

National Innovation System Study, PESTLE & SWOT Analysis- Greece

Output Title	National Innovation System Study, PESTLE&SWOT Analysis-Greece
Work Package	WP3- Context Analysis and Taskforce Formation
Activity	Activity: 3.3 (National Innovation Systems study and synthesis) and 3.4 (National PESTLE & SWOT analysis and synthesis)
Short Description	Document specifying the main issues and components of the Greek National Innovation system and performing a PESTLE and SWOT analysis. It mainly identifies the main policies and implications for RTDI policy, identifies the main actors, sectors and industries key to the innovation performance. It also investigates further aspects of the innovation system, as the policy orientations, investment trends, education and training systems, partnerships and linkages between the “knowledge triangle”. The PESTLE and SWOT analysis serves as a basis for an analysis of the internal and external environment that might affect the foresight implementation.
Status	Final
Distribution level	Internal (Partnership)
Responsible partner	University of Macedonia
Version	V01

Revision History:

Version	Responsible	Comment
01	UoM	Description of version contents or amendments
02	UoM	Incorporation of main data, review of articles, reports and related bibliography
03	UoM	Elaboration of section 2
04	UoM	Initial drafting of section 3
05	UoM	Addition of Executive Summary, introduction, methodology and conclusions
06	UoP, ISI	Review of document and provision of suggestions
07	UoM	Incorporation of comments, further elaboration of section 3
1		Final version

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Executive Summary

The current document provides a national ICT R&D innovation systems study and a national PESTLE and SWOT analysis for Greece in light of the high-level synthesis of the results of every country participating in the Regional ICT Foresight exercise for Southeast European countries. A wide array of issues is analysed in order to present the main “building blocks” and the generic landscape of the Greek innovation system as well as investigate the main orientations, needs, trends and key issues that directly or indirectly affect the RTDI sector. In this scope, the document attempts an interpretation of the enabling and hampering factors in the innovation system in order to extract key challenges and implications for stakeholders and policy makers. More specifically, the report tackles a broad spectrum of issues including the main research and innovation policies and their underlying planning and implementation phases and the targeted priorities, an analysis of the ICT RTDI sector, the main research actors and specific drivers and barriers to reveal the specific underlying needs that the ICT and research sectors face. The presentation of key partnerships and cross-cutting issues and challenges reveals key aspects related to the sector that contribute to the synthesis of the main elements of the Greek innovation system. The analysis is complemented by the permeating regional and financial dimensions of the system that can bear significant effects to the future evolution of the innovation system. Last but not least, the national PESTLE presents the main political, economic, social, technological, legal and environmental issues that define the macro-environment and the organization of the country in a wide range of domains. Apart from that, the SWOT analysis completes the picture by describing the strengths, weaknesses, opportunities and threats of the innovation system.

Whilst in theory, innovation became a horizontal issue in Greek policy making from 2000 onwards, the cross-fertilization of policies in administration remain constrained. Past growth rates and previous expansion of the economy were not accompanied by an innovation-driven rationale or high contribution of knowledge intensive sectors.

Funding of innovation priorities moved from a focus on infrastructure and networking to reinforcing the knowledge base of the country such as the commercialization and exploitation of knowledge. A number of crucial aspects, such as efficiency in policy implementation, innovation facilitating conditions, technology transfer, innovation poles and applied research and product development begun to emerge during the current programming period which aim at emphasizing the international presence of the country. In this context, the reinforcement of R&I, the improvement of the regulatory environment, the promotion of eGovernment, the education system and labour market as well as regional competitiveness and protection of the environment became the emerging patterns of public policy interventions. Thus, Greece currently focuses on strengthening the “knowledge triangle” comprising of research, education and innovation with a more specific emphasis on green development.

The main actors related to R&D which is the core of innovation in Greece are the Greek Government and the Parliament with the advisory body of the National Council for Research

and Technology and the General Secretariat for Science and Technology and they are responsible for policy making and implementation as well as for the supervision of research bodies. In addition, there are several research centres structured in disciplinary institutes and the main research performers are the universities. Additional actors that reinforce RTDI actions are Innovation zones, incubators and clusters, the Hellenic Venture Capital Association, Angel Networks and several chambers and Associations of Industries however their range of contribution is subsidiary.

The main deficiencies of the Greek innovation system can be summarized in the inherent difficulties to enter the knowledge economy and sustain competitive advantages. Thus, the mismatch between education, industry and innovation labour market, the limited exploitation of research results by the productive sector, fragmentation of the innovation endeavours as well as poor business expenditure of innovation comprise the main obstacles of reaching the knowledge base society targets. Further challenges consist of the limitations of public policies in articulating competitive advantages and in orienting the productive base towards knowledge intensive and high added-value segments, inadequate policy skills on behalf of the Greek regions and regional disparities in innovation performance. R&D aspects in regions are characterized by sharp differences between regions relying on gradual capacity building and regions with long-term prospects in innovation. Hence the main challenge of the Greek policy is to coordinate the fragmented aspects of knowledge triangle policy and build upon a paradigm moving from academic performance to business innovation. This recommendation is further reinforced by the investigation of the competitive positioning of the country in an international context.

Greece has recently initiated a programme of reforms to change the regulatory environment and address the most important barriers in the policy domain such as financial, economic, educational and regional policy. Efforts are made to improve framework conditions and innovation financing. The reforms are designed on the basis of an enabling environment for investments, including R&D and innovation and the modernisation of the business sector in terms of R&D investments. This multi-faceted approach is based on the assumption that the low demand of the private sector for new knowledge and low investments in research is related to other policy domains and especially on structural characteristics of the Greek economy and a volatile policy environment leading to low propensity for innovation. Thus the challenge is to achieve high coordination, in terms of objectives, resources and means, between research policy and policies such as innovation, education, industrial, employment and competition policy. A more inclusive approach towards RTDI by gathering research and education under one Ministry, certain favourable regulations and laws, tax incentives, measures supporting access to finance, the increase of companies with broadband access, the gradual reduction of bureaucracy and the gradual increase of transparency appear to have the potential to significantly affect the RTDI performance in the country. So far, there is no evaluation of the progress made in the light of these reforms and current austerity measures in view of the financial crisis and external debts exacerbate the potential and the proper implementation of these reforms.

Greece is situated in the group of moderate innovators. While the Greek innovators are rapidly improving in marketing or organisational innovations and resource, sales of new products and the export of knowledge intensive products are well exceeding the EU averages, employment in high-tech manufacturing and knowledge intensive services and exports of medium and high tech products are lagging behind. Greece appears to be one of the most open countries to outward mobility of researchers. In terms of its RTDI profile, Greece scores very low in R&D intensity and business enterprise expenditure on R&D, as well as commercialization aspects, patents and licencing while contribution of high-tech manufactured goods in trade balance is negative. A more moderate positioning can be noticed in public expenditure on R&D, doctoral graduates and researchers and the employment in knowledge-intensive activities while Greece is in line with the EU average in scientific publications and co-publications. The considerable participation of Greek research teams in EU research, specific initiatives that support post-graduate studies, research and networking relationships among universities as well as the satisfying amount of tertiary educational attainment are reinforcing the potential of the country in the RTDI sector. However the development of technology brokers and liaison offices are embryonic and funding issues are far complex.

It should be noted that the present report is drafted amidst a particular political circumstance in Greece, where the government is responding to the financial crisis and the Memorandum with the IMF and the European Union. This might bear severe consequences in RTDI funding and priority setting as the austerity programme and the rise of taxes decreased liquidity and internal demand further deepening the recession. The general economic downturn in the country, the reduction in investments, restricted access to capital exert further pressure on government to introduce measures for stimulating entrepreneurship and increasing the absorptive capacity of the Greek economy. Still, the biggest threat for Greece is to overcome the present economic downfall of competitiveness and manage to address the challenges of funding brought on by the financial crisis. This involves enhancing the capability of the public sector services and instilling a long-term vision.

