on the following areas:

- Nanotechnology and molecular devices for electronics;
- Nanomaterials and nanodevices for the biomedical sector;
- Nanostructures for other applications.

The Government has launched a Strategic Program called "nanotechnology, microtechnology and the advanced materials research" in order to carry out research in nanotechnology with public organizations and universities taking the lead followed by industry. The automotive sector is actively involved in nanotechnology activities in order to improve the efficiency along with reducing pollution to be used as catalysts, paints etc. Another important industrial sector in Italy, which has taken up nanotechnology, is the Healthcare sector forecasting a huge potential market.

We have found six main infrastructure facilities available in Italy, and two national and two international networks that are coordinated from Italy. NEST (National Enterprise for Nanoscience and Nanotechnology) is the most important research centre. It is closely associated with INFM and shares facilities. One of the important aspects of Italian Nanotechnology organizations is that there is a very close link between various research organizations. Like NEST, the National Nanotechnology Lab (NNL) and TASC Laboratory also have close links with each other and helped initiate Italian Nanotechnology Research. In a similar manner various networks also exists in Italy for promoting and disseminating the new technology across regional borders. INFM coordinates one of the important thematic network-Nanomat which includes more than 21 European organizations. Nanomitec and Veneto Nanotech are the other two networks which are active in Italy with the former co-funded by the EU and the latter having more of a regional focus. In addition to the major research centres mentioned in this report, Italian nanotech research is growing with the establishment of 5 centres of excellence at different Universities. Various foundations and organizations such as ELBA, Elettra, ENEA, INSTM etc. boost the nanotechnology R&D through various activities.

Name of centre	Main areas of activity	Website
Centre of Excellence in Optronics	Optoelectronics- fabrication and analysis.	http://ceo.ino.it/
CIVEN (Nano-fabrication Facility)	5 main areas: sensors, tribology, coatings, composites and bioarrays.	http://www.civen.org/EN/index.php
ELETTRA	Synchotron facility which has a Laboratory for Interdisciplinary LIThography (LILIT), that is dedicated to the development and micro- and nano-fabrication of micro-nanosystems.	http://www.elettra.trieste.it/index.php
National Enterprise for nanoscience and nanotechnology (NEST)	Nanophysics and overlap with nano-electronics, nanobio, spintronics.	http://leopardi.cmp.sns.it/index2.php
National Nanotechnology Lab	Multidisciplinary at all levels: fundamental research, fabrication, technology transfer and enhancing international profile.	http://www.nnl.it/index.html
TASC National Laboratory	Nanomaterials with emphasis on semiconductor fabrication and analysis.	http://www.tasc.infm.it/index.html

Latvia

Population: 2,348,784 (July 2003 est.)

Capital: Riga

GDP: (2002) 8910.2 million EUR **GDP per capita:** (2002) 3810 EUR

Universities: 5

Introduction

Government R&D spending is small; it represented about 34 million EUR in 2002. (0.39% of the GDP). The Department of Higher Education and Science of the Ministry of Education and Science is responsible for R&D issues. Since 1992 the Ministry is responsible for the supervision of the Market Orientated Research Support Grants (LV_67) - granting Government financial support for innovative development projects on a co-financing basis. Since 1997 further developments have also been driven by the Ministry of Economics.

The main actors for research (science/education) in Latvia are:

- Latvian Council of Science
- Latvian Academy of Sciences
- Academy of Agricultural and Forestry Sciences
- Research Institutes
- Centres of Excellence
- Union of Scientists
- Scientific societies
- Higher Education Establishments
- Higher Education Council
- Council of University Rectors

In July 1998, the Latvian government adopted a national R&D strategy for 1998 to 2010 with 4 thematic priorities including nanotechnologies. In 2005 a "material sciences" programme was launched by the government with a 1 200 000 euros budget.[11] Its objective is to coordinate all forces in Latvia for the preparation and investigation of technologies of functional nanomaterials.

This project is based on two directions:

- Development of functional nanomaterials and nanostructures
- Investigation and applications of functional nanomaterials and nanostructures.

It includes the following areas:

- Nanodevices for electronics and photonics
- Nanoparticules synthesis and treatment
- Polymers and composite nanomaterials.

We have identified three infrastructure centres in Latvia.

[11] Report : "The Latvian Innovation system, strategy and action plan 2005-2010", Riga 2004 : http://www.innovating-regions.org/download/Innovation%20strategy%20of%20Latvia.pdf

Name of centre	Main areas of activity	Website
Institute of Atomic Physics and Spectroscopy	Nanophysics- theoretical and applied (centre of execellence)	http://home.lanet.lv/~asi/en/index.htm
Institute of Inorganic Chemistry of the Riga technical University Laboratory of Plasma Process (LPP)	Nanochemistry and materials- plasma and powders.	http://www.nki.lv/Eng/index.htm
University of Latvia - Institute of solid State Physics	Nanomaterials- particularly electronic, ionic, and optical.	http://www.cfi.lu.lv/

The following persons, institutions and companies have, by their contribution made this report possible:

- Ricardas Rotomskis, from Laser Research Center, Vilnius University.
- Renata Korfer, from LORD (Lithuanian Liaison Office for Research).

Lithuania

Population: 3.4 million (UN, 2005)

Capital: Vilnius

GDP: $45.23 billion (2004 est.) **GDP per capita**: $12,500 (2004 est.)

Universities: 7

Introduction

Lithuania is a developing country within the EU, and its R&D and innovation system is still in evolution. Gross expenditure on R&D was 0.68% of GDP in 2003, that is to say about 108M€.

The main actors of R&D research and strategy are government agencies (Ministry of Education and Science, Science Council of Lithuania, Lithuanian State Science and Studies Foundation, Education, Science and Culture Committee of the Seimas (the Parliament), S&T Commission at the Government, other ministries and governmental agencies) and various state and private universities, institutes and other establishments:

The government aims to reform Educational and R&D systems with three objectives:

- To favour links between R&D and Industries,
- To adapt higher education system to market needs.
- To build research infrastructures

The Ministry of Education and Sciences, Ministry of Economy and municipal government (Vilnius, Kaunas…) are involved in the creation of science and technology parks such as "Sunrise valley" in Vilnius.

Last year, the Lithuanian government confirmed nanotechnology as one of the prioritized RTD project areas. Although, there is no national nanotechnology initiative in Lithuania one of the R&D priorities is the development of nanosciences and nanotechnologies.

In light of FP7, the government wants to encourage the involvement of Lithuania in the NMP priority, in particular in the following areas:

- Major research tasks, related to nanotechnology, microsystems technology, materials research and optical technologies.
- Nanoelectronics and nanophotonics.
- Elaboration of biophysical analytical methods and instruments, such as scanning optical near field probes, new atomic force microscopy (AFM) methods combines with laser technologies or special application.

In 2004, the Lithuanian government approved new programmes to be funded by the National Science and Education Foundation. These funds have been increased from the previous year and now represent about 2.3 million Euros per year for prioritized RTD areas projects.

We have identified six infrastructure centres and two national networks in Lithuania.

Name of centre	Main areas of activity	Website
Institute of Chemistry	Nanomaterials: metals and alloys-coatings and electrodes.	http://www.chi.lt/Eng/About.htm
Institute of Physical Electronics	Nanomaterials- electronics, thin films, lithography.	http://www.fei.ktu.lt
Institute of Physics	Nanophysics and biophysics.	http://www.fi.lt/index.htm
Lithuanian Energy Institute	Nanomaterials for hydrogen technologies including CNTs and coatings.	http://www.lei.lt/eng/index.htm
Research Centre for Microsystems and Nanotechnology	Ultraprecision engineering, systems, instrumentation and analytics.	http://www.microsys.ktu.lt/
Semiconductor Physics Institute	Nanomaterials: electronics, nanobio, fabrication.	http://uj.pfi.lt/index_e.html

The following persons, institutions and companies have, by their contribution made this report possible:

- Dr Arunas Jagminas from Institute of Chemistry.
- Ricardas Rotmskis, from Laser Research Center, Vilnius University.
- Renata Korfer, from LORD (Lithuanian Liaison Office for Research).
- Dr Gedvidas Bikulcius, Institute of Chemistry
- Dr Juras Ulbikas, Europarama, Vilnius.

Luxembourg

Population: 468,000

Capital: Luxembourg

GDP: $27.27 billion (2004 est.) **GDP per capita**: $58,900 (2004 est.)

Universities: 4

Introduction

Luxembourg devoted 1.71% of its GDP to R&D in 2000. The National Research Fund has seven national multi-annual priority programmes including a programme for new materials and nanotechnology, which is equipped with 6.7 M euro. The NANO programme aims to create a European Centre specialized in the characterisation of materials on the nanometre scale. The Fund launches periodic calls for research projects. Calls are addressed to all public institutions, Luxembourg administrations or public establishments authorised to undertake R&D activities or technology transfer activities in their respective fields of competence, in order to promote scientific progress or technological innovation. Currently three projects are funded, two at the Centre de Recherche Public - Gabriel Lippmann and one at the Laboratoire National de Santé. A second call for the period 2005 to 2008 is ongoing and equipped with a budget of 700000 euro.

A cluster programme has been launched by the Ministry of Economic Affairs, which is defined as a grouping of various sized companies united by shared, complementary or interdependent interests, which voluntarily develops cooperative relationships in one or more technology sectors. Technology clusters transcend traditional market boundaries since companies from different markets can contribute to a common goal. One of the first technology clusters was the SurfMat cluster, which represents companies that are active in the field of surface treatment (Surf) and new materials (Mat).

We have identified one main nanotechnology infrastructure centre and two networks (one international focusing on nanoanalytics, the other a national materials network), however the recently founded University of Luxembourg has a Laboratory for Physics of Materials, which is active in plasma techniques for the development of innovative surfaces. (http://www.cu.lu/lpm/)

Name of centre	Main areas of activity	Website
Centre de Recherche Public - Gabriel Lippmann	Analysis of metals, semiconductors, glasses, ceramics, biolmolecules, and polymers.	http://www.crpgl.lu/en/lam/index.php3

Netherlands

Population: 16.3 million (UN, 2005)

Capital: Amsterdam (seat of government- the Hague)

GDP: $481.1 billion (2004 est.) **GDP per capita**: $29,500 (2004 est.)

Universities: 22

Introduction

In 2003, the Netherlands' gross domestic product amounted to €453 billion, with manufacturing contributing for 15%. The Ministry of Economic Affairs has micro systems technology as one of its policy areas. In November 2003 it issued a report on innovation exploration in micro systems tehcnology: "Small Technology Means Big Business" (see the Publications section of www.nanoforum.org). Together with related technology areas as nanotechnology, life sciences and sustainable chemistry, this topic is one of the key issues of the innovation policy (www.mst.ez.nl).

