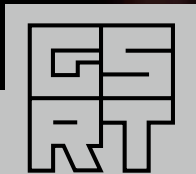


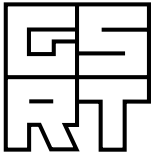
# Research & Development in Greece



MINISTRY OF DEVELOPMENT  
GENERAL SECRETARIAT FOR RESEARCH AND TECHNOLOGY



# Shaping our own "tomorrow"



MINISTRY OF DEVELOPMENT  
GENERAL SECRETARIAT FOR RESEARCH AND TECHNOLOGY

*Intense global competition, new knowledge, and fast-changing technology have made strategic planning for development a top priority.*

## Strategic planning is not, however, a task for technocrats

It is, instead, society's task, as a whole, to validate policy proposals and plans that will define our course throughout the rest of this decade.

## It is not about a solid, monolithic and arbitrary policy document

It is about a process of open dialogue and juxtapositions that will lead to a consensus in designing our course in the Eurozone.

## It is not about a theoretical "construction" available for public consumption

There is no room for "gambling". Concrete actions and works with impetus are necessary -not transient solutions. We should know where we are going and the means that will get us there, including the guidelines to which we consented in order to ensure stability in the European market.

## Social consensus is required

Wider agreement on issues of development is required. The goals of industry, workers and societal groups can be met when social needs and national priorities are respected.

## It is not about a "map drill"

The Operational Programme for "Competitiveness" (EPAN) includes programmes, co-funded by the Third Community Support Framework (CSF) of the European Union, targeting young people between the ages of 18 to 78, who wish to become entrepreneurs, and to contribute to the image building of 21<sup>st</sup> Century Greece.

## We are shaping our own "tomorrow"

And this concerns all of us: No matter what each one of us envisions for the country, we all know that between 2002 and 2010, we can make Greece optimistic, focused, and capable of meeting demands.

# Introduction

Over the last decade, Greece has made significant improvements in research and technological development. Today, Greece is in a “catching up” phase, compared with the other EU Member States, with strong overall trends in improving research and innovation.

The gross expenditure in R&D has been rising steadily from 0,20% of GDP in the early 1980s to 0,68% in 1999 and has experienced the highest annual growth rate in the EU since 1995.



The number of people employed in the area of R&D overall, as well as by occupational category (i.e., researchers, technicians and supporting staff) has increased dramatically between 1993 and 1999 by as much as 80%. Additionally, a significant percentage of R&D positions are held by women, thus making Greece one of the leaders in the EU in terms of the percentage of female researchers represented in the entire research workforce.



The country's efforts have also helped raise awareness in the Greek industry for the need to improve competitiveness and reduce the gap with European industry. The result of these efforts is reflected in the increase in innovation both in the manufacturing and services sectors. Furthermore, there is an encouraging change in the business culture since newcomers seek to gain their competitive advantage through differentiation and innovation rather than relying on cheap products and low-cost production.



Creation of new high-tech and knowledge-intensive start-ups is enjoying significant support. Since 1995, seed and start-up venture capital investment in Greece has achieved an average annual real growth close to the EU average, and is comparable to Ireland's annual growth in 2001.

On its way to developing a knowledge-based economy, Greece also has at its disposal well-designed research policy implementation tools with concrete objectives and clear priorities. The new vision for research and technological development builds upon the results and experiences of the past and reflects the international priorities, the strengths and weaknesses of the Greek research community and the needs of Greek society.

Greece is entering the research and technology area dynamically, aiming for a better quality of life for its citizens and a most-promising future.

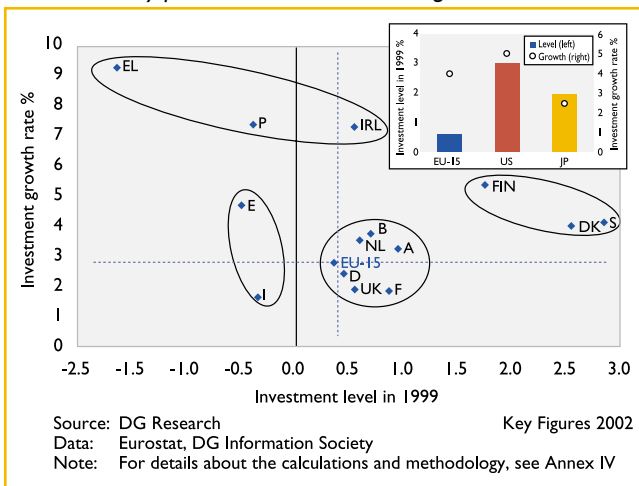


# The Course towards a Knowledge-Based Economy

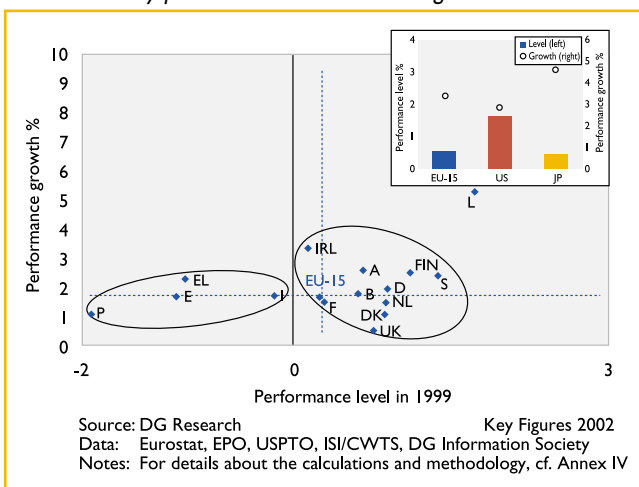
## Greece is catching up in developing a knowledge - based economy...

The Lisbon European Council in 2000 set a 10-year goal of making the EU the most competitive and dynamic knowledge-based economy in the world. Greece, in its efforts to achieve this target, is running a positive course, with some of the highest growth rates in investment<sup>1</sup> and performance<sup>2</sup> levels in the knowledge-based economy.