1 Introduction and methodology

1.1 Introduction

The overall policy for the promotion of Research, Technology and Innovation (RTI) in Greece is generally formulated to improve the competitiveness of the Greek business sector and the national economy as a whole through innovation processes, spill-overs and the exploitation of research results.

The policy mix for innovation planning and implementation in Greece is heavily influenced by European overarching strategies such as the Lisbon agenda. The term “innovation” is often captured as “an increase of investment in knowledge and the means to achieve the transition to a knowledge-based economy” (1). Greece also embraces the definition of the European Commission, according to which: “Innovation consists of the successful production, assimilation or exploitation of novelty in the economic and social spheres” (2).

In terms of policy, R&D appears to be the kernel of innovation used to further expand the existing R&D system and introduce initiatives for the diffusion of knowledge in local production systems. In this context, the measures provide incentives to firms for undertaking R&D or adopting new technologies either in isolation or in cooperation with other actors. The general framework of innovation lies within the knowledge economy through mechanisms that generate the improvement of knowledge by productive sectors and the compensation for the deficit in RDI, thus implying a re-orientation to excellence and the knowledge society (1).

Innovation is furthermore conceptualized in terms of its dynamics to contributing to economic growth, as illustrated by the emphasis placed in entrepreneurship and business development, creativity, education and skills. The significance of RDI policies and the “knowledge-based economy” has emerged in the Greek political agenda only recently, perceived as a means to rectify the low levels of competitiveness of the Greek economy and disinvestment rates. *Thus, RTD actions and innovation policy support knowledge production in areas that contribute to the shaping of the Greek economy through the production of new and improved products, production methods and/or high added value services and the creation of new entrepreneurial activities* (3).

An important parameter in the present report is that the Greek policies were envisaged before the outburst of the financial crisis and its severe implications of the Greek financial system. Many reforms were planned, especially with regards to active labour market, education and other structural reforms so as to reshape the economy’s growth potential. Long-term challenges still stand relevant and are further exacerbated by the economic crisis. Such challenges include the improvement of the business environment, the efficiency of public administration and a sustainable macroeconomic environment conducive to innovation and international competitiveness.

Today, Greece is in a “catching up” phase compared to other EU Member States that aims to improve research and innovation frameworks. Indicative of this trend is the gross expenditure

in R&D that has been rising steadily from 0.2% of GDP in the early 1980s to 0.68% in 1999 and has experienced one of the highest annual growth rates in the EU since 1995, due to the level of public investments (4).

1.2 Report Methodology

The underlying objectives of the Greek NIS, PESTLE & SWOT report in relation to the main foresight work are summarised as follows:

- to identify the main policies and implications for policy that lead to the definition of priority areas
- to understand the development, planning and implementation of ICT/RTD policies
- to grasp the region-specific needs for foresight by including the regional characteristics and regional goals, drivers and barriers
- to identify the sectors, technologies and industries that should be promoted to enhance regional competitiveness and the key development trends in central social issues
- to investigate some aspects of the innovation system central to foresight exercises, such as the design and implementation of research and innovation policies, the main orientations, the investment trends, education and training systems, key partnerships, framework conditions that promote business investments in R&D, public support to innovation etc.
- to perform PESTLE and SWOT analysis as a basis for more detailed discussion about the scope of the foresight exercises and analyse each country's external environment to review the general frame for implementation of exercises
- to enable key stakeholders involved in the foresight exercise access key information that may prove useful in strategic planning and scenario building
- to enable the FORSEE Consortium understand the resources and constraints related to ICT foresight that would contribute to the common methodology

The information collected by the national reports will be used to inform stakeholders, map competencies and capabilities, map implications and strategies and extrapolate positive trends.

A National Innovation System encompasses a broad array of institutions and relationships involved in scientific research, the accumulation and diffusion of knowledge, education, technology development and the development and distribution of new products and processes. As hybrid systems, innovation systems cut across other societal areas such as education and training, business entrepreneurship, existing infrastructures or other sectoral policies that highlight the interplay of research and innovation stakeholders and actors. The present report employs a systems approach analysis that is inclusive of the main components of a NIS such as human capital, training, the institutional environment, the regulatory environment, R&D and usage of ICT as well as the resulting linkages among the components.

Thus, the report aims to encompass the main building blocks of the innovation system so as to provide the “diagnostics” of the situation inherent in the country.

The report’s structure (elaborated by the Task Leader-University of Macedonia) abides both to the SEE Programme Manual that stipulates that the innovation capacity can be described by the education system, the human resources (level of qualification) and the institutional framework for research and development (public and private sector, institutions, enterprises, budgets, programmes and politics) as well as the “Oslo Manual” of the OECD that provides guidance on innovation indicators and their interpretation. It is also enhanced by additions based upon a scrutiny and review of European policy documents, country reports, Innovation Scoreboards and Competitiveness Reports generated by the European Union with a view of incorporating components that would serve the overarching aim of facilitating foresight work. Other conceptualisations of innovation flows (such as the concepts of innovation inputs and outputs of the Pro-Inno Europe (5)) are taken into consideration for the analysis of indicators.

A definition of “innovation” as perceived in the present report needs to be elucidated at the outset. According to the OECD innovation is “the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations” (6).

Innovation is seen as central within the knowledge-based economy, and it is recently that a better understanding of the complexity of the processes has been understood. Thus, the innovation system is perceived as an all-encompassing ecosystem based upon the pillars of science and technology institutions, the enterprise landscape, the broader framework condition of national institutional and structural factors and transfer factors that influence the efficiency of innovation linkages (6). The factors, policies and institutions fostering innovation as well as the underlying logic of analysing them in the context of the present report are:

- ◆ Institutions and the priority-setting during specific programming periods, which are essential issues to be taken into consideration by foresight exercises
- ◆ Innovation governance (the implications of governance may foster or impede investment climate, entry to market, business innovation and general efficiency in the system)
- ◆ The macro-economic environment of the country, especially in light of the current financial crisis, as fiscal and monetary policies can contribute to a stable domestic environment.
- ◆ The regulatory framework and analysis of competitiveness of the country (obstacles to competitiveness and doing business may generate additional challenges for innovation and entrepreneurship. The role of public sector procurement policies and other conditions might prove favorable to foster innovation and they are subsequently analysed).
- ◆ ICT usage and the ICT landscape in the country. As FORSEE targets RDI ICT foresight, it is imperative to include indicators regarding ICT with regards to trade, expenditure,

productivity, industry structure, economic significance etc. The micro-level (firms), the **report endeavours to assess capacities to absorb knowledge. Specific focus is placed** upon the specialization patterns of each country and existing infrastructure.

- ◆ Other components and cross-cutting issues, such as links between industry and academia, links between the educational system and research, funding modes are analysed according to the degree of strength and the underlying role within the NIS. Education and training are emphasized as drivers of innovation and are inherently included.

In terms of report generation, the methodology was elaborated by the Task Leader and is reported as a two-stage process:

During the first stage, the first section outlining the Greek NIS was elaborated. The process included an iteration of drafts reviewed by the responsible authors in cooperation with the University of Macedonia. At the outset, a literature review of work outlining the Greek Innovation System and its performance was performed so as to substantiate the statements provided on official data and safeguard a level of objectivity and validity.

During the second stage and based upon the results of the first stage, PESTLE& SWOT analysis was enabled.

The template, specific guidelines, points for analysis, existing literature and references to be consulted as well as documents including statistical indicators for each country were drafted and provided by the Task Leader (University of Macedonia).

It is important to highlight that most references date from 2009 onwards. However, in order to overcome the lack of information in specific domains, older references are used as well (from 2007 onwards). Some evaluations of the Greek NIS and innovation analysis date back in 2007-2009 however some points are included to ensure that diachronic challenges are taken into consideration.

2 National Innovation System

2.1 Governance Structure of Innovation Policy and Main Bodies Involved

This section provides baseline information on the institutions involved in innovation and RTDI policy, their weighing in the innovation systems and some major milestones in the design and implementation of the Greek innovation policy.