Nanotechnology is supported with the programme NanoNed, a strategic impuls of the Dutch government (www.nanoned.nl). NanoNed is an initiative by eight centres of excellence and Philips, and covers investments in experimental facilities, scientific research and knowledge dissemination. With this the consortium partners aim to further enhance Dutch expertise within the nanosciences and nanotechnology. Moreover they are jointly seeking to increase the future potential of nanotechnology in the Netherlands as a source of economic growth in a highly productive and sustainable knowledge economy.

NanoNed runs from 2003-2009 and has a total budget, together with the funds inherited from its predecessor NanoImpuls, of more than €235 million, including €118 million government funding. This national research programme in nanotechnology is administered by the Dutch funding council for applied research STW (www.stw.nl).

SenterNovem is the agency which is responsible for the execution of grant schemes in the above areas on behalf of a range of Dutch ministries. SenterNovem has a total of EUR 1.3 billion at its disposal which can benefit thousands of organisations (www.senter.nl).

In August 2004, the Dutch *Royal Netherlands Academy of Arts and Sciences* (KNAW, www.knaw.nl) submitted a report to the minister of Education, Culture and Science entitled 'How big can small actually be? Some remarks on research at the nanometre scale and the potential consequences of nanotechnology'.

The *Rathenau Institute* is an independent institute raised by the Ministry of Education, Culture and Science, which stimulates research and discussion in order to help politicians and citizens to form an opinion about scientific and technological developments. One of its projects concerns Nanotechnology. The Institute published several reports, on the issues of nanotechology and society, biomedical nanotechnology, chances and risks of nanoparticles, and prospects of nanotechnology in general (www.rathenau.nl).

The national nanotechnology research programme *NanoNed* includes a virtual laboratory called "*Nanolab*". This comprises the existing research infrastructure for nanotechnology in Groningen (BioMade and MSC-plus at the University of Groningen), Twente (MESA+ research centre University of Twente) and Delft (TU Delft, TNO). This infrastructure will be strengthened with investments in new equipment and labs in the coming years. Nanolab is explicitly meant to be also available for outside users, from academia as well as from large and small companies. The programme focusses especially on supporting high tech start-ups. In the framework of the NanoImpuls programme (since end 2003), €8.5 million has been dedicated to investment in this Nanolab. In the NanoNed programme (since 2005), approximately €45 million will be dedicated extra for investment in this infrastructure. The parties themselves are committed to investing €55 million from other resources. (Source: www.stw.nanoned, under 'Nanolab').

Research infrastructure for nanotechnology has been installed and maintained by other institutions as well. The *Physics Research Council FOM* funds AMOLF in Amsterdam, which specializes in Atomic and Molecular Physics including nanophotonics. This infrastructure is available for long and short term visitors. A full list of research infrastructure funded by FOM is available at www.fom.nl/uk/index.html under 'research' → 'facilities'.

The *national research institute TNO* not only participates in the above-mentioned Nanolab, but also includes some other specialized departments that can work for or with clients in order to transfer nanotechnology inventions. Since 1 January 2005, TNO consists of five core areas: Quality of Life; Defence, Security and Safety; Science and Industry; Environment and Geosciences; and Information and Communication Technology. Nanotechnology expertise is available in the core areas Quality of Life and Science and Industry.

Several Polytechnics include expertise on Microsystems and nanotechnology. Since 2004, the Polytechnics are not only educating engineers, but also employ lectors who are the leaders of knowledge circles of teaching staff. These knowledge circles are available for regional companies interested in collaborating on innovative projects. Relevant expertise and infrastructure for nanotechnology is available in Utrecht and in Heerlen (Zuyd University).

Leading industrial companies including *Philips* and *DSM* have opened campus like facilities for start up companies, in recent years. They make their expertise, facilities and business experience available to innovative businesses.

We have identified eleven infrastructure centres and five networks for nanotechnology (four are national and multidisciplinary, and one is international and focused on nanobio).

Name of centre	**Main areas of activity**	**Website**
AMOLF – Nanophysics	Nanofabrication and nanophysics. Also provides training.	http://www.amolf.nl
BIOMADE	Nanobio: emphasis on therapeutics, prophylactics and diagnostics	http://www.biomade.nl
DSM Research Campus	Nanoanalytical facilities.	http://www.dsm.com/en_US/html/campus/home.htm
K700, Hogeschool van Utrecht	Nanofabrication and analysis of microsystems.	http://www.umecc.nl/
MESA+, University of Twente	Multidisciplinary with analytical and fabrication facilities for external users. Also provides training and technology transfer.	http://www.mesaplus.utwente.nl/facilities/index.html
Nanofacility, Kavli Institute of Nanoscience, TU Delft	Nanofabrication.	http://nanofacility.dimes.tudelft.nl/
NanoLab NL – Groningen	Nanofabrication: (bio)molecular electronics and structures, optics, lithography.	http://www.rug.nl/msc/
NanoLab NL – TNO Science & Industry	Instrumentation for next generation of semiconductor chips (fabrication and analysis).	www.tno.nl ; http://www2.tno.nl/industrie_en_techniek/ ; www.planomers.com
Philips MiPlaza	Nanofabrication and technology transfer.	http://www.research.philips.com/institutes/index.html
TNO Quality of life	Nanobio : food, drugs and agrochemicals.	http://www2.tno.nl/kwaliteit_van_leven/index.xml
Zuyd University, Centre of Expertise Life Sciences (CEL)	Nanobio.	http://www.hszuyd.nl/cel

Norway

Population: 4.6 million (UN, 2005)

Capital: Oslo

GDP: $171.7 billion (2003 est.) **GDP per capita**: $37,800 (2003 est.)

Universities: 8

Introduction

Norwegian investment in R&D is in the lower half of EU and associated states (1.62% of GDP in 2001). The Norwegian Government set up the Nanotechnology and materials technology initiative (NANOMAT) in 2002 with a budget of 13.2 million euros (from 2002-2006).[12] The aim of this initiative is to enforce basic knowledge in order to pave the way for new knowledge-based and research intensive industry, and provide a sustainable revitalisation of established Norwegian industry. The programme aims at inducing research of high international quality. It sets two major priorities:

- to develop new materials, with the focus on functional materials
- to focus on selected parts of nanotechnology

In March 2005 the government announced an increase in public funding for research to 1% GDP (which brings the total fund to 50 billion NOK, or 6.1 billion euros, up to 2010). The new priorities are:

- internationalization including cooperation with the EU, N. America and Asia
- basic research
- boosting both public and private innovation

In these priorities, 3 areas of technology are highlighted including materials and nanotechnology. In addition, privately sourced support for basic research will gain a top-up of 25% through public funding. Also included in the new funding regime are "Centres for Research-driven Innovation" which will foster long-term cooperation between academia and industry.

We have identified two main centres of infrastructure in Norway and two national networks (one multidisciplinary the other focusing on chemistry and materials, nanobio, and fundamental research).

Name of centre	Main areas of activity	Website
Centre for Materials Science and Nanotechnology	Nanomaterials: catalysts, semiconductors, superconductors, magnetic materials, devices, sensors.	http://www.smn.uio.no/index.php
SINTEF	Nanoanalytical focussing on microsystems and sensors. Offers support to SMEs.	http://www.sintef.no/default.aspx?id=490

[12] http://program.forskningsradet.no/nanomat/en/index.html

Poland

Population: 38.5 million (UN, 2005)

Capital: Warsaw

GDP: $463 billion (2004 est.) **GDP per capita**: $12,000 (2004 est.)

Universities: 29

Introduction

Relative to the original members of the EU, Poland's investment in R&D is low (GERD of 0.67% as a percentage of GDP in 2001). However, the Polish government has taken the initiative to invest in nanotechnology research considering it as innovative and highly technological. The 5th and 6th Framework Programmes have given a great importance to the development of nanostructures and nanocomposites in Poland. Research centres are supported by both the European Commission and the Polish Ministry of the Science and Information Society Technologies.

In November 2000 the Polish State Committee for Scientific Research launched a Targeted Research Project (PBZ): "Metallic, Ceramic and Organic Nanomaterials: Processing – Structure – Properties – Applications". It was aimed at stimulating research in the field of nanomaterials in Poland and promoting closer scientific collaboration between researchers and the industrial entities in this field. The total funds of this project amounted to 3.1 m $. In the following year other PBZs were launched by the Polish State Committee for Scientific Research/ Polish Ministry of Science and Information Society Technologies.

The major research efforts in Poland are connected to nanostructure function, structural nanomaterials and advanced nanostructures. In the field of structural materials the major research potential is clustered around polymer nanocomposites and metallic materials. In the field of functional materials, these are materials for application in optics photonics, as well as magnetic metallic materials. Strong research is carried out in the direction of magnetic nanostructures and spintronics. Poland has achieved very important results in the field of blue light optoelectronics.

Special attention has been given in Poland to the Centres of Excellence and Centres of Advanced Technology. Centres of Advanced Technology (CZT) were created at the end of 2004, by groups of leading Polish Research Centres and Industrial companies, that will have priority in access to EC structure funds and long term Polish funding, with the aim to develop "poles of high technology" in various areas. Centres of Excellence (CD) are smaller structures, formed within existing organisations, with similar aims as Centres of Advanced Technology. The above two kinds of Centres are relatively new, so the profile of their activity will be known soon. However, it is worth watching their development, since it is likely many of them will play a major role in nanotechnology in future.

Large international companies active in Poland have their research centres in other countries. One exception is ASEA that opened a research centre in Poland, and is active in the field of nanotechnology.

In summary, the Institutes of Polish Academy of Sciences set up their Centres in the fields of nanotechnologies and nanosciences, knowledge based multifunctional materials and new production processes and devices, as have universities and other research entities throughout Poland. The Centres are well equipped with state of the art research facilities and serve as a technological platform and research centre for the national and international research community. They provide various incentives to attract different entities (national or international) to invest/donate in facilities or research projects within the Centres.

We have identified twenty-one infrastructure centres and eleven networks (four national and seven international) that are based in Poland.