**Figure 1.** Composite indicator of investment in the knowledge-based economy. Relative country positions in 1999 and annual growth rate 1995-1999<sup>1</sup>



**Figure 2.** Composite indicator of performance in the knowledge-based economy. Relative country positions in 1999 and annual growth rate 1995-1999<sup>2</sup>



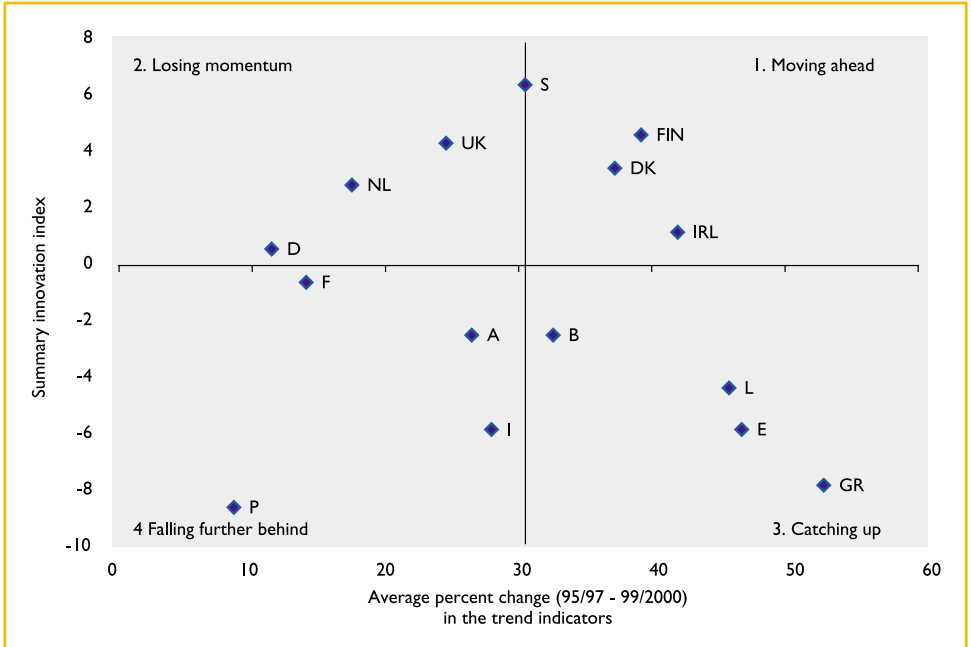
<sup>1</sup> The indicator of investment in the knowledge-based economy is a composite indicator consisting of the following sub-indicators: a) total R&D expenditure per capita, b) number of researchers per capita, c) new S&T PhDs per capita, d) total education spending per capita, e) life-long learning, f) e-government, and g) gross fixed capital formation (excluding construction).

<sup>2</sup> The indicator of performance in the knowledge-based economy is a composite indicator consisting of the following sub-indicators: a) GDP per hours worked, b) European and US patents per capita, c) scientific publications per capita, d) e-commerce, and e) schooling success rate.



**...with strong overall trends in improved innovation performance**

**Figure 3. Overall country trends by innovation index**





## Commitment to developing and utilizing new knowledge is evident

R&D intensity (GERD as % of GDP) in Greece has been constantly improving from 1991 to 1999 (Figure 4). Furthermore, since 1995 R&D intensity in Greece has been characterised by the highest annual growth rate in the EU (Figure 5).

Figure 4. Gross expenditure in R&D as % of GDP, 1991-99

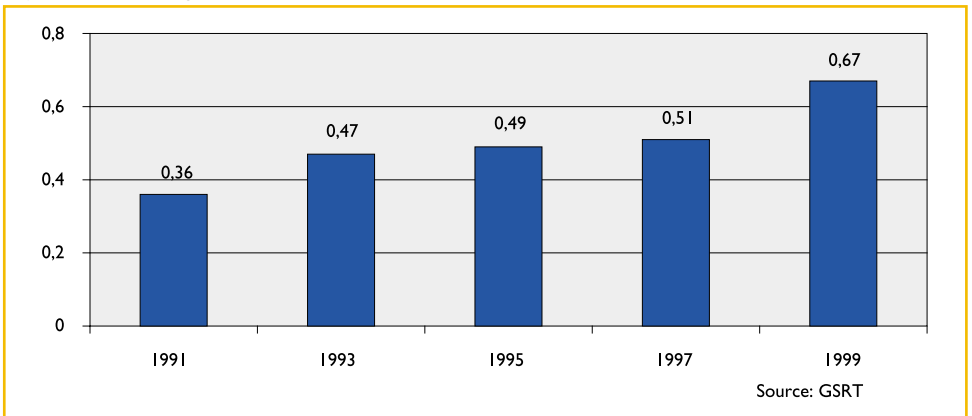
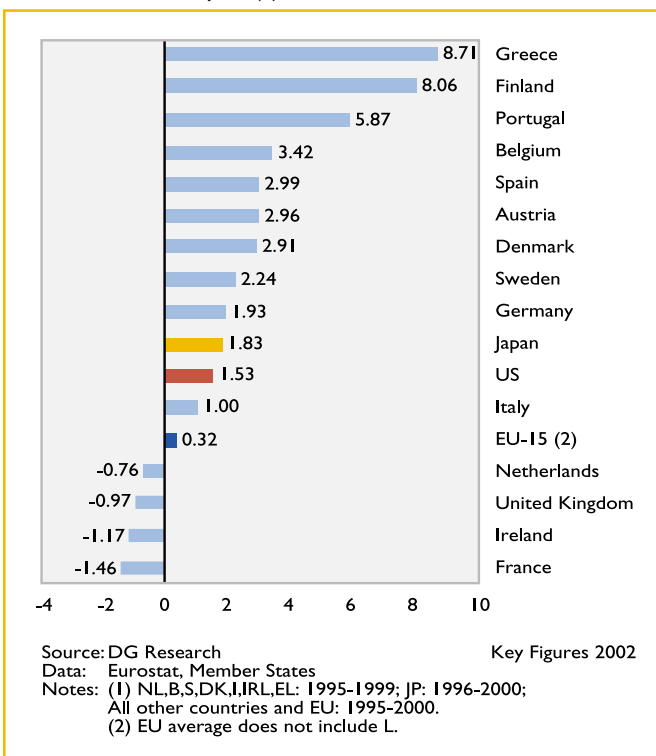


Figure 5. R&D intensity (GERD as % of GDP) – average annual growth (%) 1995 to the latest available year (1)