2.1.1 Institutional set-up on Innovation Policy

The governance structure of the Greek innovation policy is at first level distinguished at political and operational level. At the political level the Greek government and the Special Permanent Committee on Technology Assessment (SPCTA) are the main actors. It is though at the operational level that policy design and implementation are performed. The main research policy maker and funder is the **General Secretariat for Research and Technology (GSRT)**, previously under the Ministry of Development and now a part of the Ministry of Education, Lifelong Learning and Religion, rendering the Ministry responsible for planning and funding research to ensure that policies follow the knowledge triangle rationale (education, research, innovation) (7). GSRT is the main authority competent for the implementation of RTD policy, nevertheless, innovation coordination is shared between the Ministry of Regional Development and Competitiveness and the Ministry of Education (7). In addition, the main advisory body on research, the National Council for Research and Technology (NCRT), is attached to GSRT and contributes to priority setting for research funding.

This structure has been introduced since 2009 following multiple reforms, as there is no agency solely dedicated to innovation and innovation is conceptualised in conjunction with research and technological development or productive investment. GSRT supervises most public research centres and interacts with the main advisory body on research, the National Council for Research and Technology, (NCRT) which contributes to setting priorities for research funding. The Council holds an institutional role and provides scientific advice to the Greek Government. The main research performers are the universities and their research institutes.

Other important public organizations developing legal instruments and multi-annual programming for policy elaboration and implementation are:

- *The Ministry of Development, Competitiveness and Shipping (MinDev)*,¹ which serves at reforming the Greek economy and social cohesion through investments and entrepreneurship. Investments, the Nationals Strategic Reference Framework, state aid, public-private partnership, as well as policies for industry, commerce and

¹ Former Ministry of Development (MoD)

competition fall under MinDev. The General Secretariat for Investments and Development is a core element of the promotion of funding programmes to support investments of the private sector and the development of the productive dynamics of the country (8).

- *The General Secretariat for Research and Technology (GSRT)*, now a part of the Ministry of Education, Lifelong Learning and Religious Affairs (MinEdu). GSRT supports research activities of the scientific research institutes and those of the industry, promotes the transfer and dissemination of advanced technologies, contributes to the reinforcement of research personnel and establishes institutes and centres in support of critical and high-priority sectors. It also promotes cooperation with other countries and international organizations and supports innovation awareness (9).
- *The Ministry of Finance (MEF)* through instruments for macro-economic policy in Greece. MEF orientates the stability and growth programme, supports mechanisms, tax reforms and privatization of the economy. Tax incentive programmes for innovative and RTD investments, grants and subsidies are delivered by MEF (10).
- *The Ministry of Environment, Energy and Climate Change (MEECC)* is a new player in the innovation domain, being responsible for demand side innovation policies, such as energy saving, renewable energy technologies in firms, new production processes etc. (11).
- *The Regional General Secretariats of each Greek Region*. However, RTD and innovation activities are new priorities for the Regions. It was from 2000 onwards that the region's role has been reinforced through the Regional Operational Programmes; their budgets and authority have been given to GSRT that allocates amounts to regions based on regional programme budget breakdown (7). Recently, the design of RTDI measures is actually performed by the Secretariats of the corresponding Programmes while monitoring of the measures of the ROPs relies on the Intermediate Managing Authority of the corresponding region. (11)

Innovation in the private sector is supported by the General Secretariat for Investments Development of MinDev through incentives for investment schemes. Regional policies are also generated by the same body. It is the GSRT that supports most of the public research centres, RTD activities in universities and firms as well as S&T-based innovation. In practice, innovation policy design and implementation is now shared between the Ministry of Education, Lifelong Learning and Religion on the one hand and the Ministry of Economic Development, Competitiveness and Shipping on the other, so as to increase coordination in the research domain and between research and education.

A newly planned Law (2008) (12) ²redefines the competencies of the GSRT and created some new bodies to handle the future of research governance and funding, with emphasis on basic research. This includes an Inter-ministerial Committee chaired by the Prime Minister in order to assure coordination of funding sources, a National Research and Technology Council to

² Law 3653-2008 has been postponed for no earlier than 2012

draw priorities and a flexible implementing National Agency for Research and Technology. The law re-introduces the National Programme for Research and Technology aiming to promote basic and applied research (3).

The preparation and implementation of the current priorities is thus underlined by political authorities focusing on the status of research establishment and the creation of successive structures of design and implementation. It is also noted that research labour market issues related to labour legislation and mobility fall under the responsibility of the Ministry of Labour. The Ministries of Rural Development and Defence also provide some funding for research.

Innovation policy programmes and resources

Innovation policy resources are managed by the ministries and funds are distributed all over the country by calls for tenders/proposals designed centrally. Regional innovation policies exist but are highly influenced by the decisions and management of the national administration. In specific, the current strategic planning (2007-2013) is implemented through:

- 9 Operational Programmes (OPs) which constitute the main policy documents. Their basis is the Regional Development Plan and they are implemented of structural actions co-financed by the European Commission. Their general orientations and approach derive from relevant EU priorities (such as the Lisbon strategy) in parallel with national goals of competitiveness and convergence (12).
- 5 Regional Operational Programmes (RoPs) emphasizing on specificities and requirements of Greek regions (13) .

The main strategic priorities of RTD policy are set by the GSRT following structural funds interventions turned into operational targets and funding schemes.

A wide portfolio of policies exists. The most relevant programmes are sectoral measures to support innovation (ICT, support to entrepreneurship) and RTDI programmes such as cooperation, innovation vouchers, spin offs and support of SMEs for RTD. The ROP's also serve priorities for the competitiveness and extroversion of the regional economies. Some schemes are implemented by the regions to support innovation and RTD especially in terms of infrastructure modernizations and educational interventions.

These developments have called for the Greek regions to be actively involved in planning and implementation of the Operational Programmes. In theory, regions can design and implement measures related to industrial and RTDI policies in the framework of the ROPs. In practice however, the overall design of RTDI, industrial and educational policies are formulated at the Central Government level after consultations with the Regions. Regarding RTDI policy, there is no specific governance system in place. All decisions, i.e. policy design and implementation, pass through the general governance structures of the region which are similar for all 13 Greek regions (14). The new regulatory framework granted space for the regions to implement policies which is not clearly defined by law.

2.1.2 General Policy Considerations

According to (15) the governance structure of the Greek R&D system was designed in the early 1980's based on the concept of an investment programmed for the development of technological infrastructure and mobilisation of skilled research personnel. Knowledge development and innovation became cross-cutting issues recently to serve as a basis for regional development and competitiveness. The economic importance of research has emerged due to the level of competitiveness of the Greek industry and disinvestment rates that urged the Greek political leadership to shift the attention to the "knowledge based economy" (7).

The gradual emphasis placed on regions illustrated the need to serve specific characteristics and competitive advantages of each region, since RTD and innovation activities are very recent priorities for the regions (12). So far, regions were particularly interested in planning and implementing policies such as urban and rural development, infrastructure projects and human resource actions (3). Thus, policy makers in local contexts marked traditional approaches such as low technology, SMEs, tourism and infrastructure.

Innovation policy emerged with an initial focus on the research policy components and is now enriched with new directions for investments, support to the private sector and the stimulation of entrepreneurship. Cross-cutting elements, such as connection with educational policies were not ex ante introduced to the policy orientations. Thus, innovation is put at the core of the development policy; nevertheless the Ministries in charge have limited budgets and capacities for supporting it and in some cases competing or conflicting priorities. GSRT also acknowledges some inherent difficulties in establishing "thematic" priorities, in putting lead market policies in place and in using public procurement for technological development. A change in mindframe would result in a more dominant entrepreneurial paradigm that requires a strategic thinking towards new sectors based on pure advantages and a gradual "emancipation" from traditional sectors such as tourism, banking and shipping.