Name of centre	Main areas of activity	Website
ABB Corporate Research Centres – Poland	Multidisciplinary offering commercial support to R&D.	http://www.abb.com/global/plabb/plabb046.nsf/viewUNID/50E7E3EB296C453CC1256B5700478DED
Centre Advanced Materials and Nanotechnology	Nanomaterials: physics and chemistry of condensed matter, materials science, electronics and photonics microsystems.	http://www.cmzin.pwr.wroc.pl/index_en.html
Centre for Knowledge Based Materials and Technologies	Chemical engineering, physics and nanomaterials.	Email: Prof. Dr. Ryszard J. Kaleńczuk rk@mailbox.ps.pl
Centre for Low Temperature Studies of Promising Materials for Applications CELTAM	Nanomaterials: nanoelectronics, spintronics, optoelectronics, non-linear optics and laser technology.	http://celtam.int.pan.wroc.pl/
Centre for Nanometre-scale Science and Advanced Materials	Nanomaterials: electronic, biological, liquid crystalline, magnetic, superconductors.	http://www.if.uj.edu.pl/NANOSAM/
Centre of Advanced Materials and Technology CAMAT & IZATEM	Nanomaterials: metallic, ceramic, polymeric and composite materials (synthesis and analysis).	http://tytan.inmat.pw.edu.pl/camat/
Centre of Advanced Technology and Materials for Opto- and Microelectronic	Nanoelectronics and optoelectronics.	Email: Assoc. Prof. Adrian Kozanecki kozana@ifpan.edu.pl
Centre of Excellence for Magnetic and Molecular Materials for Future Electronics	Nanomaterials: physics of magnetic and molecular (dielectric) nanostructured materials for future applications in novel electronics.	http://www.ifmpan.poznan.pl/mmmfe.htm
Centre of Excellence in Nano- and Microscale Characterization and Development of Advanced Materials (NAMAM)	Nanomaterials: R&D and offers training for external users.	http://www.namam.krakow.pl/
Centre of Excellence in Physics and Technology of Semiconductor Interfaces and Sensors	Nanoelectronics: semiconductor surface preparation and processing.	http://cesis.org.pl/
Centre of Excellence NAFCELLS: Nanomaterials for Fuel Cells	Energy: fuel cells (materials and properties).	http://nafcells.int.pan.wroc.pl/
Krakow Research Centre for Ion Engineering	Nanofabrication using ion beam methods for surface processing for different application sectors.	http://www.ionmed.agh.edu.pl/index.php?item=0
Micro- and Nano-Technology Applied Research Centre	Integrated microelectronic, micromechanical and optoelectronic systems and devices.	Email: Piotr Dumania, Ph.D. pdumania@ite.waw.pl

Name of centre	Main areas of activity	Website
Nanocrystalline Materials: Fabrication, Structure, Modelling, Properties and Applications – NanoCentre	Nanomaterials: processing, modelling and characterisation of structure and properties (particularly magnetic, intermetallic and hard coating materials).	http://www.nanocentre.inmat.pw.edu.pl/
New Technologies for Medical Applications: Studying and Production of Carbon Surfaces Allowing for Controllable Bioactivity	Nanomaterials: biomaterials particularly crystalline carbon synthesis at surface of materials used for orthopedic surgery, artificial organs implantation and other biomedical implementations including new tools for surgery and for diagnostic tests.	http://www.p.lodz.pl/NANODIAM/
Physics and Fabrication of Low Dimensional Structures for Technologies of Future Generations Centre	Nanomaterials: metallic, semiconductor and magnetic. New methods for processing and characterization.	http://info.ifpan.edu.pl/celdis/
Physics and Technology of Photonic Nanostructures CEPHONA	Nanophysics and photonics: microcavity physics, technology and applications; high power semiconductor lasers; new technologies for photonic devices and systems.	http://www.ite.waw.pl/cephona/index.php
Regional Laboratory of Physicochemical Analysis and Structural Research. Joint Center for Nanotechnology	Scanning probe microscopy; electron microscopy and X-ray microanalysis, spectroscopy.	http://www.chemia.uj.edu.pl/slafibs/index.htm
Sol-Gel Materials and Nanotechnology Centre of Excellence	Nanomaterials: glasses (porous and doped), nanocrystallites, optical sensors, sub-micron sphericle particles.	http://sgmn.immt.pwr.wroc.pl/
Thermodynamic Laboratory for Environmental Purposes	Nanochemistry: theoretical chemistry, physical chemistry and chemical engineering as well as applications of new methods in industrial technology.	http://ichf.edu.pl/Tales/English.htm
UNIPRESS: High Pressure Methods in Optoelectronics, Nanotechnology and Biotechnology Centre (PRENABIO)	Solid state physics, materials science and biotechnology as well as high pressure techniques. The largest high pressure research centre in West and Central Europe.	http://www.unipress.waw.pl/CE/

Portugal

Population: 10,566,212 (July 2005 est.)

Capital: Lisbon

GDP: $188.7 billion (2004 est.) **GDP per capita:** $17,900 (2004 est.)

Universities: 24

Introduction

Most developed countries exhibit high rates of R&D but the situation is considerably different in medium income countries such as Portugal. It is estimated that Portugal allocated 0.94% of its GDP to R&D activities in 2004, while the average for the EU is 1.95%. Nanotechnology research in Portugal is funded by the Ministry of Science.

We have identified four centres which make available research infrastructure to outside users. We have not identified any networks in Portugal.

Name of centre	Main areas of activity	Website
Atomic and Molecular Collisions Laboratory	Analytical using molecular beams.	http://www.df.fct.unl.pt
ICEMS – Instituto de Ciencia e Engenharia de Materiales e Superficies	Nanomaterials and thin films for industrial applications.	http://www.icems.ist.utl.pt/
LEPAE- Laboratory Process, Environmental and Energy Engineering	Engineering and materials: nanocapsules.	http://www.fe.up.pt/lepae/
INETI – Instituto Nacional de Engenharia e Tecnologia	Optical nanometrology, nanochemistry, colloidal drug delivery systems, molecular nanotechnology, nanostructured materials.	http://www.ineti.pt

Romania

Population: 22,329,977 (July 2005 est.)

Capital: Bucharest

GDP: $171.52 billion (2004 est.) **GDP per capita:** $7,700 (2004 est.)

Universities: 40

Introduction

Funding for R&D in Romania is much lower than the European average (GERD of 0.37% of GDP in 2003). However, the Romanian programme "New materials, micro and nanotechnologies – MATNANTECH" aims to develop and support the research focused on advanced materials, nanomaterials and nanotechnologies. Since 2001, when it was created, the program managed to gather the representative Romanian research and to finance interesting projects on new materials, nanomaterials and nanotechnologies, being more and more involved in developing the strategy of research in this field.

The strategic goals of MATNANTECH program are:

- Development of scientific knowledge in the field of science and engineering of new materials, micro and nanotechnologies
- Dissemination of results
- Transfer of results to practical applications, innovative and competitive products and technologies
- Development of partnerships between research and end-users
- Innovative application of new materials and technologies for environment and resource protection.

Through its thematic directions, the national R&D programme MATNANTECH responds to the need of integration of Romanian research into European Research Area (ERA). There is a certain correlation between the thematic fields as they are mentioned in European Commission documents and MATNANTECH work program.

We have identified three networks (CENOBITE, BIONANONET and NANOTECHNET) headquartered in Romania and two major centres which make infrastructure for nanotechnology research available to outside users.

Name of centre	Main areas of activity	Website
National Institute for Research and Development in Microtechnologies (IMT-BUCHAREST) – Centre of Nanotechnology	Nanomaterials and nanostructures, with main areas of expertise: silicon nanoelectrode arrays, low-frequency noise in nanostructured materials; porous silicon layers; field emission nanostructures; biofunctional nanostructures and interfaces.	http://www.imt.ro
Scientific, Research and Technological Engineering Institute in precision Mechanics (INCDMF)	Precision engineering and analysis.	www.cefin.ro

Slovenia

Population: 2 million (UN, 2005)

Capital: Ljubljana

GDP: $39.41 billion (2004 est.) **GDP per capita**: €19,600 (2004 est.)

Universities: 3

Introduction

The share of GDP invested in R&D in Slovenia is relatively high (1.53% in 2002). Furthermore, the country profits from well established international scientific co-operation and a relatively high number of researchers. According to the number of scientific publications per capita, Slovenia is close to the average of the OECD and EU. Slovenia is also well placed with the number of total researchers per 1000 workforce that is 4.7 researchers per 1000 workforce in 2002. This means 4642 (FTE) researchers working in Slovenia in 2002.

The country adopted its "Strategy of the Economic Development of Slovenia" and "The National Development Plan 2001-2006" in 2001, its second "Research and Development Act" in 2002 and "Guidelines for the National Research and Development Programme" in 2003. The "National Research and Development Programme 2004-2008" is still under preparation. The new Ministry for Higher Education, Science and Technology (MHEST) has been established at the end of 2004. The Slovenian Research Agency (ARRS) will take over most of the former funding activities of the old Ministry of Education, Science and Sport (MESS) in 2005. Using EU Structural Funds for the first time, MESS and ME launched in spring 2004 a call for centres of excellence in Slovenia which are under MHEST responsibility.

The most important centre is the Jožef Stefan Institute (IJS) in Ljubljana, which includes three departments with a focus on nanotechnology research. In addition, national centres of excellence are being established as networks of research institutes at the IJS. Project funding sources are partly governmental, private, and industrial. Furthermore, Slovenia takes part in many EU-projects.

We have identified one centre of infrastructure, one international (thin films, deposition methods) and three national (multidisciplinary and materials) networks in Slovenia.

Name of centre	Main areas of activity	Website
Jožef Stefan Institute	Several disciplines: nanomaterials (nanotubes, ceramics), electronics, nanophysics.	http://nano.ijs.si/

Spain

Population: 40,341,462 (July 2005 est.)

Capital: Madrid

GDP: $937.6 billion (2004 est.) **GDP per capita:** $23,300 (2004 est.)

Universities: 64

Introduction

The expenditure on research is comparatively below the European average, with Spanish Government R&D spending representing around 1.1% of the GDP. In general, it can be said that resources for nanotechnology research are scant, €1.5 million in 2003. These are mainly initiatives of individual researchers or the European Commission rather than the Government. The Ministry of Science and Technology modestly finances some activities.

There are other institutional efforts such as the creation of the Instituto de Nanotecnología y Nanobiotecnología, Centro de Nanotecnología de Aragón, and the creation of the Instituto de Nanotecnología y Diseño Molecular.

Although economic efforts devoted in Spain to promote R&D have increased during the last few years, they are still far below the level of most developed countries. The first general initiative concerning the support of nanotechnology was announced at the end of 2003, and is included within the Spanish R&D National Programme for the period 2004–2007.

In this report we have identified five major infrastructure centres and one network for nanotechnology in Spain. It is difficult to make a separation between investment completely devoted to nanotechnologies and those which include other technologies such as microtechnologies, molecular biology, etc.