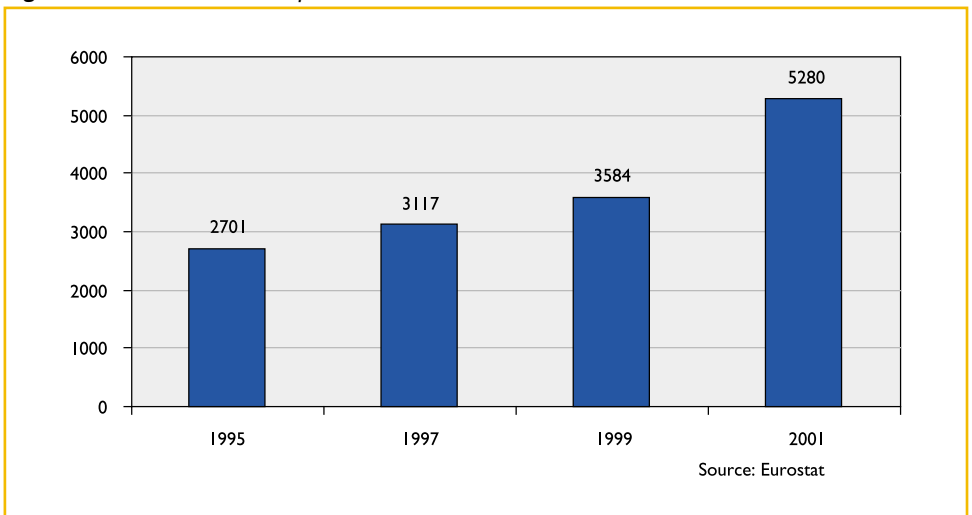




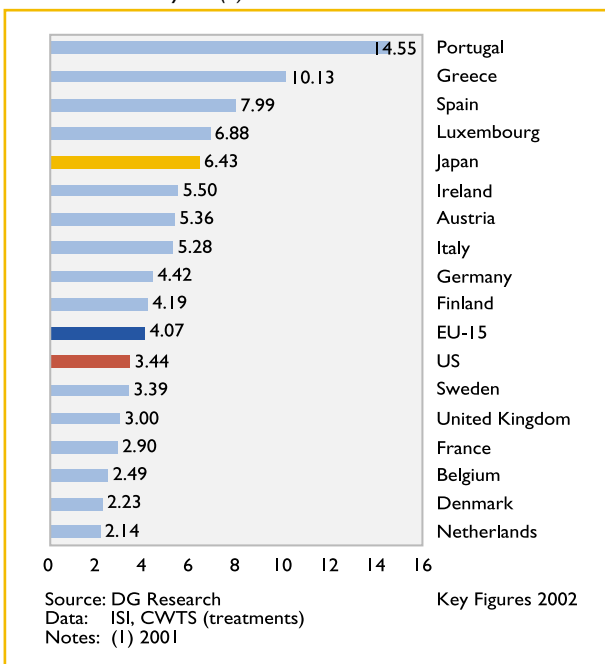
## ***Increased activity in R&D is reflected in improved scientific performance...***

Scientific performance expressed in the number of scientific publications has almost doubled between 1995 and 2001 (Figure 6). Also, the number of scientific publications per million people presents one of the higher average annual growth rates in the EU for the same period (Figure 7).

**Figure 6.** Number of scientific publications, 1995-2001



**Figure 7.** Average annual growth (%) of number of scientific publications, 1995 to latest available year (1)



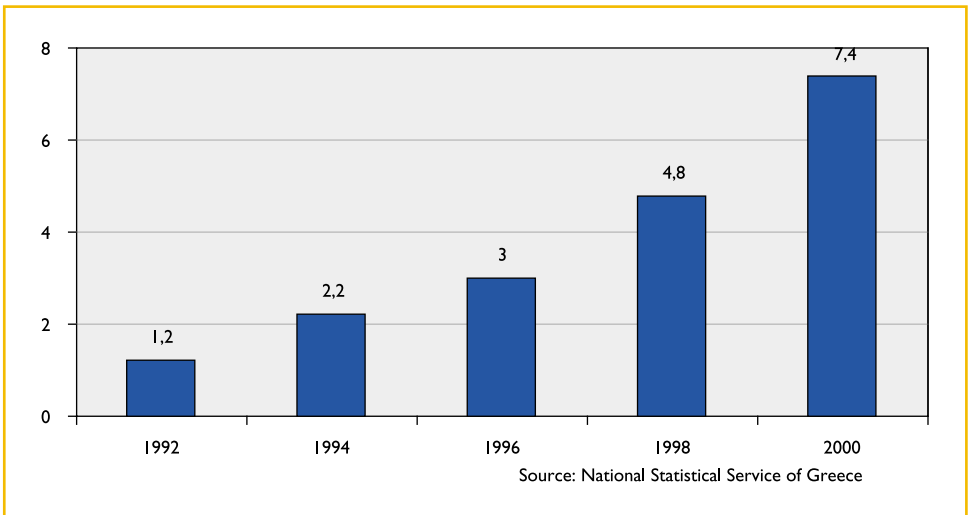




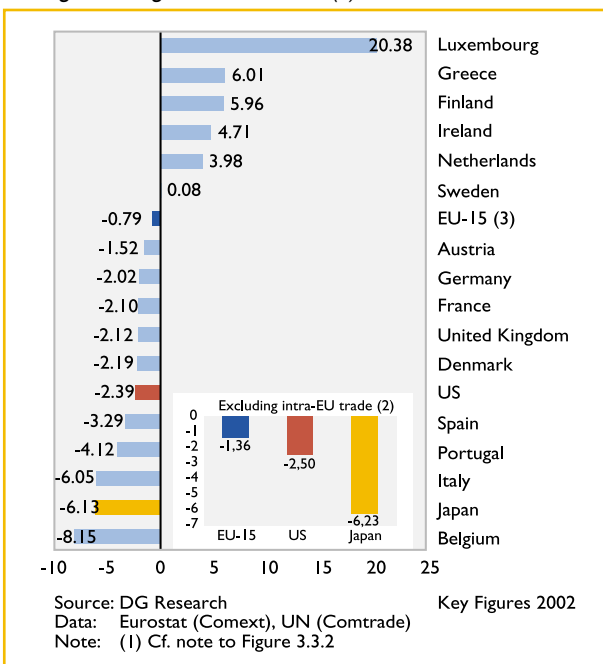
## ... and more dynamic performance in high-technology trade

The percentage of high-tech products exports in relation to total exports is an indication of the economic productivity of R&D activities. Although this figure is still low for Greece, it more than quadrupled during the 1990s (Figure 8). Additionally, Greece's share in the world market of high-tech products exports presented one of the highest average annual growth rates since 1995 compared to the other EU Member States (Figure 9).

**Figure 8.** Exports of high-tech products as % of total exports, 1992-2000



**Figure 9.** World market share of exports of high-tech products: Average annual growth 1995-2000 (1) %



The international bibliography directly correlates economic development growth rates with the research activities of business, the trend to create new knowledge-intensive enterprises, the increase of market share in international markets, and generally the competitiveness of a country and its appeal to investors. The policy and priorities of the Ministry of Development aim to tackle the deficits and weaknesses of Greece in relation to the above-mentioned fields and to create the conditions necessary to trigger development dynamics based on a “knowledge” economy.

### ***Priorities and Objectives***

The priorities and objectives of the Greek research, technological development and innovation policy apply on three levels: structural and programmatic interventions, thematic or sectoral specifications and regional dimensions of these specifications.