The government adopted the (former) Lisbon objectives and in particular the increase in the share of R&D expenditure by 2015. Much of the national RTD landscape depends on Community research policy, as indicated from the percentage of funding through projects within the EU Framework Programmes for R&D (FPs) and Community Structural Funds. Therefore, Community R&D and structural policies bear a considerable impact on the orientation of the national priorities. Structural Funds and EU Framework Programmes' effect on research orientation and funding has been significant as they strongly contribute to Gross Domestic expenditure in R&D (GERD)³ and more than half of the research project expenditure is directed towards Framework Programmes priorities (7).

³ According to Eurostat, Gross domestic expenditure on R&D (GERD) includes expenditure on research and development by business enterprises, higher education institutions, as well as government and private non-profit organizations

2.1.3 R&I Policy Milestones

According to the Greek National Strategic Reference Framework, the RTI policy in Greece in the last 18 years is influenced by the structural funds and formulated and financed in their context. The main milestones of the Greek policy are shortly described below to introduce the rationale for policy making and the subsequent foci of RTD policies.

- The first Community Strategic Framework was implemented in 1989 by the establishment of Science and Technology parks and public research centres.
- Collaborative research consortia started to emerge from 1993 onwards, mainly based on project funding schemes
- Innovation emerged as an issue from 2000 with the introduction of schemes for the exploitation for research results, incubators, liaison offices etc.
- 2000 was also marked by the creation of a Special Secretariat for Competitiveness
- An emphasis on financial incentives for RTD was delivered in 2002 (12)

Many changes were also implemented since 2009, starting with a restructuring of the government, illustrated by merging and abolition of ministries and other public organizations. The centre of coordination of research and innovation policy is now closer to the “knowledge triangle”, as the policies are now under the umbrella of the Ministry of Education, Lifelong Learning and Religion. Further changes are expected during 2012. The restructuring is also visible via the creations of a new multi-annual programming instrument (the National Programming Framework for Research and Innovation (NPFRI)) which integrates all research and innovation objectives and activities of the ministries in a single action plan aiming at a small number of national priorities with a view of the development of an integrated research area, research infrastructures and human resources in research (7).

2.2 Priority Setting and public policies

This section analyses the priorities of RTI policies with a particular view to ICT, the priority instruments put in place as well as specific policies. Some generic problems of the Greek innovation system are introduced here based on a comparative review of sources.

2.2.1 R&I policies in Greece

Before embarking on an analysis of the public innovation policies, we first provide a snapshot of the different foci of public policies during the last two decades in order to illustrate the diachronic handling of deficiencies as well as the rationale of public intervention.

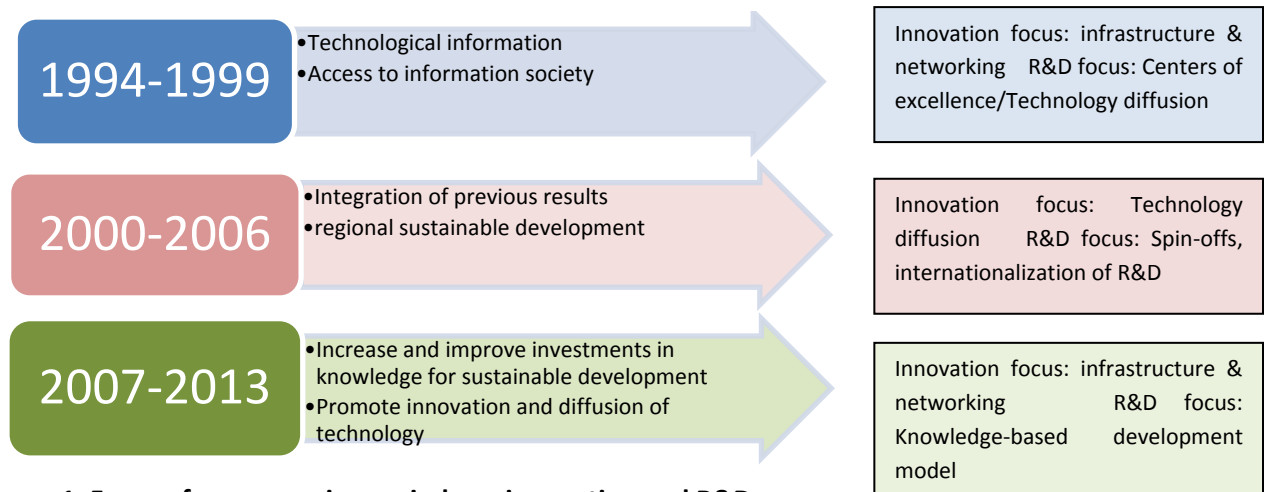


Figure 1. Focus of programming periods on innovation and R&D

The initial emphasis of funding priorities was placed on transportation, communication, energy, building, infrastructures, etc. Notwithstanding the research priorities, infrastructure was the first concern of the research policy authorities. The second wave of structural interventions responded to the networking problems but also more research infrastructures. Networking was also supported by the intense participation of an important segment of researchers into the Framework Programme of the EU. In 2006, the EU and the national authorities decided to displace the centre of gravity of the actions to the framework and institutional conditions, keeping also in line networking among the research organisations and the economic actors and opening research to the society (3). During the previous programming period, several initiatives took place to strengthen the knowledge base of the country such as the commercialization and exploitation of knowledge, development of private S&T and incubators, business parks, venture capital, strengthening of linkages between research labs and industry, research consortia, innovation poles etc. (1).

Innovation and entrepreneurship started to share emphasis during 2000-2006, where the relevant policies focused on a number of crucial aspects such as efficiency in policy implementation, innovation facilitating conditions, technology transfer, innovation poles, applied research and product development. Some of these policy instruments still hold valid today. In the programming period 2007-2013, Greece aims at emphasizing the international presence of Greece, a competitive and productive economy. In this context, education, the young, quality, technology, innovation and respect for the environment become the emerging patterns of public policy interventions.

According to the National Reform Programme 2008-2010, the main goal of the research policy in Greece is “to facilitate the transition to a knowledge-based society by restructuring the Greek economy towards the production of high added-value goods and services, the faster increase of productivity and the improvement of the competitiveness of the economy (7).

2.2.2 Structural Problems of the R&I System that Public Policy Seeks to Address

Current priorities for Greece are anchored on the perception that Greece needs to be transformed into a highly competitive, extrovert economy based on education, youth, quality,

technology and innovation as well as respect for the natural environment. Innovation, research and entrepreneurship shift increasingly to the core of a knowledge-based development model, where the private sector is considered the engine of growth. It is asserted though that despite the support measures taken, Greece remains caught up in paradoxes, which constitute interwoven challenges that need to be addressed. These challenges are linked to the structural characteristics and vicious circles of the Greek economy as well as innovation governance drawbacks. The main challenges identified in several documents are as follows (1), (12) (3), (7), (13):

Moving from academic performance to business innovation. Failed commercialization and investments unlinked to new technologies have triggered effects that are not conducive to mobilize investments and help new companies grow.

Limitation of public sector and reduction of red tape: Despite the growth in research funding and S&T policy design, innovation governance remains deficient since more emphasis is still given to research compared to innovation. In addition, organisations often interact ineffectively. The detailed design of the measures and the delivery modes of envisaged interventions is further considered to hamper effective policy making and management practices.

Inadequate policy skills in the Greek regions. Policy makers on a regional level are still oriented in improving infrastructure and supporting basic skills. These activities are of low added value and low competitiveness. Moreover, the governance structure which grants some degree of freedom to regions, whereas planning is centralized further complexes the situation.

Limited spending of firms on innovative activities based on scientific and technical progress. A substantial amount of research activity in Greece is implemented in Educational Institutions and research centres, while Business Expenditures on R&D (BERD) remains in very low levels (0.18% as compared to 1% in the EU). The low investment in research by the private sector is a result of the very poor demand for research-based knowledge. Small increases in BERD are due to the increase of research intensity in a few sectors. Although some priority has been given to increase rates of expenditures in enterprises and diffuse new technologies, related indicators (please visit section 1.6) remain low, except non-technological innovation. Support measures were introduced throughout the period 2000-2006 to provide subsidies, industrial research, development of innovation poles and investment initiatives in high technology or investments for spin-off companies. These initiatives continue for the present programming period, dealing with this primary shortage.