There is one national and one international network in Spain. The national network is NanoSpain, which currently has 159 research groups and more than 1000 scientists. It was founded in 2003 by CMP Cientifica, and it was partially funded by the Spanish Ministry of Science and currently involves 158 partners. Some of its activities are: facilitate research planning and coordination, define objectives for the research and development needs that will ensure Spanish activities will be competitive with the developments in Europe, disseminate European research initiatives, increase collaborations between universities, research institutions and private and public companies, etc. The international network (BioPolySurf) is focussed on nanobio and nanomaterials.

Name of centre	Main areas of activity	Website
Centro Nacional de Microelectrónica	Nanoelectronics.	http://www.cnm.es
CIDETEC (Centre for Electrochemical Technologies)	Applied electrochemical technologies: energy, surface finishing, new materials.	http://www.cidetec.es/
Institute for Systems based on Optoelectronics and Microtechnology	Optoelectronics and microsystems. Also offers industrial cooperation, technology transfer and external services.	http://www.isom.upv.es
Instituto Biología Molecular de Barcelona (IBMB)	Nanobio.	http://www.ibmb.csic.es/
Instituto Universitario de Nanociencia de Aragón (INA)	Multidisciplinary: nanowires, spintronics, nano-particles, nano-bioengineering, medical applications.	http://ina.unizar.es/

Sweden

Population: 8.9 million (UN, 2005)

Capital: Stockholm

GDP: $255.4 billion (2004 est.) **GDP per capita:** $28,400 (2004 est.)

Universities: 24

Sweden has one of the highest global investment rates in R&D (4.27% of GDP in 2001). Government support for nanotechnology comes from two agencies of the ministry of education, NFR and TFR and through the Swedish Foundation for Strategic Research SSF. They fund(ed) ten consortia in materials science related to nanotechnology.

The Swedish agency for innovation systems *Vinnova* supports nanotechnology through two growth areas: Micro and Nanoelectronics; and Materials Design, including nanomaterials. In 2002, this agency for innovation systems launched a new programme, *Vinnväxt*, aimed at stimulating innovation and growth in the regions of Sweden. The budget is €40 million over ten years. A first batch of 25 projects started in July 2002. The second call, which closed in January 2003, received 50 proposals, with projects starting in July 2003. The aim is to foster innovation and regional development in a triple helix collaboration involving research, industry and government. It is not clear if nanotechnology is included among the selected projects. (Source: www.vinnova.se/innovreg/innovreg_en.htm)

In Swedish nanotechnology, the focus is mostly on metal nanotechnology including superconductors and quantum computing, and on semiconductor nanotechnology. At the Gothenburg University one specialises in experimental and theoretical nanophysics and nanoelectronics. There is also a small nanochemistry programme funded by the foundation for strategic research at the KTH Stockholm. http://www.nanochem.kth.se/nano/.

At Lund University a lot of effort is put into silicon nanotechnology research. These groups are led by Lars Samuelson chairman of the nanometer consortia. As a result of ongoing projects and developments in the Lund region as well as in Sweden in general a new research institute for Nanotechnology (ProNano AB) has been established. The institute offers the tools and other important resources for research in nanotechnology field.

In Sweden, there is one nanotechnology centre of excellence in Lund University (*The Nanometer Structure Consortium*), and one in Gothenburg. The Nanometer consortium at Lund University emphasises nanoscale materials science, fundamental nanoscience, nano-optics and quantum device physics.

We identified four national and two international networks for nanotechnology headquartered in Sweden. All national networks and one of the international networks are interdisciplinary, while the other focuses on quantum mechanics and materials. We also found five centres which make research infrastructure available to outside users. Three are university laboratories in Lund University, Chalmers University and Uppsala University. One of the others is a national research centre specializing in electronics, the fifth is operated by the Royal Institute of Technology (KTH).

Name of centre	Main areas of activity	Website
Acreo	Nanoelectronics with extensive international and industrial collaboration, cooperation, technology transfer and training.	www.acreo.se
MC2 Chalmers	Nanomaterials, devices and subsystems for electronics in the fields of microwave electronics, quantum devices, photonics, superconducting devices and circuits, and molecular electronics, etc.	http://www.mc2.chalmers.se/
Nanometer Structure consortium (Lund University)	Nanomaterials: physics, nanoelectronics and bio-sciences.	http://www.nano.ftf.lth.se/index.html
Ångström nanocentre	Nanomaterials: process and analysis. Funded by the EC under the Access to Research infrastructure action (covering visiting costs and use of infrastructure).	www.angstrom.uu.se/nanocentre
Electrum laboratory, KTH	Nano and microfabrication, advanced materials, training and technology transfer.	www.electrumlab.se

Switzerland

Population: 7.1 million (UN, 2005)

Capital: Bern

GDP: $239.3 billion (2003 est.) **GDP per capita**: $32,700 (2003 est.)

Universities: 10

Introduction

Switzerland invests approximately 3% of its GDP in R&D, making it one of the worldleaders. 80% of this expenditure is funded from the private sector and 14 out of every 1,000 employees work in R&D. Switzerland is active at linking academic research with industry to both bolster the quality and innovativeness of its research, and to ensure that its economy remains world class. It has 20 National Centres of Competence (NCCR) whose funding is voted for by parliament and in addition consists of funding from institutes, universities and from other sources including industry. One of these is the Nanoscale Science NCCR Network. All NCCR have the remit to promote long-term research projects in areas which are seen to be of strategic importance to Swiss science, economy and society. They must "conduct research of outstanding, internationally recognised quality, and actively foster knowledge and technology transfer, training, and the promotion of women researchers."

The Swiss Innovation Promotion Agency (CTI)[13], which is part of the Office for Professional Education and Technology (OPET), is responsible for bringing science to market through linking academic R&D with industry, thus strengthening market-orientated research and at the same time boosting funding for the academic research groups. The CTI has an annual budget to support innovative R&D collaborative projects between academia and industry (with industry supplying more than 50% of the costs). By 2007 it is expected that there will be over 1000 applications per year (since 1986 over 3700 projects have been funded). In addition there is specific funding available for start-ups, which has supported 64 projects since 1996, with 57 still operational. The CTI has 8 areas of activity including nanotechnology and Microsystems, and was also responsible for managing the TOP NANO 21 initiative which ran from 2000 to 2003 with the objectives of enhancing N&N in industry, academic R&D and academic training.

In this report we have identified eight major infrastructure centres and three networks (all of which are multidisciplinary).

[13] http://www.bbt.admin.ch/kti/aufgaben/e/index.htm

Name of centre	Main areas of activity	Website
Center of MicroNano-Technology (CMI)	Processing and fabrication. Clean room facilities and training available.	http://cmi.epfl.ch/organisation/presentation.html
CERN	Particle physics.	http://public.web.cern.ch/Public/Welcome.html
CSEM	Nanoelectronics and nanomaterials- from design to prototyping and manufacture. Offers technology transfer and support for SMEs.	http://www.csem.ch/homepage/
EMPA	Nanomaterials: bio, electronics, composites, powders, thin films.	http://www.empa.ch/
FIRST (Centre for Micro- and Nanoscience)	Processing, fabrication and analytical centre.	http://www.first.ethz.ch/
IBM Zurich Research Lab	Multidisciplinary with focus on electronics, analytics, spintronics.	http://www.zurich.ibm.com/st/nanoscience/index.html
Paul Scherrer Institut (PSI)	Analysis and metrology of various materials, process engineering and fabrication.	http://www.psi.ch/index_e.shtml
SAMLAB (IMT)	Sensors, actuators and microsystems. Developed innovative fabrication processes.	http://www-samlab.unine.ch/home.htm

Turkey

Population: 73.3 million (UN, 2005)

Capital: Ankara

GDP: $508.7 billion (2004 est.) **GDP per capita**: $7,400 (2004 est.)

Universities: 57

Introduction

Historically Turkey has invested poorly in research (GERD of 0.64% of GDP on R&D in 2000). However, in 2005 government investment more than doubled from 205 million USD (2004) to 525 million USD. Turkey has a number of bodies which are involved in determining R&D policy. The highest echelon is the Supreme Council of Science and Technology which consists of the Prime Minister, TÜBİTAK (the Scientific and Technical Research Council of Turkey), TÜBA (the Turkish Academy of Sciences), YÖK (the Higher Education Council of Turkey), TAEK (the Turkish Atomic Energy Council), Foreign Trade and the Treasury, and the Union of Chambers and Commodity Exchange of Turkey. Of these TÜBİTAK is tasked with preparing the agenda for the Supreme Council; and promoting, organizing and developing R&D strategies, which it does with financial and administrative autonomy. Turkish R&D policies revolve around five-year development plans with the main current priorities being information technology, advanced materials, biotechnology, space technology, and nuclear technology.

We have identified two infrastructure centres in Turkey.

Name of centre	Main areas of activity	Website
Central Laboratory (METU)	Multidisciplinary from fundamental to applied science.	http://centrallab.metu.edu.tr/
Micro-Nano Technologies Research Centre (Koç University)	Nanomaterials (production, processing and characterization), optoelectronics, MEMS and NEMS.	http://mint.ku.edu.tr/

United Kingdom

Population: 59.6 million (National Statistics, 2003)

Capital: London

GDP: $1.782 trillion (2004 est.) **GDP per capita**: $29,600 (2004 est.)

Universities: 114

Introduction

UK investment in R&D is in line with the EU average (GERD of 1.86% of GDP in 2003). UK funding for R&D is administered by a number of different agencies: the research councils (Engineering and Physical Sciences Research Council [ESPRC], the Biotechnology and Biological Sciences Research Council [BBSRC], the Medical Research Council [MRC]), a large number of charitable organizations (e.g. the Wellcome Trust, Leverhulme Trust, Cancer Research UK) and government departments such as the Department of Trade and Industry (DTI). All of these agencies provide funding for both research projects and infrastructure. In addition there are a large number of industrially funded projects in UK universities and institutes.

The UK demonstrated a very early interest in nanotechnology when in 1986 it proposed the National nanotechnology initiative (NION). This started with a benchmarking study to analyse the possibilities of nanotechnology for UK industry. The DTI along with regional development agencies, the EPSRC, BBSRC, and MRC, promotes and supports the UK nanotechnology industry. Like other industrialized countries, the UK identified nanotechnology as one of the priority areas for developing a knowledge based economy. In 2003 the Science and Technology Department announced a £90m nanotechnology initiative with an additional £20m announced in 2005. The UK Government has identified the following sectors as the potential areas where nanotech will bring a considerable impact on British economy:

- Healthcare
- Advanced Materials
- Manufacturing
- Energy
- Communication

The UK boasts the largest number of post graduate N&N programmes in Europe, along with various undergraduate programmes and short courses. The UK has also placed much importance to the social, ethical and environmental issues of Nanotechnology. In 2003 the government commissioned the Royal Society and the Royal Academy of Engineering to "carry out an independent study of likely developments and whether nanotechnology raises or is likely to raise new ethical, health and safety or social issues which are not covered by current regulation." A report (Nanoscience and nanotechnologies: opportunities and uncertainties)[14] detailing the findings and recommendations of the study was published in 2004, following a series of meetings with experts and stakeholders, and interviews with cross-sections of the public. In addition to this, various organizations such as the Institute of Occupational Medicine (IOM), and initiatives such as the SnIRC (safety of nanomaterials Interdisciplinary Research Centre) are giving these issues more importance than before.