The structural and programmatic interventions mainly include:

#### ■ **Increase in demand for new knowledge and research results and an increase of investment in knowledge-intensive sectors in Greece**

- Actions are taken to increase the strategic interest of businesses in technological innovation and the utilisation of this new scientific and technological knowledge, as well as to create new knowledge-intensive enterprises. An indirect aim of these efforts is the development of enterprises and organisations in Greece providing scientific and technological services with significant export activities.
- Businesses are supported with both indirect (tax incentives) and direct (grants) measures to become involved in research, technological development and demonstration activities or to hire research personnel that will enable them to design and carry out such activities.
- Researchers in public research centres and higher education institutes, as well as the institutes themselves, are encouraged to develop new entrepreneurial initiatives in collaboration with the appropriate funding organisations.
- Foreign investors enjoy the same incentives as local ones to establish their organisations in Greece and to utilize the human resources and infrastructure in their efforts to increase competitiveness in the international arena.
- Regional and local players for economic and social development become more active and participate in initiatives to create innovation centres through scientific and technological parks and incubators in direct collaboration with private investors.

#### ■ **Re-organisation of the public research system**

- The priorities of the public research centres are redirected towards economic and social development policy. The research mission of the centres supervised by the GSRT is differentiated from that of the higher education institutes so as to be complementary. The public research centres become more oriented in covering the medium- and long-term needs of businesses and public organisations and services and in creating new entrepreneurial initiatives. The average size of a research unit in the public research centres increases while the number of research units decreases, and the sources are focused on priorities of international scientific and technological interest and of national or local economic and social utility.

- At the same time, the selective development of research units is promoted: merging of research centres for marine research, development of a Centre for Information and Communication Technologies Applications in southern Greece, convergence of the structures and objectives of the biology institutes in Attica.
  - University-based research is primarily supported for educational purposes and the training of new researchers, as well as for the creation of reference points for international research. Exploitation of research results is supported either by rendering services or with the creation of business incubators.
  - Effectiveness in the administration and management of the research centres is improved to assist the research teams in meeting the complex needs of the new decade.
- **“Opening up” of the Greek research system (both public and private) to the international arena**
- Increase in international collaborations of the public research centres and enterprises with foreign counterparts will make research activities more productive according to the criteria imposed by the globalised economy.
  - The constant qualitative improvement of Greek participants in the EU Framework Programmes and the increased participation in European and International Organisations programmes (ESA, ESF, etc.), as well as the “opening up” of the national programmes for international collaboration, will not only improve the level of research, but they will also make it attractive for investors.
- **Technological infrastructure for the implementation of science and technology**
- The continuous modernisation of electronic networks, access procedures in networks, databases and data banks, as well as the improvement of other infrastructures (buildings, equipment, etc.) are necessary prerequisites for ensuring the entire system’s competitiveness.
  - Upgrading the system for patenting or acquiring other industrial property titles, and the facilitation of access for researchers and the public in patenting and intellectual property rights information also form important conditions for the transition from an agricultural and trade economy to an economy based on knowledge and technological innovation.
- **Focus of public and private research and technology investments on selected priorities**
- Focusing of public funding on sectors that combine the national economic and social interests with the international scientific and technological trends and perspectives is a condition without which no investment can be successful.
  - The creation of a steady organisational infrastructure for technology foresight activities and the selection of priorities with social participation and consensus will contribute to increasing the credibility of the process and the social acceptance of the priorities chosen.
- **Increase of the gross domestic expenditure in R&D (GERD) to 1.5% of GDP in 2010 with industry participation reaching 40% of GERD.** This increase is directly related to the decisions of the European Council in Lisbon and Barcelona that GERD should reach 3% of GDP in the EU by 2010 with industry’s participation covering 67% of GERD.

### ***Thematic priority areas of research and technology policy***

The thematic priorities of the research and technology policy are based on two main policy tools which guide the research activities:

- The Concerted Programmes under the Operational Programme for Competitiveness and the Operational Programme for the Information Society (2002-2006)
- The 6th Framework Programme as well as the programmes of the International Organisations (European Space Agency, etc.) 2002-2006

Additionally, the National Technology Foresight Programme, which started in 2001 and will be completed in 2003, aims at identifying thematic priorities for 2004 and beyond.

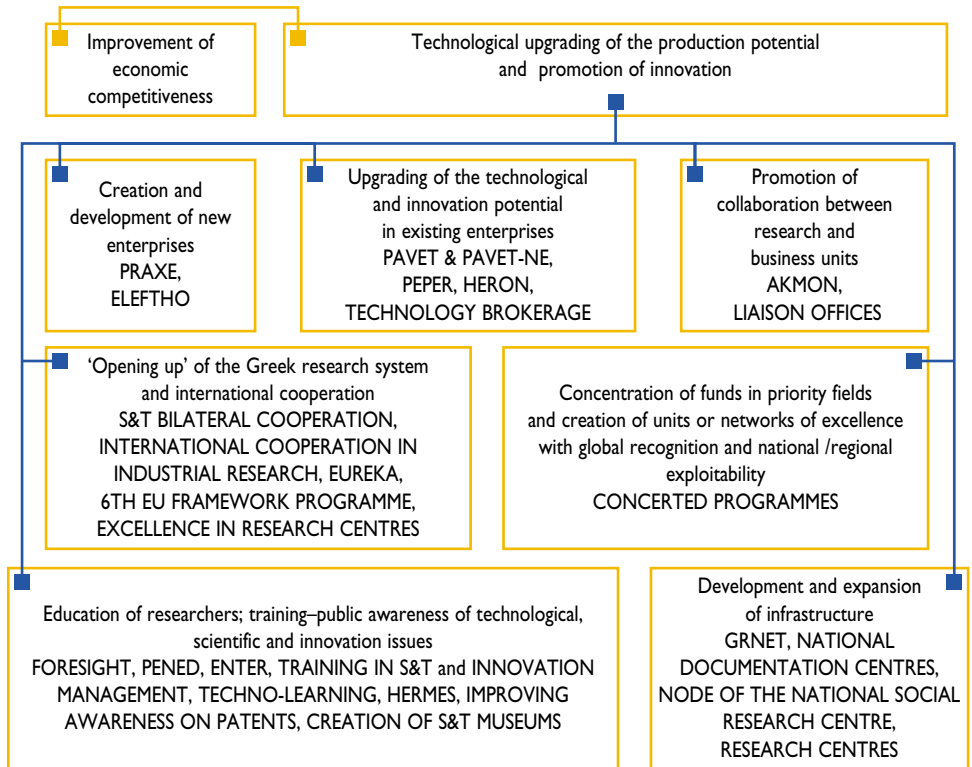
The priority areas of the Concerted Programmes of the Third CSF, follow the international scientific and technological trends and reflect the importance of certain fields as national priorities for Greece (i.e., food-aquaculture, culture and tourism, sea transport, earthquake protection, etc.), sectors of major social importance (energy, environment, health) and also the major trends in the course to a knowledge-based economy (i.e., new forms of organisations for businesses, working and training, e-learning and e-business):