Funding behaviour. Young scientists often hesitate to create knowledge-intensive ventures and financing organizations are not mature in the Greek market. Banks are the main financiers of all ventures, where business angels, venture capitals and established firms are limited and reserved in funding. Against this backdrop, policy makers were faced with the essential need to facilitate the creation of technology-based firms and favour the protection of Intellectual Property Rights (IPR) as a driver for innovation. At the same time in general the innovation-

friendly attitude of Greek citizens needs to be reinforced (56% of customers have a negative attitude towards innovation) (16)

Lack of critical mass: Greece needs to overcome deficiencies linked to its isolation from the core of the EU and its access to positive spill-overs from abroad. The networks at the international level through staff mobility, increased BERD and international cooperation are relatively weak. The weak linkages between businesses and the public research sector constitute a long-lasting challenge, as there are imbalances in the way academia and the business sectors perceive and respond to knowledge needs. Thus, the system is often typical supply-driven resulting in poor exploitation patterns.

Misprioritisation and competitive advantages. Greek RTD policies have followed a horizontal approach covering a variety of interventions. In addition, the dispersion of scientific interests of the academic community resulted in a large variety of fields which are not dynamically linked to industrial sectors. There has not been a clear and specific focus of RTD effort in specific areas of national priority so as to specify and enhance the country's competitive advantages, despite some dispersed foci on seismic risks, renewable energy etc.

Intra-country regional disparities: R&D aspects in regions present a diversified picture, characterized by regions relying on gradual capacity building and regions with long-term prospects in innovation. By contrasting regional indicators, one can infer that some regions appear to be wavering far away from the country's average, due to some structural characteristics of the local economy (unemployment, dominance of traditional sectors, and low share of GDP etc.) and deficiencies in terms of infrastructure and linkages with Universities. The Region of Attiki concentrates the bulk of public and private R&D actors and expenditure in the country, absorbing 60% of the national GERD and 41% of national BERD, although, there is still a gap to the EU-27 average due to limited demands from industry.

Traditional Production Base: the Greek production base remains traditionally structured with the co-existence of a small number of highly innovative companies and a large number of mainly SMEs which often fail to reorient themselves to the changing environment. These firms often present a very low absorptive capacity of innovation where technological acquisitions are not accompanied by significant organisational adjustments (11).

The most pronounced deficiency of the Greek system is ***its inherent difficulties to enter the "knowledge economy" so as to harvest sustainable competitive advantages***. This is often linked to the fact that education and training do not respond to the needs of the labour market and they are not oriented to cultivating entrepreneurship or based upon competitive advantages. Lifelong learning remains poor and its role in building a new economy still remains to be explored. The current economic downturn has aggravated these deficiencies, resulting in a reduction in investments, and restricted access to capital hindering mobilisation of resources to fund innovation. ***Moderate innovation is also reflected in the economy's inability to embody and exploit innovations and thus adjust to the changing market environment.*** (11)

Innovation and entrepreneurship in Greece are equally hampered by macroeconomic tensions, the effects of the current financial crisis and the difficulty of the state to provide funding. Past

investments and improvement of policy designs could not transform the country into a knowledge economy, mainly because business confidence could not increase (13). Notwithstanding the public resourced dedicated to Science, Technology and Innovation and the improvement of the policy mix has to adapt to these challenges, limited multiplication effects were created. Thus, the structure of the economy remains low-tech and the past challenges prevail (13). A combination of factors including dominance of low-tech sectors, significant institutional and bureaucratic obstacles and a volatile policy environment orient business activities towards less knowledge-intensive and lower added-value segments of the economy. The technology diffusion process represents another inherent challenge where policy makers add new programmes for every specific problem, which they identify in the local network of knowledge intermediation. That increases the number of inexperienced actors and creates bottlenecks in the channels of international diffusion of technology (15).

According to Mr. G. Papakonstantinou (17), present Minister of Environment, Energy and Climate Change, there is the need for finding new methods and ways as well as for expansion to new markets and products which will contribute to the differentiation of the innovation system.

2.2.3 Main Priority Axes

The National Strategic Reference Framework 2007-2013, is considered the main funding tool of innovation. Co-financed by the Structural Funds, it aims to transform Greece into an extrovert economy, highly competitive, with strong international presence. The specific objectives encourage among others the reinforcement of research and technology and the promotion of innovation in all productive sectors, representing the basic trigger for restructuring the production web and leading to a knowledge-based economy. The main generic priorities identified that correspond to the Greek structural challenges are illustrated as follows:

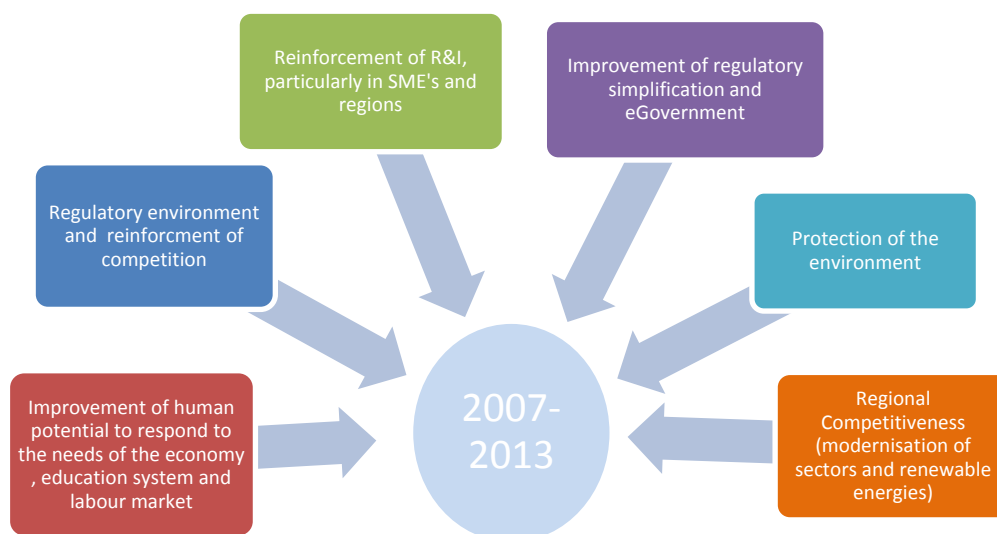


Figure 2. Strategic Priorities under the 2007-2013 programming period

According to the National Strategic Reference Framework 2007-2013, the development effort focuses on promoting innovation, research and entrepreneurship, as well as creating links between them, investing on sustainable infrastructure and human quality and upgrade the institutional environment so as to become an effective tool for planning and implementing public policies. The focus is thus on compensating for the deficit in research, innovation and technology, emphasizing the participation of the private sector and the orientation to excellence and Knowledge Society.

Five Thematic priorities are defined that specify the strategic objectives that serve to fulfil the vision outlined. A brief description of the thematic priorities follows, since R&D and innovation policy is a cross-cutting issue:

1. Investment in the productive sector of the economy

- a. Enhance extroversion and Foreign Direct Investment inflow. This priority entails attracting investors, improving the outward-looking attitude of the Greek productive system, exploring the advantages of the country and consolidate its position as an international business and financial centre
- b. Develop entrepreneurship and increase productivity. Measures include boosting the trend for entrepreneurship, moving from necessity-based entrepreneurship to high-potential, corporate entrepreneurship, supporting innovative entrepreneurship in sectors presenting a competitive advantage and promoting the entrepreneurial dimension in environmental protection and management
- c. Diversify the country's tourist product.