[14] Nanoscience and nanotechnologies: opportunities and uncertainties (http://www.nanotec.org.uk/finalReport.htm)

We have identified twenty-two major centres of infrastructure in the UK, however there are also a large number of other facilities in different Universities. There are a number of Interdisciplinary Research Collaborations (IRC) which focus on different areas of nanosciences and nanotechnologies (N&N) and involve major universities such as Oxford, Cambridge, London, Glasgow, and industrial stakeholders. Some of the other important centres include the London Centre for Nanotechnolgy, INEX, Rutherford Appleton Laboratory (RAL), and the National Physical laboratory (NPL). We have identified eighteen networks which are coordinated from the UK, nine of which are international. The national networks support most N&N sectors with two having a focus on business support (the Micro and NanoTechnology [MNT] Network and the NanoMicroClub).

Name of centre	**Main areas of activity**	**Website**
Advanced Materials Department & Nanotechnology (Cranfield University)	Nanomaterials: processing and characterization, to MEMS prototyping.	http://www.cranfield.ac.uk/sims/materials/nanotech/
Advanced Materials Research Institute (AMRI) (Northumbria University)	Nanomaterials: surface engineering, corrosion and wear. Has 5 core functions: research, education, technology transfer, consultancy, and training.	http://amri.unn.ac.uk/soeindex.asp
CCLRC Daresbury Laboratory	Synchotron, surface and structure analysis of materials.	http://www.cclrc.ac.uk/Activity/DL;
Centre for Self-Organising Molecular Systems (SOMS) (University of Leeds)	Self-assembling nanostructures for electronic, sensor and medical applications.	http://www.soms.leeds.ac.uk/index.html
Industrial Centre of Particle Science and Engineering (University of Leeds)	Nanoparticle synthesis, measurement and characterization. Offered as a service to external users.	http://www.particletechnology.org/
INEX	Nanomaterials and nanofabrication: semiconductors and biomaterials. Also offers technology transfer and training courses.	http://www.inex.org.uk/
Institute of Industrial Materials and Manufacturing (IIMM)	Nanomaterials (world-class research centre). Offers support and training to industry.	http://www.materials.ox.ac.uk/IIMM/home.html
IRC in Nanotechnology	Multidisciplinary with focus on fabrication, self-assembly, mechanical and electronic properties of materials, training. Collaboration between Universities of Cambridge, Bristol and University College London.	http://www.nanoscience.cam.ac.uk/irc/index.html
Kelvin Nanotechnology Ltd	Nanoelectronics, bioelectronics and optoelectronics: fabrication and characterization.	http://www.kelvinnanotechnology.com/index.html
London Centre for Nanotechnology (LCN)	Multidisciplinary purpose built centre with labs on 8 levels.	http://www.london-nano.ucl.ac.uk/lcn/index2.htm
Manchester Centre for Mesoscience and Nanotechnology	Nanomaterials and structures: fabrication and characterization.	http://www.cs.man.ac.uk/nanotechnology/index.htm

Name of centre	Main areas of activity	Website
Materials Analysis & Research Services (MARS) Centre for Industrial Collaboration (Sheffield Hallam University)	Nanomaterials and analysis.	http://extra.shu.ac.uk/marscic/index.html
Microengineering and Nanotechnology Research Centre (University of Birmingham)	Nanofabrication and processing: electronics, ceramics, thin-films.	http://www.crnnt.bham.ac.uk/fabrications.htm http://www.micro-nano.bham.ac.uk/
NanoMaterials Rapid Prototyping Facility (University of Southampton)	Nanofabrication: electronic and optoelectronics.	www.nanomaterials.soton.ac.uk
Nanotec NI	Nanofabrication and characterization: electronics, MEMS, bio-sensors, nanobio, coatings, magnetic storage, photonics.	http://www.nanotecni.com/index.html
Nanotechnology Research Institute (University of Ulster)	Nanofabrication and nanobio: bio-sensing, tissue-engineering, drug delivery, surface science, nanotubes, plasma technology, nano-scale patterning, nano-scale manipulation.	http://www.engineering.ulster.ac.uk/nri/overview.html
National Physical Laboratory (NPL)	Nanoanalytics and metrology: bio, electronics, chemistry, optics, structure, fabrication.	http://www.npl.co.uk/nanotech/
Nottingham Micro Nano Technology (MNT) Centre	Nanofabrication and characterization with focus on health and pharma.	http://www.biocity.co.uk/
Oxford Bionanotechnology IRC	Nanobio: molecular machines, functional membrane proteins, bionanoelectronics and photonics. Collaboration between Universities of Oxford, Glasgow and York and the MRC's National Institute for Medical Research.	www.physics.ox.ac.uk
Rutherford Appleton Laboratory (RAL) Central Microstructure Facility	Nanofabrication and prototyping based on E-beam and semiconductor equipment.	http://www.cmf.rl.ac.uk/index.html
Scottish Microelectronics Centre (SMC)	Nanoelectronics: design, fabrication and characterization.	http://www.see.ed.ac.uk/research/IMNS/SMC/index.html http://www.see.ed.ac.uk/IMNS/facilities/labcap.html
Surrey Ion Beam Centre at the University of Surrey	Ion beam for material analysis, electronics and bio-medical applications.	http://www.ee.surrey.ac.uk/Research/SCRIBA/ibc/

Networks

A total of 144 N&N networks were identified in this report. Of these 80 are national and 64 international networks. Germany has the largest number of national networks (22), followed by the UK (9). France, the Netherlands, and Poland each have 4 national networks. This data is summarized in Figure 2.

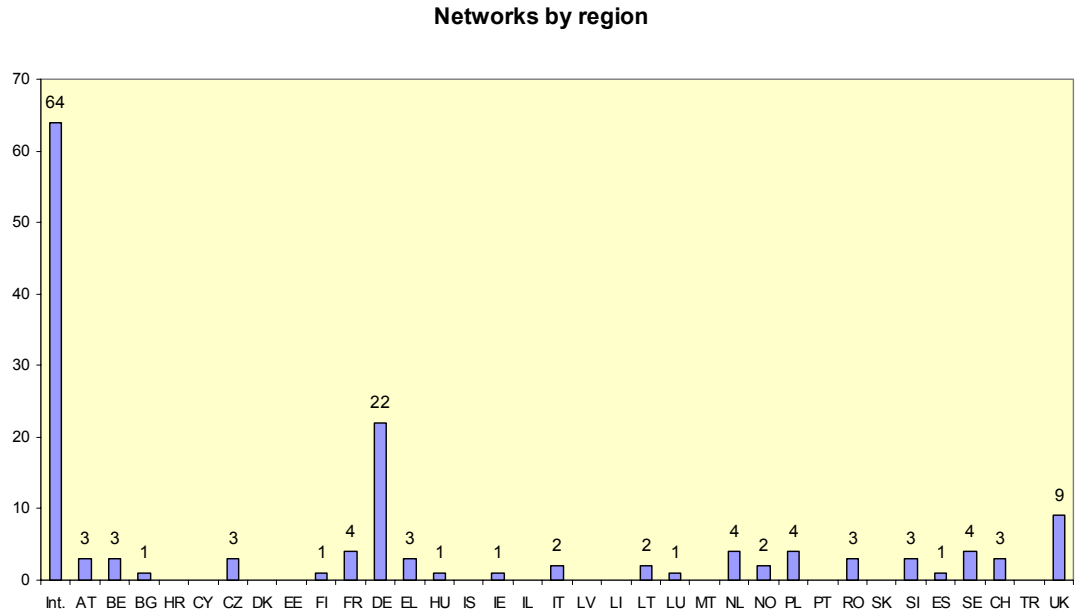

Figure 2. N&N networks in the EU and associated states. A total of 144 networks were identified.

Networks listed in this report have been categorized as follows:

- All disciplines
- Chemistry and Materials
- Nanobiotechnology
- Electronics
- Physics
- Analytical and Diagnostic Tools
- Engineering and Fabrication
- Energy

Figure 3 shows a breakdown of networks based on the disciplinary area that each covers, and Figure 4 shows how the international networks compare with national networks. It should be noted that most networks involve several disciplines and many cover all.

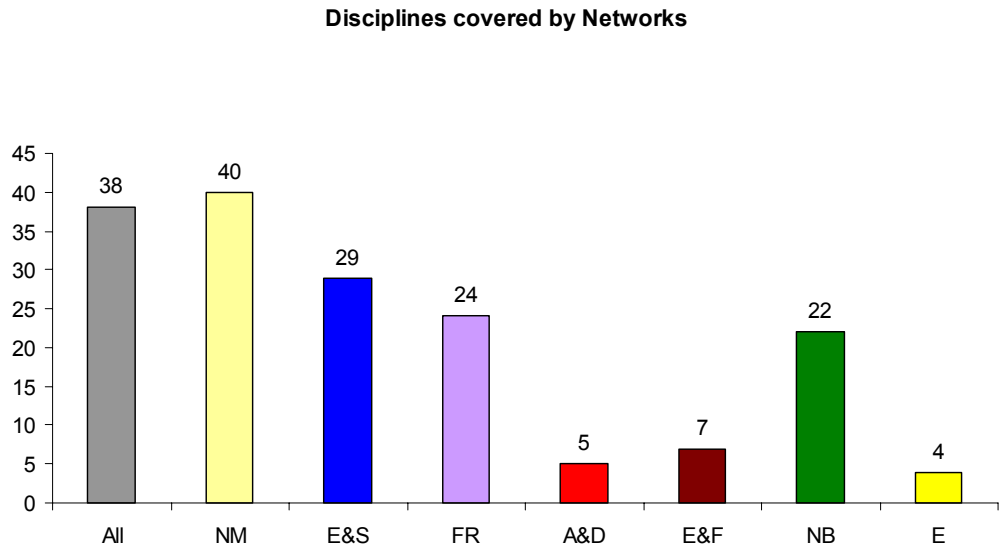

Figure 3. Breakdown of 144 EU N&N networks based on area covered: **NM** nanomaterials, **E&S** electronics and systems, **FR** fundamental research, **A&D** analytical and diagnostics, **E&F** engineering and fabrication, **NB** nanobiotechnology, **E** energy.