- Renewable energy resources
- Food - aquaculture
- Knowledge-intensive culture and tourism, sport
- Sea transport
- Health - biomedicine - diagnostic and therapeutic methods
- Natural environment
- Structured environment and earthquake protection
- New forms of organisations for businesses, working and training
- E-learning
- E-business
- Picture - sound - language

At the regional level, the Ministry of Development promotes the creation of technological innovation hubs, around which efforts will be focused to create economies of scale and scope, thus making selected regions attractive to investors in knowledge-intensive sectors. These regions have to be “visible” worldwide, showcasing available human resources, organisations and their infrastructure, so as to attract investors from the most developed areas of Europe, Asia and the US. Specifically, the Ministry’s policy aims to:

- Establish Athens and Thessaloniki as European innovation hubs
- Establish Patras and Iraklio as Mediterranean innovation hubs
- Establish Volos - Larisa, Ioannina, Xanthi - Alexandroupoli, Chania, and other areas as innovation regional axes

Research and technological development, as a prerequisite for improving Greek economic competitiveness, is divided into the following objectives, which can be achieved by the implementation of the following programmes and actions:



#### Brief description of the implementation tools

- **PRAXE** Programme for the Exploitation of Research Results (76 MEuro)
- **ELEFTHO** Programme for the creation of S&T parks and incubators (85 MEuro)
- Programme for the Development of Industrial Research and Technology (**PAVET**) (52 MEuro)
- Programme for Demonstration Projects (**PEPER**) (54 MEuro)
- **HERON** Programme for the support of employment of research staff in enterprises (75 MEuro)
- **TECHNOLOGY BROKERAGE** Programme for the support of intermediary technology transfer organizations (5.9 MEuro)
- **AKMON** Programme for the development of research centres with the participation of users (30 MEuro)
- **Liaison Offices** in Research Centres and Higher Educational Institutes for the exploitation of research results and the matching of researchers with potential sponsors (30 MEuro)
- **International Cooperation** in Industrial Research (21.5 MEuro)
- **Bilateral and International S&T Collaboration Programme** with bodies from technologically developed countries and International Organisations (15 MEuro)
- European Union **Framework Programme** and development of the **European Research Area (ERA)**
- **Development of Excellence** in the Research Centres supervised by the GSRT (10.3 MEuro)
- **Concerted Programmes** in selected economical, scientific, cultural and environmental fields (164 MEuro)
- **Foresight Programme** for the selection of research and technology policy directions in Greece (1.5 MEuro)
- **PENEDED** Programme for the Support of Researchers for training young researchers (60 MEuro)
- **ENTER** Programme for the Integration of Foreign Researchers for attracting notable researchers from abroad and integrating them in the national research system for a specific time period (7 MEuro)
- **TECHNO LEARNING** Programme for the familiarisation of pupils and teachers with science and technology issues (3.9 MEuro)
- **HERMES** Programme for increasing public awareness in science and technology
- **Programme for improving awareness on patents and their use**

The management of the above programmes and measures is carried out by the personnel of GSRT (about 150 people representing all educational levels and specialties) along with external collaborators, the members of the National Advisory Council for Research and Technology and other experts from Greece and abroad.

# The Greek Research & Innovation Scene

The state effort for the formulation and implementation of the science and technology policy is the responsibility of several authorities: Ministry of Development through the General Secretariat for Research and Technology, Ministry of National Education, Ministry of Agriculture, etc.

The bulk of research activities in Greece is carried out by entities falling into three major groups:

- The higher education institutions supervised by the Ministry of Education
- The public research and technology centres, most of which are supervised by the General Secretariat for Research and Technology, Ministry of Development
- The private sector

Although the Ministry of Education exerts great influence on the national research system due to the large number of universities in the total R&D effort, the only body that has an explicit research and technology policy in Greece is the General Secretariat for Research and Technology (GSRT) of the Ministry of Development. Its share in the government financing of R&D is about 1/3 of the overall budget.

The Greek research arena is characterised by constantly improving gross expenditures in R&D and by increasing trends in R&D personnel.



The largest part of research funding comes from the state. In 1999 most of the R&D expenditure was financed by the government (plus General University Funds) followed by the Business Enterprise Sector and the EU (Framework programme plus Structural Funds), thus reflecting the “openness” and emphasis of the Greek R&D players in international collaborations.

The Higher Education Sector is the major player in research performance accounting for almost half of the total R&D expenditure in 1999. The Business Enterprise Sector is second with 28.48% and the Government Sector comes third with 21.71%.

# THE GREEK PUBLIC RESEARCH SYSTEM

## RESEARCH MANAGEMENT AND FUNDING BODIES

Ministry of Education

Ministry of Development  
General Secretariat of R & T

Other Ministries

- National & Kapodistrian University of Athens
- National Technical University of Athens
- Athens School of Fine Arts
- Agricultural University of Athens
- Athens University of Economics & Business
- Panteion University of Political & Social Sciences
- University of Piraeus
- Aristotle University of Thessaloniki
- University of Patras
- University of Ioannina
- Democritus University of Thrace
- University of Macedonia Economic & Social Sciences
- University of Crete
- Technical University of Crete
- Ionian University
- University of Thessaly
- Harokopio University
- University of the Aegean
- Hellenic Open University
- 14 Technological Education Institutes
- National School of Public Health

### Research Bodies

- National Observatory of Athens
- Hellenic Pasteur Institute
- National Centre for Scientific Research 'Demokritos'
- National Hellenic Research Foundation - National Documentation Centre
- National Centre for Marine Research
- National Centre for Social Research
- Biomedical Sciences Research Center "Alexander Fleming"
- Centre for Research and Technology - Hellas
- Institute of Marine Biology of Crete
- Foundation of Research and Technology - Hellas
- Institute for Language and Speech Processing
- Cultural and Educational Technology Institute
- Industrial System Institute
- "Nestor" Institute for Deep Sea Research, Technology and Neutrino Astroparticle Physics
- Centre for Renewable Energy Sources (CRES)

### Technological Bodies

- Greek Atomic Energy Commission (GAEC)
- Industrial Property Organisation (OBI)
- Aquaculture Center of Acheloos S.A.
- Metallurgical Industrial Research and Technology Development Center (MIRTEC S.A.)
- Ceramics and Refractories Technological Development Company (CERECO S.A.)
- Food Industrial Research and Technological Development Company (ETAT S.A)
- Clothing, Textile and Fibre Technological Development Company (CLOTEFI S.A.)
- Greek Research and Technology Network (GR-NET)
- Thessaloniki Technology Park (TTS)
- Crete Scientific & Technological Park (STEP-C)
- Patras Scientific Park (PSP)

- Institute of Geology and Mineral Exploration (IGME)

### Ministry of Agriculture

- National Agricultural Research Foundation
- Fisheries Research Institute
- Mediterranean Agricultural Institute Of Chania
- Benaki Phytopathological Institute