2. Knowledge Society and Innovation

- a. Improve the quality and the intensity of investments in human resources to upgrade the Greek educational system (entailing reforms, accessibility, lifelong learning and improvement of the quality of education and training)
- b. Reinforce Research and Technology and promote Innovation in all sectors as a key-factor for the restructuring of the Greek economy and transition to the Knowledge Economy. This includes a variety of measures and orientation such as: generate new knowledge in priority sectors of interest to the country's productive sector and serve the implementation of policies in various sectors, turn knowledge into innovative products, processes and services, and assisting the transfer of technology and know-how to businesses, especially SMEs, promote extroversion in the field of R&D and
- c. Achieve the country's digital convergence through the integration and use of Information and Communication Technologies (ICTs) in social and economic

activity fields. Measures include improving productivity through ICT and the quality of life through the use of ICT

3. Employment and social cohesion

- a. Reinforce the adaptability of workers and enterprises.
- b. Enhance access to employment through reforms in labour market policies (female employment, reinforcement of young people, reducing unemployment inflows etc.)
- c. Promote Social Inclusion and deal with drawbacks in education and training of individuals and groups
- d. Establish an efficient and economically sustainable health system
- e. Enhance the economic, social and development aspects of gender equality issues, by linking them directly to national political priorities (growth – employment - social cohesion).

4. Institutional framework. : This priority axis includes improve the quality and effective implementation of national policies to upgrade citizens' quality of life and facilitate entrepreneurial action.

5. Attractiveness of Greece and the Regions as an area to invest, work and live in:

Measures within this axis include accessibility aspects such as trans-European networks and transport intermodality, connection with transport networks and relevant upgrades in infrastructure. Energy and environment sustainability aspects are also reinforced.

Specific priorities relating to R&D

In similar terms, the priority sectors for R&D of the Strategic Development Plan of Research, Technology and Innovation for the period 2007-13, are the following:

- Increase and improvement of investments in Knowledge and Excellence, for sustainable development. RTD actions are needed to support knowledge production in areas that will contribute to the reorganization of the Greek economy through the production of new or improved products, production methods and/or high added-value services, as well as through the creation of new entrepreneurial activities and businesses in sectors that produce innovation and high technology are encouraged.
- Reinforcement of the European, Multilateral and Regional R&T cooperation in the implementation of RTD projects and in the networking and mobilization of the research potential. The objectives are to encourage excellence; achieve high added value in the national and regional economy, society and the environment; and attainment of the European and international standards. For instance, Centres of Excellence and international cooperation are of particular interest.

- Innovation and new technologies and entrepreneurship diffusion promotion, aiming to the production of economic and social benefits. Actions to help knowledge conversion to innovative products, processes and services, the creation of new innovative enterprises and support actions to SMEs in research and technology are envisaged. The provision of incentives for increasing patents and attracting new researchers are actions of equal attention.

The operationalization of these programmes is achieved through a spectrum of instruments such as joint research projects, excellence networks, networking of research support actions, support to basic research schemes, support to research centres, support to regional policies etc. The main support mechanisms for these thematic areas are medium-sized research collaborative projects and sectoral R&D poles. In addition some of the actions related to the improvement of the research human capital, supported by the Operational Programme “Education and Lifelong Learning” of the Ministry of Education, follow the above priority areas (18).

The following thematic priorities are relevant:

- ✓ Exploration and exploitation of the earth (3.18% of funding)
- ✓ Environment (2.61% of funding)
- ✓ Exploration and exploitation of space (2.11% of funding)
- ✓ Transport, telecommunication and other infrastructures (1.62% of funding)
- ✓ Energy (1.99% of funding)
- ✓ Industrial production and technology (9% of funding)
- ✓ Health (6.91% of funding)
- ✓ Agriculture (5.64% of funding)
- ✓ Education (2.21% of funding)
- ✓ Culture, recreation, religion and mass media (1.% of funding)
- ✓ Political and social systems, structures and processes (1.04% of funding)
- ✓ General advancement of knowledge: R&D financed from General University Funds (50.70% of funding)
- ✓ General advancement of knowledge: R&D financed from other sources (11.42%)
- ✓ Defence (0.55% of funding)

Specific priorities relating to ICT

Regarding ICT R&D, as well as some issues conducive to innovation, there are some explicit objectives that relate to this scope. In particular, there is a focus on providing support to clusters of businesses at regional level and broadening support for investment activities, from intangible investments to investments on human resources. In addition, they focus on developing a rational system of structures to strengthen entrepreneurship, on upgrading and simplifying the business environment, on lifting obstacles that impede the development of small businesses and on creating a “friendly” administrative - regulatory setting.

With regard to a specific orientation to ICT, the provision of digital services to businesses is further reinforced, balancing the contribution of the ICT sector to the Greek economy. The promotion of entrepreneurship in areas that use new technologies and a modern electronic and broadband environment and the promotion of institutional interventions which will speed-up transition to digital broadband transmission systems are patterns that underline the need to make the most of new information technologies and electronic communications technologies. The potential of ICT is particularly acknowledged in areas that improve citizens' everyday life, while also reinforcing equal access to the new technologies. Greece has planned an integrated and coherent "Digital Strategy" for the period up to 2013, dealing with interventions regarding information technology and electronic communications in an integrated way in all aspects of economy and society.

According to the same source, the research in ICT aims at valuating the capacities for the Greek economy competitiveness, reducing the gap in comparison to other European countries regarding ICT penetration rates and upgrading the quality of life. Key areas such as health, education, public administration, transport and tourism are expected to directly benefit from ICT related research. The following table captures the strategic and operational priorities for ICT:

Table 2-1: ICT specific priorities

Communication networks and infrastructure for ICT projects	Broadband wireless networks, next generation telecommunications	Software engineering focusing on open platforms
	Technological infrastructure for voice, image and data merging	Multimedia applications such as: Video conferencing, health data visualization, digital TV
	Grid computing και Global computing	Radio frequency identification – RFID
	Embedded systems	Network security systems
	Database management and communication networks	
Information Systems Technologies, knowledge management	Collaborative applications among Greek SME's, open source software, etc.	Multimedia databases: content analysis for metadata extraction, indexing and retrieving multimedia content
	Improvement of business in conjunction with certification	Computing services (e.g., services outsourcing)
	Service Oriented Architecture applications	knowledge management systems and environment interaction technologies
	Multi-modular platforms of multimedia content and applications	Human-Computer Interaction, natural language processing, robotic use in various contexts

Microelectronics and embedded/integrated systems	Tools for designing, testing and verification of integrated circuits, nano-and micro- electronic systems	Wireless sensors for the environment
	Lab-on-a-chip and hybrid systems for the manufacture of sensors for health, safety, transport and communications and space	Smart Microsystems enabling wireless networking with applications in health, safety, transport and communications
	Integrated microsystems in materials, machinery and construction	
Applications on the Economy	Address the technological challenges in B2B, B2C and M2M applications	Supply Chain Logistics
	Development of tools and services that support financial services such as electronic payment systems, electronic wallets, smart cards etc.	Dynamic network collaborative business processes, collaborative working and knowledge sharing.
	Smart applications for e-tourism services.	Design and production for personalization products for the textile industry
	Smart processes for the economy and services in priority areas such as agriculture, food - beverages, construction, chemical and oil industry	
Learning and Content Development	Development and use of digital content with an emphasis in 3D interactive content	Organization and content analysis, semantic representation
	Personalization of services	Intelligent systems
	Development of interactive digital content for cultural, tourist, educational and entertainment contexts	Interactive applications, digital libraries and e-learning tools that promote and enrich the Greek cultural heritage.
	Platform multimedia content for mobile devices	Interactive learning environments
Governance, Society and Quality of Life Health	Diagnostic and medical information systems, sensor-based systems for high-risk patients, health management systems, bioinformatics, Disease Diagnostic systems based on the use of medical data.	
Governance	Electronic government (e-government), including development of new methodologies and e-government applications, tools and applications that increase efficiency, facilitate access to services and promote transparency and social accountability. Electronic democracy (e-democracy), electronic society (e-society) and the promotion of public debate is also evidence of research regarding e-governance. Mobile applications (m-government) (m-alerting), (m-info)	

Provide services to people with disabilities	Methodologies, tools and systems that will facilitate and encourage disabled users to use online services. The research priorities include: Information systems for remote monitoring of people with disabilities, smart homes, ICT for independent living and other schemes for the elderly.
Environment, Energy, Transport and Geographic areas Environment	Cooperative systems for environmental monitoring and management, sensor networks, optimization of data flows, rapid and secure access to distributed data, modelling and simulation systems, and decision-making systems are directly related to research in the field of monitoring and environmental management
Energy	Methodologies and systems related to cycle life and power management, such as Intelligent and interactive systems for monitoring the production, distribution and consumption, management and control of natural resources
Transport	"smart" vehicles, alert systems, detection of potential risk and use of sensor networks.
Intelligent and smart areas	Intelligent systems developed to remote geographical areas combining both wireless local area networks, sensors and embedded systems, and other broadband services to businesses, population and public administration.