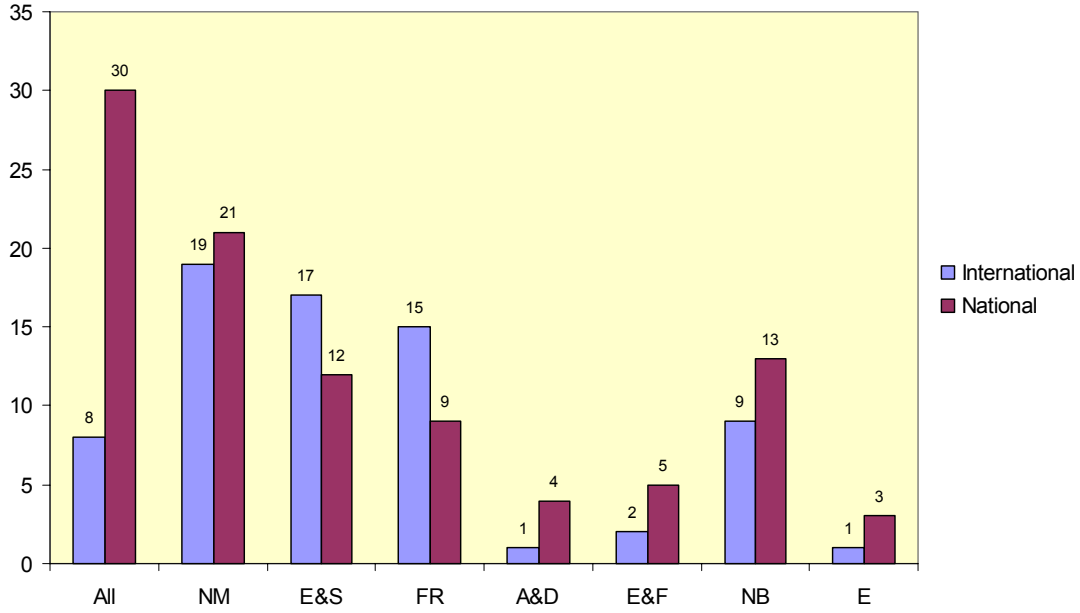

Figure 4. Comparison of international and national networks based on area covered: **NM** nanomaterials, **E&S** electronics and systems, **FR** fundamental research, **A&D** analytical and diagnostics, **E&F** engineering and fabrication, **NB** nanobiotechnology, **E** energy.

38 (or 26.4%) of all N&N networks in the EU and associated states cover all disciplines. The most common type of thematic network focuses on nanomaterials (40 or 27.8%). This is followed by electronics (29 or 20.1%), fundamental research (mainly physics and chemistry) by 24 networks (16.7%), nanobiotechnology (22 or 15.3%), engineering and fabrication (7 or 4.9%), analytical and diagnostic tools (5 or 3.5%), and energy (4 or 2.8%).

International networks tend to be more specialized (37.5% of national networks support all disciplines compared with 12.5% of international networks). However in two areas (Analytical and Diagnostics, and Energy) most of the relevant networks are national.

The following pages list the networks by country and discipline. Further information on each network can be found in the appendix to this report, which can be downloaded from the Nanoforum website.[15]

[15] The Nanoforum publications section of the website is accessible from the home page. Alternatively click on the link below:
http://www.nanoforum.org/index.php?struktur=5&modul=loadin&folder=125&code=1595af6435015c77a7149e92a551338e&userid=1363830&wb=125251&

Name of network	Coordinator	Website	Discipline	Region covered
4M (Multi-Material Micro Manufacture)	4m_info@4m-net.org	http://www.4m-net.org/	ICT, NEMS/MEMS	International
ALISTORE	Jean Marie Tarascon	http://dbs.cordis.lu/fep-cgi/srchidadb?ACTION=D&SESSION=141762005-7-20&DOC=28&CALLER=FP6_PROJ&TBL=EN_PROJ&RCN=EP_RCN:73970	Energy	International
AMAS-ISN: International Scientific Network for Advanced Materials and Structures	Prof. W.K. Nowacki wnowacki@ippt.gov.pl	http://www.ippt.gov.pl/amas-isn/index.php	Materials	International
AMICOM	Robert Plana plana@laas.fr	http://www.amicom.info/	Electronics, MEMS/NEMS	International
ARRESTED MATTER	Prof. Kenneth Dawson kenneth@fiachra.ucd.ie	http://mc-opportunities.cordis.lu/show-PRJ.cfm?obj_id=4482	Chemistry, physics	International
ASSEMIC	Dr. Werner Brenner Werner.Brenner@TUWien.ac.at	http://www.assemic.net/	Tools and techniques	International
ATOM CHIPS	Dr. Chris Westbrook Christoph.westbrook@iota.u-psud.fr	http://www.iota.u-psud.fr/~atomchip/	Physics	International
BE-NANO - "Nano-technologies"	Baudouin JAMBE, Attaché b.jambe@mrw.wallonie.be	http://mrw.wallonie.be/dgtre/progmobi.htm	physics; nanobio; materials science	International
BIOMIMETIC SYSTEMS	Dr. Angelo Valleriani PMOBiomimeticSystems@mpikg-golm.mpg.de	http://www.biomimeticsystems.org/	Nanobio, nanomaterials	International
BIOPOLYSURF	Jose Carlos Rodriguez-Cabello cabello@eis.uva.es	http://www.biopolysurf.net/	Nanobio, nanomaterials	International
BMG-RTN	Professor Alain Reza Yavari euronano@ltpcm.inpg.fr	http://www.inpg.fr/BMG-RTN/	Materials (glass)	International
COST D21 Metalloenzymes and chemical biomimetics	Professor Luigi Casella bioinorg@unipv.it	http://costchemistry.epfl.ch/docs/D21/d21-main.htm	Nanobio	International
COST 288- Nanoscale and ultrafast photonics	Dr. Judy M. Rorison judy.rorison@bristol.ac.uk	http://www.een.bristol.ac.uk/cost288/home.html	ICT	International
COST 527 Plasma Polymers and Related Materials	Prof. Hynek Biederman bieder@mbox.troja.mff.cuni.cz	http://www.troja.mff.cuni.cz/~cost527/	physics; chemistry	International
COST Action 525- Advanced Electroceramics: Grain Boundary Engineering	Dr. Robert Freer robert.freer@umist.ac.uk	http://www2.umist.ac.uk/material/research/cost525/index.htm	Electronics and nanomaterials	International

Name of network	Coordinator	Website	Discipline	Region covered
COST Action 528- Chemical Solution Deposition of Thin Films	Prof. Marija Kosec marija.kosec@ijs.si	http://www.imem.cnr.it/cost528/index.html	Thin films, Deposition methods	International
COST action P12 "Structuring of Polymers"	Prof. Dr. Christoph Schick christoph.schick@physik.uni-rostock.de	http://www.uni-rostock.de/fakult/manafak/physik/poly/COST%5FP12/	Materials, Polymers	International
COST Action P8 "Materials and Systems for Optical Data Storage and Processing	Prof. Hans J. Eichler eichler@physik.tu-berlin.de	http://moebius.physik.tu-berlin.de/COST_P8/index_ie.html	Nano-optics	International
COST D14 Functional molecular materials	Prof. F.C. de Schryver frans.deschryver@chem.kuleuven.ac.be	http://cost.cordis.lu/src/action_info/ActionD14.cfm	physics; chemistry	International
COST D19: Chemical Functionality Specific to the Nanometer Scale	Prof. Rolf Hempelmann r.hempelmann@mx.uni-saarland.de	http://cost.cordis.lu/src/action_detail.cfm?action=D19	Chemistry	International
COST D22- Molecular Interactions of the Lipid-Protein Interface	Dr Hannelore RÖMICH hroemich@cost.esf.org	http://cost.cordis.lu/src/action_detail.cfm?action=d22	Nanobio	International
COST D33- Nanoscale Electrochemical and Bio-processes (Corrosion) at Solid-aqueous Interfaces of Industrial Materials	Dr. Wolfgang Sand sand@mikrobiologie.uni-hamburg.de	http://cost.cordis.lu/src/action_detail.cfm?action=D33	Chemistry	International
COST D35- From Molecules to Molecular Devices: Control of Electronic, Photonic, Magnetic and Spintronic Behaviour	Professor Antonin Vlcek a.vlcek@qmul.ac.uk	http://cost.cordis.lu/src/action_detail.cfm?action=d35	Electronics; photonics, magnetics and spintronics	International
COST P13: Forging the missing link: From Molecular Simulations to Nanoscale Experiments	Hendrik Monard monh@belspo.be	http://cost.cordis.lu/src/action_detail.cfm?action=p13	Physics	International
DUCTILE BMG COMPOSIT	Dr. Alain R. Yavari Euronano@Itpcm.inpg.fr	http://mc-opportunities.cordis.lu/show-PRJ.cfm?obj_id=4481	Nanomaterials	International
ENCAST	Peter van Daele peter.vandaele@intec.ugent.be	http://www.gooddie.net/gd_frameset.htm	Electronics	International
Erasmus Mundus Master of Nanoscience and Nanotechnology	Prof. Karen Maex maex@imec.be	http://www.ftw.kuleuven.ac.be/english/erasmusmundus.shtml	physics, chemistry, nanobio, and materials science	International
European Nanobusiness Association	info@nanoeurope.org	http://www.nanoeurope.org	All	International
Europractice, EC DG INFSO	Dr. Gisele Roesems gisele.roesems@cec.eu.int	http://www.europractice.com	Electronics	International