### Ministry of Economy & Finance

- Centre for Economic Programming and Development

### Ministry of National Defense

- Defense Analyses Institute

## PUBLIC RESEARCH ORGANISATIONS

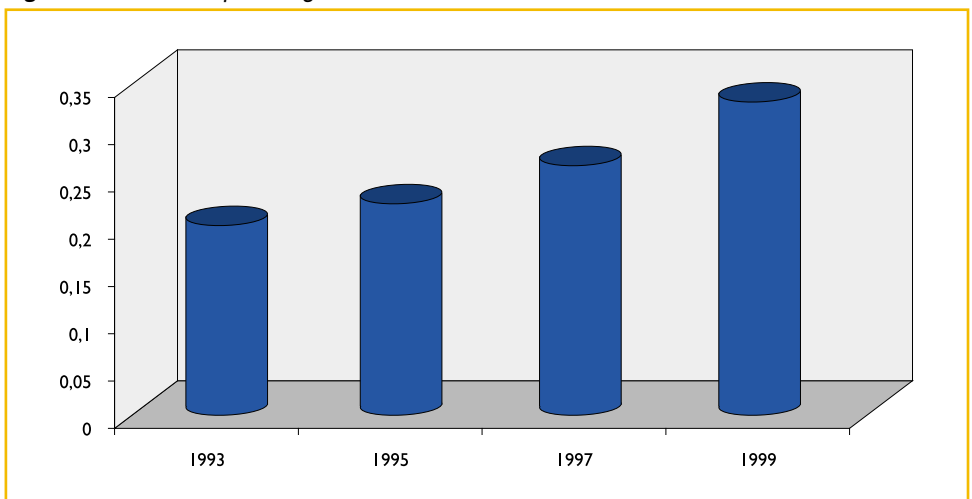
### ***The Higher Education Sector Continues its Dynamic Research Performance***

Education undoubtedly forms a country's future in economic development, in improving social structures and living conditions and in increasing the intellectual standards of its citizens. By paying appropriate attention to the development of its research workforce, Greece not only lays the foundation for a healthy tomorrow, but also defines the course for economic activities.

The Greek Universities show significant research performance both in projects aiming at strengthening the competitiveness of Greek enterprises, as well as projects addressing social issues.

R&D expenditure of the Higher Education Institutes (HERD) presents a steady upward trend. HERD expressed as a percentage of GDP has been steadily increasing since 1993 reaching 0.33% in 1999.

**Figure 10.** HERD as a percentage of GDP



University-based research presents a declining dependence on government funding and an increasing emphasis on international research activities. The primary source of funding coming from the government has been decreasing since 1993 while the sources from abroad, the EU Framework Programme and the Structural Funds being the second source of funding, have been steadily increasing. Higher Education Institutes' research has also supported increasing numbers of R&D personnel. The number of R&D personnel in Higher Education Institutes more than doubled since 1993. Significant increases were noted in both numbers of people and Full-time Equivalent (FTE) in all three research categories (researchers, technicians and supporting staff).



Figure 11. HERD by Source of Funds (%)

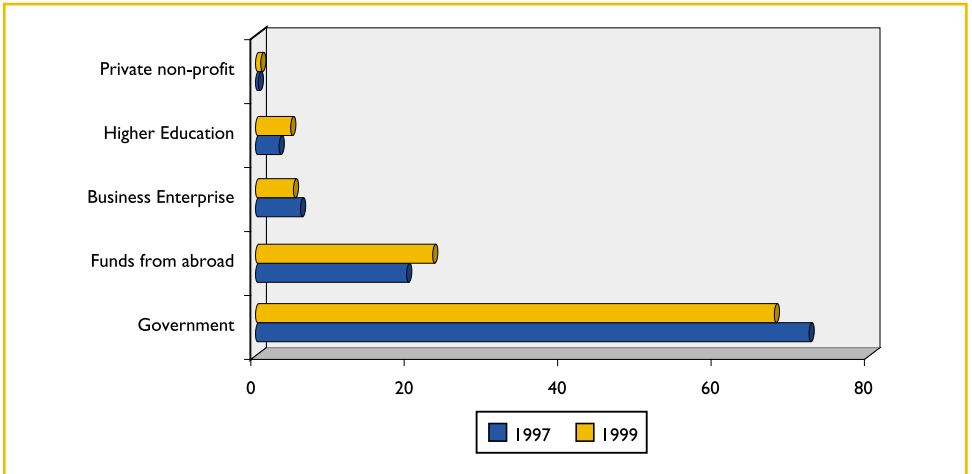
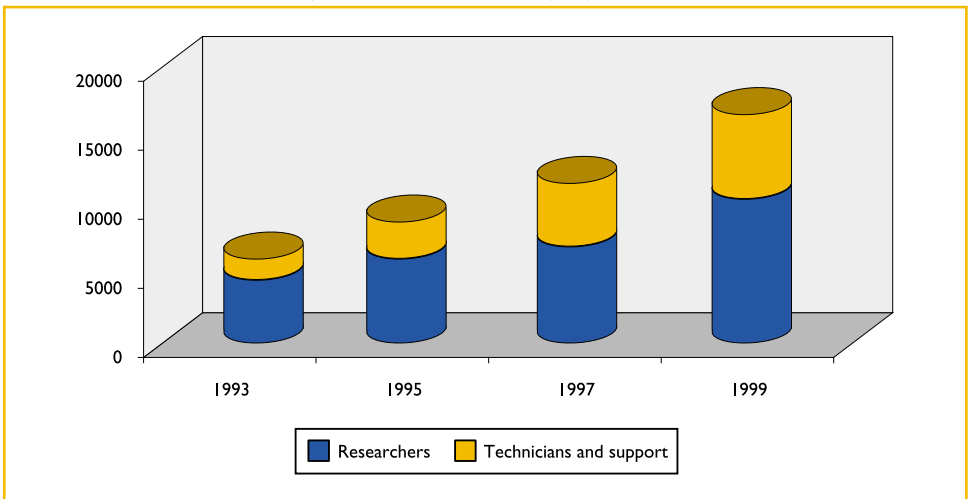


Figure 12. R&D Personnel in Higher Education Institutes (FTE)



New R&D policy measures and legislation:

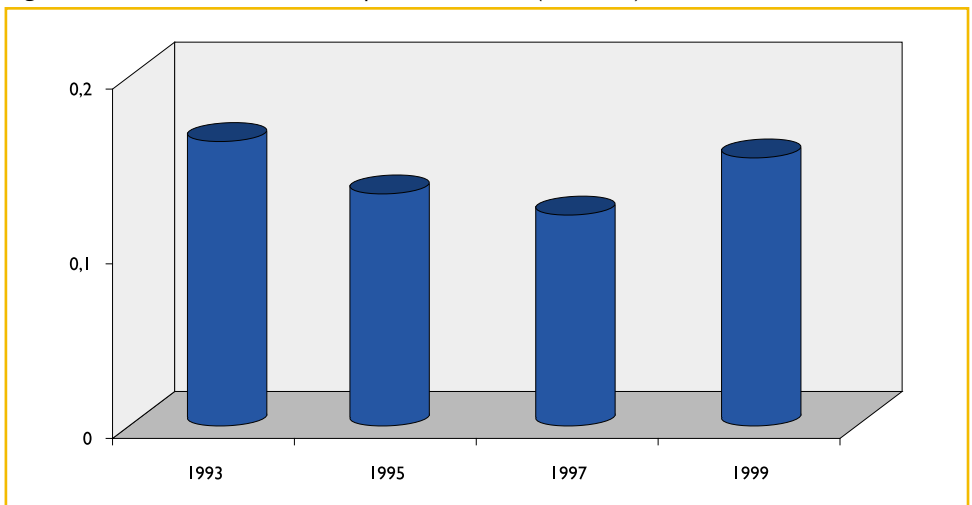
- A broad range of financial schemes under the Operational Programme “Competitiveness” addresses universities.
- The Operational Programme “Education” under the 3<sup>rd</sup> CSF will also provide university research with funding of €100 m through postgraduate studies between 2002 and 2008.
- The GSRT has adopted a new Presidential Decree (17/2001) for the financial support of research spin-offs.

### ***The Government Sector is Upgraded and Restructured***

The public research centres in Greece have the potential (through the Operational Programme for Competitiveness as well as the EU Framework Programme and the Structural Funds) to further develop their infrastructure and acquire high-quality scientific equipment, to collaborate with industry and develop leading-edge technologies, to focus their research activities on sectors of high interest and join international research projects together with distinguished foreign counterparts.

R&D expenditure of public research centres has again reached 1993 levels. As a percentage of GDP, R&D expenditure of public research centres rose to 0.15% in 1999 from 0.12% in 1997.

**Figure 13.** Public research centres' expenditure in R&D (% of GDP)



The Government sector places great emphasis on international research collaborations. The primary source of funding coming from the government has been decreasing since 1995 while the sources from abroad, the EU Framework Programme and the Structural Funds, being the second source of funding, has steadily increased. R&D personnel in public research centres have reached a steady level after re-organisational changes.



Figure 14. GOVERD by Source of Funds (%)

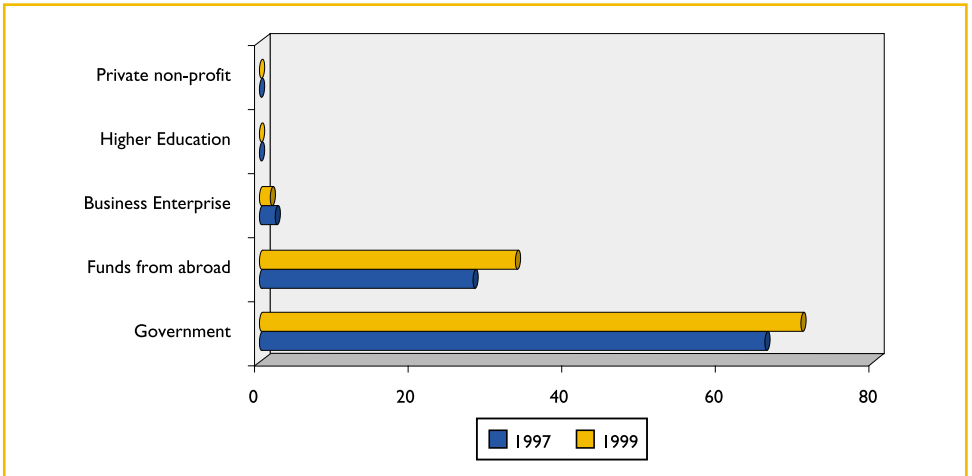
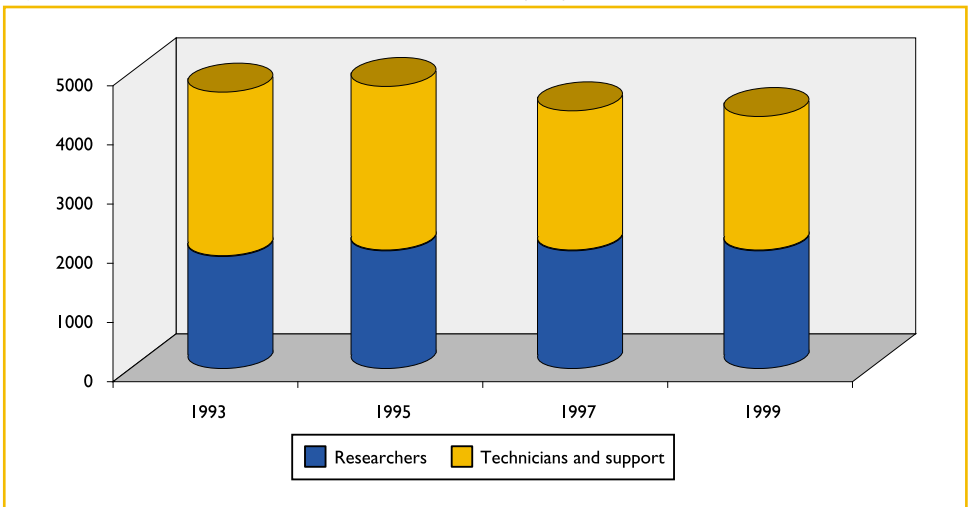


Figure 15. R&D Personnel in Public Research Centres (FTE)



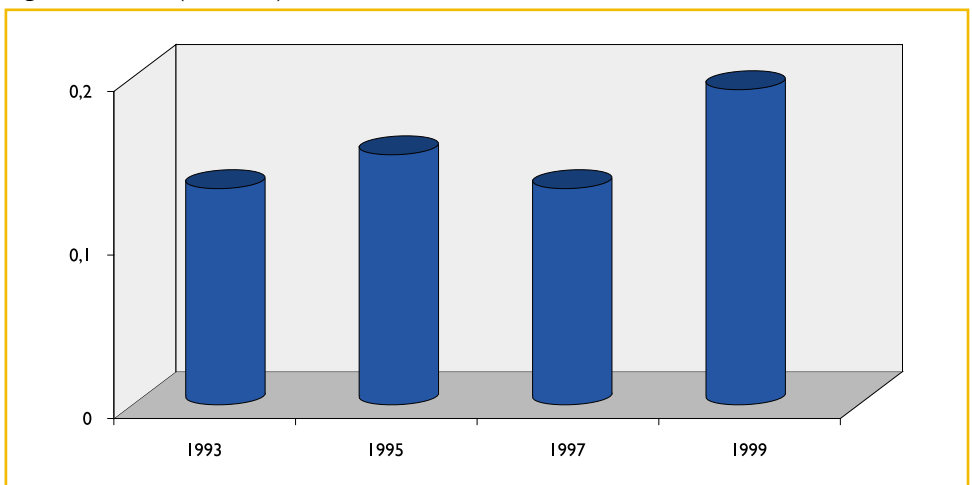
New R&D policy measures and legislation:

- A broad range of financial schemes under the Operational Programme “Competitiveness” addresses public research centres.
- 27 projects aiming at the upgrading of already existing research units into ‘centres of excellence’ have already been approved under the O. P. “Competitiveness”.
- A new Law (2919/2001) partly amending the existing one (1514/85) ‘on the development of the scientific and technological research’ gives emphasis to the linkage of research with production. Incentives are provided for the exploitation of new knowledge and research results, and financial incentives are established for the construction of technology parks and high-tech firm incubators. The creation/re-organisation of four research-technological agencies is scheduled and provisions have been made for the re-organisation of the research framework in the defense sector.

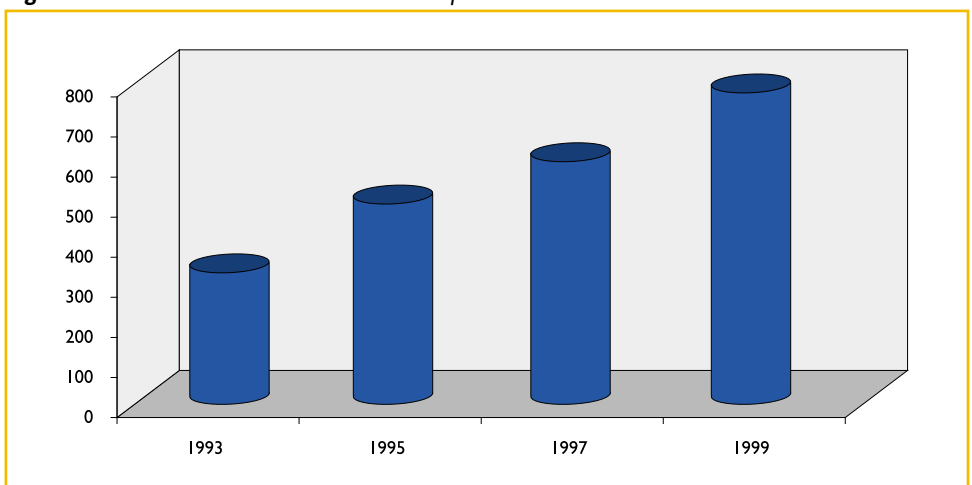
### ***The Business Sector provides Encouraging Signals***

The efforts of the past in strengthening the private sector's involvement in research and technological development activities have also started bearing positive results. The business expenditure in R&D reached 0.19% of GDP in 1999 from 0.13% in 1997. The number of businesses involved in R&D activities has more than doubled since 1993 and the number of researchers in businesses has been steadily increasing. The main source of research funding (over 70%) has come from the businesses themselves. Around 50% of business R&D is performed by Higher Education Institutes.

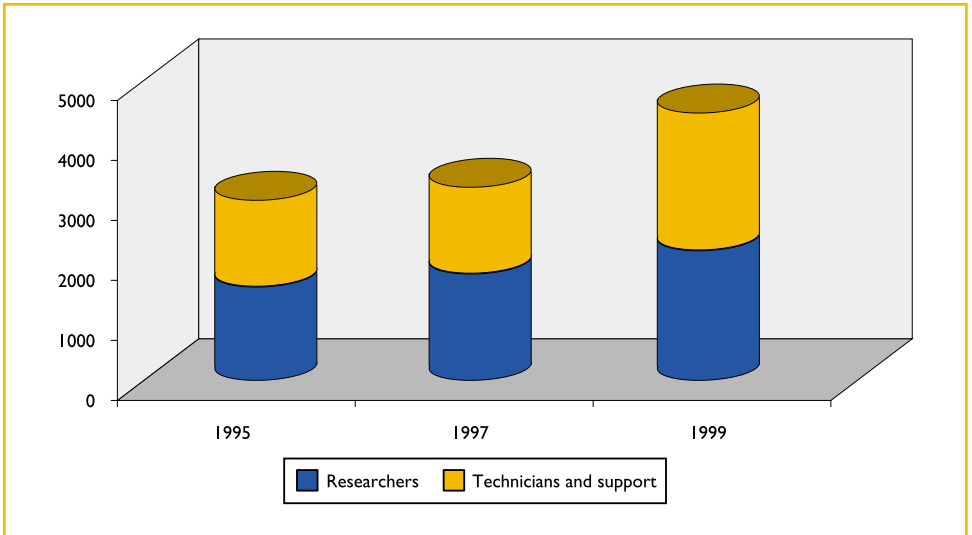
**Figure 16.** BERD (% of GDP)



**Figure 17.** Number of Businesses with R&D expenses



**Figure 18. R&D Personnel in Businesses (FTE)**



The profile of the average Greek enterprise engaged in research activities is a private, independent, medium-size (20-49 employees) company established within the last 20 years. It is important to note that the most research - active enterprises come from the information-technology sector, even though it is not the most important sector in the Greek economy.

**New R&D policy measures and legislation:**

- New schemes have been introduced which focus on strengthening research in enterprises and creating the necessary infrastructure for the exploitation of research results.
- Efforts are made to create a framework conducive to innovation. Presidential Decree 274/2000 aims at readjusting the legal framework for financial aid to enterprises. The 'Fund for the Development of the New Economy' established by Law 2843/2000 aims to financially support venture capital companies investing in early-stage ventures and to strengthen prototype development programmes. Financial support of new knowledge-intensive enterprises (spin-offs) has been established (Presidential Decree 17/2001). Indirect support measures, such as tax incentives (law 2292/2001 article 10) and guarantee fund schemes have been put in place.

# Striving for a Brighter Future

In recent years, Greek research and technology policy has focused on international cooperation and opening up the national research community to international competition. This vision reflects the overall efforts undertaken at the European level for the establishment of the European Research and Innovation Area — a key point in Lisbon strategy.



Greece today, through its fast rate of development and successful economic convergence with its European counterparts, can afford to look at the future with great optimism.

We are now in the position to not only want, but to be able to play an active role within a united Europe, contributing to human progress and social growth. We are ready, more than ever before, to put to use our past experience and to help forge a common Greek, European, and global future.



So far, it has been a long and difficult road. But, despite the difficulties and challenges encountered, we have become more determined in shaping a better future, ensuring fair management of common resources, achieving harmonious cooperation of nations, and enabling effective use of science, research and technology to benefit humankind and to better protect the planet we inhabit.