Source: GSRT

In broad terms, the thematic priorities underline the need for:

- ◆ The development of broadband infrastructure and in particular sound, data and image merging
- ◆ The improvement of long-term employment in key sectors like fabrics, tourism, commerce, transport, finance and health and the contribution of ICT to the improvement of services and activities pivotal for the quality of life.
- ◆ The endogenous development of ICT and telecommunication sectors through innovative services and products and the facilitation of ICT penetration in all spheres of life.
- ◆ The attractiveness of new entrepreneur investments and the reorientation of the productive base towards products and personalized services of high added-value
- ◆ Monitoring new technological developments in cutting-edge ICT research pillars such as grid and global computing, wireless communications etc.

Greece plans to increase the total investments on research to 2% of GDP by 2013 (7). The commitment for increasing funding for research and education reflects the intention of the government to set the knowledge triangle policies at the centre of public policy. However, the latest developments regarding the crisis of the high public deficit and debt will probably hamper the realisation of the goal (ibid) this objective will be supported by research subsidies for new enterprises and small and medium sized enterprises (SMEs).

Table 2-2: Existing Greek Innovation policy measures

Strategy 1.	Document	R&D Policies affected	Actions/orientation	Coherence with EU goals/priorities
Transition to a knowledge-based society through the restructuring of Greek economy	National Reform Programme for Growth and Jobs 2008-2010 ⁴	Production of high value added goods and services Enhancing international cooperation in R&D	Promotes a growth model aiming at developing health, private entrepreneurial initiatives and promoting openness of the economy. Target for RTD set at 1.5% of GDP by 2015 with the contribution of the private sector corresponding to 40% of the total.	Addresses Lisbon strategy (competitiveness of the economy) and expected reforms in Greece so as to achieve macroeconomic stability and employment and growth increased rates. (Based on the Integrated Guidelines (COM 2005/141) Establishment of the ERA within the EU
Improving investments in knowledge and excellence aimed at sustainable development	Strategic Development Plan for Research, Technology and Innovation under the 2007-2013 NSRF (2007) ⁵	A number of sectors important for the Greek economy are specified, such as Tourism, Culture, Energy and environment, Health, Financial Services, Agricultural and food production, ICT including space technologies, Smart products for traditional sectors. In terms of technological priorities, three key technologies are targeted	Two broad areas of actions concern the improvement of investment in knowledge by supporting R&D activities in areas of national strength, strengthening regional collaborations for R&D projects and R&D infrastructures. Actions for the promotion of innovation include the diffusion of new technologies and entrepreneurship such as supporting commercialization, demand by SME's for research activities and the support of research personnel.	These measures describe the research policy in national and regional level for 2007-2013 and is the main policy framework for R&D which will be included in the Regional Operational Programmes and in OP 'Entrepreneurship and Innovation'. In congruence with the Europe 2020 strategy objectives and the

⁴ Ministry of Economy and Finance 29.10.2008

⁵ Produced by the Directorate for Planning and Programming of GSRT in the Context of the National Strategic Reference Programme 2007-2013 30.10.2007

		especially biotechnology, nanotechnology and information technologies.		Innovation Union Framework.
Research governance reorganization and support of coordination to minimize fragmentation of research activities	Law for the Institutional Framework of Research and Technology (2008) ⁶	Basic research excellence, applied and technological research through programmes in sectors of national priority.	Actions are mainly oriented towards funding modes of research centres, networking of research programmes and funding of research centres.	Of national interest n/a
Strategic management of research	Legal Framework for the Development of scientific and technological research ⁷	Measures to enhance cooperation among research centres Framework for exploitation of research outcomes	The policy-actions defined relate to science and technology, setting out the operational principles of public research centres and the backbone framework for research and technology Development Programmes In turn, its consecutive amendments enable research and technology	n/a

⁶ Law Produced by the Interministerial Lawmaking Committee under the auspices of the Ministry of Development and the Ministry of Education and Religious Affairs 21.03.2008

⁷ Law 1514/1985 and subsequent amendments

			organisations to respond to constantly changing environment in economic, management and personnel terms.	
Digital Strategy	Digital Strategy 2006-2013 ⁸	Enhanced business productivity through the use of ICT, and new skills (boost ICT uptake, digital services, ICT-enabled ventures) Improved Quality of Life through IC (e-Services, ICT for citizen welfare)	Operational Programme “Information Society” Digital Convergence Public-Private Partnerships New law for investments and special provisions for broadband infrastructure and services and investments in the technology sector.	European policy for the Information Society “i2010” “Jobs and Growth’ action plan
Reformation of strategy of competitiveness and investments in new technologies	Operational Programme “Competitiveness and Entrepreneurship” ⁹	Upgrading production in Greece towards high value-added goods and services offering quality, environmental awareness, knowledge and innovation Tourism Energy supply	The acceleration of the transition to the knowledge-based economy The development of healthy, sustainable and extrovert entrepreneurship The goal of making Greece a more attractive place for developing business activities, with respect for the environment.	Improving knowledge and innovation for growth strategic guidelines Lisbon strategy as to the component of making Europe and its regions an attractive place to invest and work

⁸ Ministry of Economy and Finance, Special Secreteriat for Digital Planning , 2005

⁹ Produced by Ministry of Development 3.09.2007

Support higher education research and post graduate studies	Operational Programme “Education and Life-Long Learning” 10	Public Research Organizations Policy measures concerning excellence, relevance and management of research in Universities Stimulation of PhDs Mobility of researchers (e.g. brain-gain, transferability of rights)	The objectives are to support research in higher education, support of international co operations, upgrade of postgraduate studies, support of the International University.	Improving knowledge and innovation for growth strategic guidelines Increasing investment in human capital through better education and skills ERA policy the Strategic Development Plan for Research, Technology and Innovation
Motivation of the products sector to involve in the transformation of the economy	Towards the knowledge Economy. Roles and Perspectives (2003) ¹¹	Transition towards a knowledge society and the attainment of the Lisbon Objectives Increase of the demand for RTDI services by the private sector. Research infrastructures	The objective is to motivate larger parts of the productive sector to deal with Greece’s transformation towards the new economic paradigm by detecting the dominant actors of the knowledge economy	It is the first time a document addresses the Lisbon objectives quantitatively.

¹⁰ Produced by Greek Ministry of Education and Religious Affairs 16.03.2007

¹¹ Produced by General Secretariat for Research and Technology 03.11.2003

		Attraction of investments from foreign companies positioned in the technological frontier		
Support measures ¹²				
Support of interdisciplinary research projects	Archimedes III ¹³ Programme to support research	Support to engineering and ICT fields Pre-competitive research	Policy measures concerning excellence, relevance and management of research in Universities and the Stimulation of PhDs	National aspects of the Lisbon Strategy components :growth and jobs”and investment in RTD Bologne process reforms
Support of HR capital and increase of supply of high quality personnel	Heraclitus II ¹⁴	High quality research personnel and the absorptive capacity and research capabilities in enterprises	Stimulation of PhDs and Public Research Organizations	
Support Universities’ research	Thales ¹⁵ Programme to support research	Reinforcement of Greek University research teams so as to become competitive in strategically important fields Strengthening of networking among universities and attract most talented national and non-national researchers	Policy measures concerning excellence, relevance and management of research in Universities, Public Research Organisations, Research Infrastructures and Stimulation of PhDs	

¹² These measures are mostly support measures, mentioned here for coherence. They do not fall under a specific OP’s.