Name of network	Coordinator	Website	Discipline	Region covered
Euspen	Dr. Theresa Burke info@euspen.org	http://www.euspen.com/	Precision engineering, micro-engineering and nano-technology tools	International
GlycoGold	Dr. Johannis P. Kamerling j.p.kamerling@chem.uu.nl	http://mc-opportunities.cordis.lu/show-PRJ.cfm?obj_id=9000	Nanobio, medicine	International
GOSPEL	Udo Weimar upw@ipc.uni-tuebingen.de	http://www.gospel-network.org/	Nanobio, electronics	International
International Network ADMA: Advanced Materials, Parts and Devices for Use in Informatics, Telecommunications, Electronic, Automatics & Robotics and Medicine	Zdzisław Librant libran_z@itme.edu.pl	http://www.adma.edu.pl/ang/home_page_ang.php	All	International
International Scientific Network of Nano and Microtechnology (NaMic)	Witold Lojkowski wl@unipress.waw.pl	http://www.unipress.waw.pl/NaMic	Materials-nanopowders and fibres	International
Magnetic Nanomaterials Scientific Network	Prof. Tadeusz Kulik tkulik@inmat.pw.edu.pl	http://www.nanocentre.inmat.pw.edu.pl/networks.html	Materials- Thin films; soft magnetic materials; hard magnetic materials	International
MAGNETIC NANOSCALE PARTICLES (Correlation of Structure and Magnetism in Novel Nanoscale Magnetic Particles)	Prof. Michael Farle farle@uni-duisburg.de	http://ttphysik.uni-duisburg.de/RTN/	Magnetic Nanoparticles	International
METAMORPHOSE	Sergei Tretyakov Sergei.tretyakov@tkk.fi	http://www.metamorphose-eu.org/	Nanomaterials, electronics	International
MINT - MIcrosystem and NanoTechnology Network	Noël Parmentier noel.parmentier@imec.be	http://www.imec.be/mint/	All	International
MNT Europe - Staircase towards European *MNT* Infrastructure Integration	JOLY Jean Pierre contact-this-project-via@cec.eu.int	http://dbs.cordis.lu/fep-cgi/srchidadb?ACTION=D&SESSION=136702005-7-22&DOC=3&TBL=EN_PROJ&RCN=EP_CT_D:Integrating%20activities%20implemented%20as%20Integrated%20Infrastructu&CALLER=FP6_PROJ	All	International
MULTIMAT	Prof.Dr. Dominique Schryvers Nick.schryvers@ua.ac.be	http://webhost.ua.ac.be/multimat/	Nanomaterials	International
Nano Øresund	info@nano-oresund.org	http://www.nano-oresund.org/	All	International

Name of network	Coordinator	Website	Discipline	Region covered
Nano2life	Françoise Charbit admin@nano2life.net	http://www.nano2life.org	Nanobio	International
Nanobeams	Henri-Noël Migeon migeon@crpgl.lu	http://www.crpgl.lu/fr/apropos/nanobeams.php3	Nano-analytics	International
Nanocluster (Monodispersed Inorganic Nanoclusters as Building Blocks for Functional Materials)	Prof. Peter LIEVENS hannah-lockwood@euspen.com	http://www.fys.kuleuven.ac.be/vsm/projects/nanocluster/index.html	Physics	International
Nanoforum	Mark Morrison mark@nano.org.uk	www.nanoforum.org	All	International
NANOMAT	Dr. Elisabetta Borsella borsella@padova.infm.it	http://www.padova.infm.it/nanomat/Home.htm	Materials	International
Nanomaterials as Catalysts for New, Environmentally Friendly Processes	prof. dr hab. Małgorzata Witko ncikifp@cyf-kr.edu.pl ncwitko@cyf-kr.edu.pl	http://atom.ik-pan.krakow.pl/siec/index.html	Materials	International
NANOQUANT	Hans Ågren agren@theochem.kth.se	http://www.kth.se/forskning/pocket/project.asp?id=20665	Quantum mechanics, nanomaterials	International
NANOSTIM	Andrzej Dworak	http://dbs.cordis.lu/fep-cgi/srchidadb?ACTION=D&SESSION=141762005-7-20&DOC=24&CALLER=FP6_PROJ&TBL=EN_PROJ&RCN=EP_RCN:73566	Nanomaterials	International
NANOTEMP	Prof. Malcolm L. H. Green malcolm.green@chem.ox.ac.uk	http://www.nanotemp.org/	Nanomaterials	International
NAoMITEC	Piero Bufalini naomitec@airi.it	http://www.airi.it/NAOMITEC/index.htm	All	International
NEMO	Hugo Thienpont hthienpo@vub.ac.be	http://www.micro-optics.org/	Optics, photonics	International
New Materials for Magneto-electronics MAG-EL-MAT	Doc. dr hab. Bogdan Idzikowski Bogdan.Idzikowski@ifmpan.poznan.pl	http://www.ifmpan.poznan.pl/MAG-EL-MAT/Main/index_en.php	Materials- Spin electronics, magnetic nanostructures, magnetic materials, magnetoelectronic systems,	International
PARSEM	Dr. Philomela Komninou komnhnoy@auth.gr	http://parsem.physics.auth.gr/	Semiconductors, physics	International
PATENT	Andrew Richardson a.richardson@lancaster.ac.uk	http://www.patent-dfmm.org/	All, enterprise and innovation	International
PHOREMOST	Clivia Sotomayor Torres Clivia.sotomayor@nmrc.ie	http://www.phoremost.org/index2.htm	Photonics	International
PLASMO-NANO-DEVICES	Alain Dereux alain.dereux@u-bourgogne.fr	http://www.plasmonanodevices.org/	Photonics	International

Name of network	Coordinator	Website	Discipline	Region covered
POLYAMPHI	Prof. Axel Muller Axel.Mueller@uni-bayreuth.de	http://www.polyamphi.org/	Chemistry	International
Quantum Size Effects in Nanostructured Materials	Prof. Dr. Yvan Bruynseraede yvan.bruynseraede@fys.kuleuven.ac.be	http://www.fys.kuleuven.ac.be/vsm	physics	International
SANDiE – Self-Assembled semiconductor Nanostructors for new Devices in photonics and Electronics	Prof. Dr. Marius Grundmann grundmann@physik.uni-leipzig.de	http://www.sandie.org	Electronics, Semi-conductor, Self-assembly, Photonics	International
ScanBalt	Peter Frank pf@scanbalt.org	http://www.scanbalt.org/	nanobio	International
SINANO (silicon Based nanodevice)	Francis balestra balestra@enserg.fr	http://www.sinano.org/	Electronics	International
Supramolecular Chemistry and Catalysis	Prof. F.C. de Schryver frans.deschryver@chem.kuleuven.ac.be	www.chem.kuleuven.ac.be/research/mds/new_page_5.htm	physics; chemistry	International
SyntOrbMag - Synthesis and Orbital Magnetism of core-shell nanoparticles	Prof. Dr. Michael Farle farle@uni-duisburg.de	http://agfarle.uni-duisburg.de/SyntOrbMag/	Magnetism, Nanoparticles, Synthesis	International
Nanonet-Styria	DI Helmut Wiedenhofer helmut.wiedenhofer@joanneum.at	http://www.nanonet.at	All	Austria
MNA Networking, Micro@Nano-Fabrication-Austria	1.) O.Univ.-Prof. Dr. Friedemar Kuchar 2.) Dr. Ernest J. Fantner physics@notes.unileoben.ac.at ernest.fantner@ims.co.at	http://www.mna-nano.at	Materials and fabrication	Austria
w-Inn West Austrian Initiative for NANO Networking	Dr. Gundula Weingartner g.weingartner@winn.at	http://www.winn.at	Materials, nanobio, sensors	Austria
NanoWal Wallonia Network for Nanotechnologies	Françoise Remacle fremacle@ulg.ac.be	http://www.nano.be/Index.html	All	Belgium
BE-NANOTECH3	Rudi Stevens rs@iwt.be	http://www.iwt.be/	All	Belgium
National Centre on Nanotechnology (NCNT)	Iovka Dragieva iovka@cleps.bas.bg	http://www.bas.bg/nano/	Physics; Chemistry & Materials; Fundamental Research & Engineering; Metrology (diagnostics & analysis)	Bulgaria
Academy of Sciences of the Czech Republic (ASCR)	info@cas.cz	http://www.cas.cz/index.html.en	All	Czech Republic
MOVPE	Dr. Eduard Hulicius hulicius@fzu.cz	http://www.fzu.cz/departments/semiconductors/movpe/index.php	physics; electronics; chemistry	Czech Republic
Czech Nano-Team	Dr Jan Kočka kocka@fzu.cz	http://www.fzu.cz/~nanoteam/members/index.php	Physics	Czech Republic

Name of network	Coordinator	Website	Discipline	Region covered
The Czech Society for New Materials and Technologies (CSNMT)	Ing. K. Sperlink, C.Sc. tastech@sl.inext.cz	http://www.tms.org/International/CSNMT.html	materials science; electrical engineering	Czech Republic
Nano.fi (Nanotechnology in Northern Europe)	Pekka Koponen info@spinverse.com info@nano.fi	http://www.nano.fi	All	Finland
R3N	na	na	Nanobiosciences, materials and electronic nanodevices.	France
OMNT: Observatory for Micro and nanotechnologies	Stephane Fontanell omnt@cea.fr	www.omnt.fr	All	France
Research Network in Micro and Nano Technologies (RMNT)	René Roussille rmnt@technologie.gouv.fr	www.rmnt.org	All	France
Club micro nanotechnologies	Claude Puech nanotech@bp.univ-evry.fr	www.clubnano.asso.fr	All	France
NanoNetzWerk Hessen	Dr. Beatrix Kohnke management@nanonetzwerkhessen.de	http://www.nanonetzwerkhessen.de	All	Germany
ENNaB - Excellence Network Nano-BioTechnology	Dipl.-Phys. Hagen Göttlich goettlich@lrz.uni-muenchen.de	http://www.ennab.de	Nanobio	Germany
HanseNanoTec	Heiko Fuchs hfuchs@physnet.uni-hamburg.de	http://www.hansenanotec.de	All (focus on nanoanalytics)	Germany
UPOB - Competence Centre for ultraprecision surface engineering	Dr. Uwe Brand uwe.brand@upob.de	http://www.upob.de	Production techniques, machines, metrology, sensors and materials	Germany
NanOp	Matthias Kuntz nanop@sol.physik.tu-berlin.de	http://www.nanop.de	Nano-Optics, Lateral Nanostructures, Optoelectronics, Nanoanalytics	Germany
NanoBioTech	Dr. Kerstin Krauß krauss@physik.uni-kl.de	http://www.cc-nanobiotech.de	Nanobio	Germany
NanoChem - Network of Excellence for Chemical Nanotechnology	Dr. Marius Kölbel koordination@cc-nanochem.de	http://www.cc-nanochem.de	Materials	Germany
UFS - Centre of Competence "Ultrathin Functional Films"	Dr. Ralf Jäckel ralf.jaeckel@iws.fraunhofer.de	http://www.nanotechnology.de	Ultra-thin films; Nanoelectronics	Germany
NanoMat	Dr. Regine Hedderich regine.hedderich@int.fzk.de	http://www.nanomat.de	Materials	Germany
Fraunhofer Nanotechnology Alliance	Dr. Karl-Heinz Haas haas@isc.fraunhofer.de	http://www.fraunhofer.de/fhg/EN/profile/alliances/Nanotechnology.jsp	Materials: Coatings, Nanoparticles	Germany

Name of network	Coordinator	Website	Discipline	Region covered
NanoCluster for Information Technology in Northrhine-Westfalia	Maike Meyer meyer@amo.de	http://www.amo.de/nrwnanocluster.html	Nanoelectronics	Germany
NanoBio NRW	Dr. Holger Winter hw@centech.de	http://www.nanobionrw.de/	Nanobio	Germany
Nanotechnology for Power Engineering	Dr. Uwe König u.koenig@zbt-duisburg.de		Power Engineering, Energy	Germany
Competence Centre for Nanoanalytics	Claas Sudbrake cs@centech.de	http://www.cc-nanoanalytik.de	Nanoanalytics, Microscopy	Germany
FORNEL - Bavarian Research Cooperation for Nanoelectronics	Dr. Bernd Fischer bernd.fischer@iisb.fraunhofer.de	http://www.abayfor.de/fornel/en/index.php	Electronics	Germany
FORCARBON - Bavarian Research Cooperation for Carbon-based Materials	Dr.-Ing. Stefan M. Rosiwal Stefan.Rosiwal@ww.uni-erlangen.de	http://www.abayfor.de/forcarbon/en/index.php	Materials (carbon-based)	Germany
NanoBioNet - The Centre of Excellence of Nano biotechnology	Dr. med. Rainer Hanselmann hanselmann@nanobionet.de	http://www.nanobionet.de/eng.htm	Nanobio	Germany
Nanotechnology programme of the Helmholtz Association	Dr. Rainer Nicolay Rainer.Nicolay@helmholtz.de	http://www.helmholtz.de/en/Research_Fields/Key_Technologies/Nano-_and_Microsystems.html	Materials	Germany
RWTH- NanoClub	Dr. rer. nat. Marion E. Franke nanoclub@rwth-aachen.de	http://www.nanoclub.rwth-aachen.de/english.html	All	Germany
Lifescience Bavaria	Dr. Matthias Konrad konrad@bayern-innovativ.de	http://www.lifescience-bavaria.de	Nanobio	Germany
Nanotechnologie-Verbund NRW e.V.	Prof. Dr. Wolfgang Fahrner wolfgang.fahrner@fernuni-hagen.de	http://www.nanotech-nrw.de/index_Engl.html	Tools and techniques	Germany
BioMeT Dresden	Dr. Claus Martin contact@gwtonline.de	http://www.biomet.de	Nanobio	Germany
MICROELECTRONICS, MICROSYSTEMS, NANOTECHNOLOGY (MMN) NETWORK	Dr. A. Nassiopoulou A.Nassiopoulou@imel.demokritos.gr	http://www.imel.demokritos.gr/Diktua/MMN_Network_Home.html	Electronics	Greece
Scientific Society "MICRO&NANO"	Dr. A. Nassiopoulou A.Nassiopoulou@imel.demokritos.gr	http://www.imel.demokritos.gr/micro_nano/	All	Greece
NANONET	Prof. Stergios Logothetidis logot@auth.gr	http://www.auth.gr/nanonet/en_site/home_en.htm	All	Greece

Name of network	Coordinator	Website	Discipline	Region covered
Hungarian Network for Nanoscience and Technology	Dr. Erika Kálmán kale@chemres.hu	www.nanoscience.hu	Chemistry	Hungary
The Irish Nanotechnology Association	editor@nanotechireland.com	http://nanotechireland.com/index.html	All	Ireland
Nanotec IT	Elvio Mantovani info@nanotec.it	http://www.nanotec.it/eng/index_eng.html	All	Italy
Veneto Nanotech	info@venetonanotech.it	http://www.venetonanotech.it/index_eng.htm	Materials and analytics	Italy
Lithuanian Nanoscience and Nanotechnology network	Prof. Valentinas Snitka vsnitka@ktu.lt	http://www.microsys.ktu.lt/	All	Lithuania
NENNET	MSI, Institute of Lithuanian scientific society	na	Materials and energy	Lithuania
SurfMat Cluster	Mr Ian Cresswell ian.cresswell@luxinnovation.lu	http://www.surfmat.lu	Materials	Luxembourg
MinacNed	M. van den Berg m.van.den.berg@fhi.nl	http://www.minacned.nl	All	Netherlands
NanoNed	(Secretary) monique@stw.nl	http://www.nanoned.nl (for English, click upper left button "Nanoned")	All	Netherlands
MicroNed	Prof. dr. ir. A. van Keulen F.vanKeulen@wbmt.tudelft.nl	na	All	Netherlands
Virtueel kennisloket, miniaturisatie	Ineke Malsch postbus@malsch.demon.nl	http://www.virtueelkennisloket.nl	All	Netherlands
FUNMAT	sekretariat@funmat.no	http://www.funmat.no/english/	All	Norway
Complex Systems and Soft Materials	Jon Otto Fossum jon.fossum@phys.ntnu.no	http://www.phys.ntnu.no/complex/	Chemistry & Materials; Nanobio; Fundamental Research	Norway
International Scientific Network of Nano and Microtechnology (NaMic)	Witold Lojkowski wl@unipress.waw.pl	http://www.unipress.waw.pl/NaMic	Materials-nanopowders and fibres	Poland
NANOMATERIALS NETWORK	Prof. Krzysztof Kurzydłowski kjk@inmat.pw.edu.pl	http://tytan.inmat.pw.edu.pl/zaklady/zpm/nmn/	Materials	Poland
Polish Laser Network POLLASNET	Marek STRZELEC mstrzelec@wat.edu.pl	http://www.pollasnet.org.pl	Laser and optic technologies/ metrology	Poland
Polish Supramolecular Chemistry Network	Assoc. Prof. Marek Pietraszkiewicz pietrasz@ichf.edu.pl pietrasz1@wp.pl	http://www.gscn.org/index.php?newlang=english	Materials, nanobio, electronics	Poland

Name of network	Coordinator	Website	Discipline	Region covered
NANOTECHNET- Network of Research Laboratories in Nanotechnology	Dan Dascalu & Marius Bazu dascalu@imt.ro mbazu@imt.ro	http://www.imt.ro/NANOTECHNET	All	Romania
BIONANONET- Bio-nanotechnology Network	Dan Dascalu & Rosana Vasilco dascalu@imt.ro rosanav@imt.ro	http://www.imt.ro/BIONANONET	Nanobio	Romania
CENOBITE (Research Centre in Nano-biotechnologies)	Dan Dascalu & Marius Bazus dascalu@imt.ro mariusv@imt.ro	http://www.imt.ro/CENOBITE	Nanobio	Romania
SINANO	Prof. Marija Kosec marija.kosec@ijs.si	na	Structural applications and information processing	Slovenia
Centre of excellence: Nanosciences and Nanotechnology	Prof. Dr. D. Mihailovic dragan.mihailovic@ijs.si tamara.matevc@ijs.si	http://optlab.ijs.si/esrr/ESRR.htm	All	Slovenia
Centre of excellence: Materials for electronics of next generation and other emerging technologies	Prof. Marija Kosec marija.kosec@ijs.si	na	Materials	Slovenia
NanoSpain (Spanish Nanotechnology Network)	Antonio Correia Prof. Fernando Briones antonio@phantomsnet.net briones@imm.cnm.csic.es	http://www.nanospain.org/	All	Spain
Quantum Materials (QuMat)	Lars Samuelson lars.samuelson@ftf.lth.se	http://www.nano.ftf.lth.se/main.html?who.html http://www.stratresearch.se/programblad/MSaT.html	physics; materials science	Sweden
NANOPTO	Per-Olof Holtz poh@ifm.liu.se	http://www.ifm.liu.se/matephys/nanopto/	physics; electrons; materials science	Sweden
CARbon Allotropes for MicroELectronics (CARAMEL)	Gunnar Forsberg (chairman) forsber@attglobal.net.on	http://www.fy.chalmers.se/caramel/	physics; chemistry	Sweden
Swedish Network for Nanoscience and Nanotechnology	Prof. Lars Börjesson borje@fy.chalmers.se	http://www.fy.chalmers.se	physics and chemistry	Sweden
Nanoscale Science NCCR network	Prof. Dr. Hans-Joachim Güntherodt hans-joachim.guentherodt@unibas.ch	http://www.nccr-nano.org/nccr/	All	Switzerland
MaNEP (Materials with Novel Electronic Properties)	Prof. Øystein Fischer oystein.fischer@physics.unige.ch	http://www.manep.ch/index.html	Chemistry & Materials; ICT; Energy; Fundamental Research.	Switzerland
Micro Centre Central Switzerland	Bruno R. Waser info@mccs.ch	http://www.mccs.ch/index.html	All	Switzerland

Name of network	Coordinator	Website	Discipline	Region covered
Bio-Medical Applications of MeV Ion Beams	Dr Karen Kirkby k.kirkby@surrey.ac.uk	http://www.ee.surrey.ac.uk/ibc/index.php?target=6:63	Bio-medical	UK
Extreme Nanotechnology	Andrew Fisher Andrew.Fisher@ucl.ac.uk	http://www.nano-spm.ucl.ac.uk/about.html	Analytics and fabrication	UK
Nano-Optical Research Consortium	Dr. David Richards david.r.richards@kcl.ac.uk	http://www.maxwell.ph.kcl.ac.uk/~snom/index.html	Analytical; microscopy	UK
NANOFIB network	Dr. B.J. Inkson beverley.inkson@sheffield.ac.uk	http://www.nanofib.org/index.htm	Nanofabrication and analytical methods using Focussed Ion Beam	UK
NanoNet	Keith Firman keith.Firman@port.ac.uk	http://www.nanonet.org.uk/	All	UK
Micro and Nanotechnology (MNT) Network	Professor Hugh Clare ruth.williams@liverpool.ac.uk	http://www.microandnanotech.info/	All	UK
Collaborative Research Network in Nanotechnology	Prof Jon A Preece j.a.preece@bham.ac.uk	http://www.crnnt.bham.ac.uk/index.htm	All	UK
NanoMicroClub	Del Stark Del@nano.org.uk	http://www.nanomicroclub.com/	All	UK
Silicon Futures	Gary Shorthouse gary.shorthouse@tcore.co.uk	http://www.sifutures.org.uk/home.htm	Semiconductors	UK

na- not available

Glossary

AFM atomic force microscope

COST European cooperation in the field of scientific and technical research

EC European Commission

ERA European Research Area

EU European Union

EUREKA pan-European network for market-oriented, industrial R&D

FP6 framework programme 6

FTE full-time employment

GDP gross domestic product

GERD gross domestic expenditure on research and development

ICT information technology and communication

N&N nanosciences and nanotechnologies

NCP national contact point

NMP new materials and processes

OECD Organisation for Economic Co-operation and Development

R&D research and development

RDI research, development and innovation

SME small and medium sized enterprises

SPM scanning probe microscope

UN United Nations