¹³ Ministry of Education, Life Long Learning and Religious Affairs, Unit B2 of the Special Management Service of the Operational Programme "Education and Life Long Learning"

¹⁴ Ministry of Education and Religious Affairs, Special Service for the Management of the Operational Program "Education and Life Long Learning"

¹⁵ Ministry of Education and Religious Affairs, Special Service for the Management of the Operational Program "Education and Life Long Learning"

Energy Efficiency and Green procurement	Energy Efficiency in Household	Fiscal incentives in support of diffusion of innovative technologies	The measure aims at improving the energy efficiency of the existing stock of household buildings through and at the same time at stimulating demand and thus supporting the relevant industries
Green Strategies	Green Business 2010 Green Tourism Green Infrastructures 2010	Support to innovation in services, sectoral innovation in manufacturing	Reduction of energy consumption, promotion of development and marketing of green products, improvement of environmental and social profile of business, compliance with international standards, improve national capacity to increase employment in the sectors involved, developing a green culture and improvement of related services and their competitiveness.
R&D cooperation in sectors of national priority	Joint Ventures for research and technological development in sectors of national priority (2011 cycle)	Joint projects, PPP	Support of cooperation between companies and research organisations through common implementation of research and technology programmes.
support of financing	New Investment Law (3908/2011)	support of financing, innovation vouchers etc	The new Investment Law provides a higher ceiling in terms of subsidies, tax remits and depreciation of capital for innovative ventures.
	New Economy Development Fund SA (TANEO) Entrepreneurship Fund' (ETEAN SA)		Providing flexible funding (venture capital, start up and seed capital, business angels), for new ventures. The Financial Institutions that will be selected to participate in this fund are expected to contribute €800 million along with public resources of €400 million in six actions, 1) General Entrepreneurship 2) Technological Development, Regional Cohesion and Clusters 3) Youth Entrepreneurship (4) Access to international markets 5) Thematic Tourism, Water Desalination, Waste Management, Green Infrastructures and applications (150m), 6) Innovative Entrepreneurship, Logistics, Food, Beverages
Recruitment of skilled personnel and	Operational Programme	Subsidies	Facilitation of new research skills by doctoral researchers and provision of subsidies for firms employing highly scientific training.

mobility researchers of	"Education and Life-Long Learning" 16		
Support of businesses	JEREMIE New Business: Favourable risk-sharing loans for Micro and Small Enterprises.	Support to innovative start-ups and support to risk capital, support of risk capital	Strengthen small businesses through loans, guarantees, investments in venture capital, etc. - but not grants.
Strengthening of business technological innovation	DIGI-CONTENT: Business support for the implementation of investments in the sector of digital broadband content DIGI-RETAIL DIGI-mobile	Support to innovation in services and technology transfer	Strengthening of business technological innovation, aiming to develop new value added services through investments. enhancing the availability of digital media technology from multiple channels and support businesses that operate in the field of retail trade in order to implement investments in new technologies Support of SME's in the field of tourism, culture, hospitality, trade, health, entertainment and environment in the field of ICT in the development of innovative applications in smart mobile devices and tablet computers.
Manufacturing under new conditions		Support to sectoral innovation in manufacturing, organisational innovation and technology transfer	Strengthening of business technological innovation and implementation of innovative investment projects, aiming to develop new value added services.
Various schemes for direct support of business R&D (PAVET etc)	Support Groups	Direct support in form of tax incentives and guarantees, grants and loans	Encourage SME's and groups of SME's to undertake R&D performance in traditional of high technology fields to boost their competitiveness

¹⁶ Produced by Greek Ministry of Education and Religious Affairs 16.03.2007

As indicated from the table above, the country's strategic planning for the period 2007-2013 is to be implemented through Sectoral Operational Programmes, Regional Operational Programmes and European Territorial Cooperation Programmes. The most relevant operational programmes for the achievement the priorities are 'Competitiveness and entrepreneurship' (OPCE) emphasising in particular innovation, 'Digital Convergence' aiming at the dissemination of ICTs in the business sector and the civil service, 'Education and lifelong learning' improving the quality of basic skills and the accessibility to lifelong learning, as well as the five Regional Operational Programmes (ROP), corresponding to the 13 regional administrations, that contain elements of the national programmes adapted to the regional needs (3). An analysis of regional aspects follows in the next section.

The Strategic Development Plan for Research, Technology and Innovation 2007-13 published in 2006 and the new National Strategic Reference Framework" (NSRF) aligned the national research strategy to the Lisbon's Strategy Integrated Guidelines by enriching the existing measures with EU good practices. Hence, R&D policy was significantly strengthened due to Lisbon leverage.

Some other priorities are currently addressed, especially in terms of the European Research Area objectives (ERA 2020). The policy changes include: the law of the higher education sector and a programme for postdoctoral research to encourage inward outward mobility, a strategy for the internationalisation of the research systems, the new multi-annual programming instrument NPFRI, existing measures funded by GSRT, the new measure for the promotion of spin-offs and the new measure supporting research in non-research performing firms are incremental to address the ERA objectives in terms of (7): Establishing and open an attractive labour market for researchers, Increasing public support for research, Enhancing research capacity, Developing research infrastructures, Strengthening research institutions, Improving framework conditions for private investments, Promoting knowledge transfer, Strengthening international cooperation in science and technology and Promoting structural changes towards a knowledge-intensive economy.

Although an evaluation of programmes is not available, a study by Bartzokas et al. (15) has found that most of the successful policy initiatives in the Greek case have addressed the need to maintain existing capacity with very few cases of initiatives that drive further expansion of local R&D capacities. In the second case, success is attributed to the size of local markets and interaction between involved actors and the promotion of an outward orientation in the world market for knowledge.

2.2.4 Funding Considerations and Regional Aspects in Priority Setting

In most of the Southern European countries and in most of the EU Member States, government is the main source of funding. Greece, however, is not included in the group of countries whose R&D expenditures are covered by the government by at least 50%. In Greece, most of the government funding is direct and entails absence of indirect support towards R&D, via tax incentives. Most of funding for Greece comes from direct government funding and the rest by European Commission funding (19). Approximately 5.3% of the budget of the National Strategic Reference Programme 2007-2013 will support innovation and research measures.

(1.37b Euro. A recent change in terms of funding sources has been the steep reduction in the budget of the National Investment Programme as a result of the current economic crisis, reducing in consequence also the absorption rate of the Structural Funds as the National public co-financing could not be provided. National contribution has been recently reduced by the European Union in 2011, leading to an increase in the Public Investment Programme (11).

In Greece, the dominant situation in the R&D funding sector is characterized by the importance of the contribution of the public sector, which exceeds two thirds of GERD, the insignificant contribution of the private sector (0.58% of GERD, in 2007) and the fundamental role of the European Community Funds with the R&D Framework Programmes and the Structural Funds (7). Investments are heavily dependent on Structural Funds, which represent approximately 10% of GERD. During the period 2007-2009 funding from Structural Funds to R&D and innovation was almost zero. Thus, the only sources for funding of research for the whole of 2007-2009 were institutional funding, FP7 and a diminishing number of projects from the previous programming period (7).

Public funding exceeds 2/3 of Gross Expenditures on R&D (GERD) and half of this spending is university spending. The percentage of public funding on R&D is half of the EU average. The private sector is not investing in research, mostly due to poor demand for research-based knowledge. Poor demand derives from the low absorptive capacity of the business sector, bureaucratic and institutional obstacles (ERA 2010). It has to be noted that the funding for promoting innovation is based on the OP's which are co-funded by structural funds, meaning that innovation policy is heavily dependent on external sources of finance. The Operational Programmes and the general University Funds are the main instruments for funding research (7). For instance, average annual funding from the Structural Funds is approximately 10% of GERD and 22% of total government funding, from which about 5-6% is estimated to support research- and innovation-related measures.

So far, we have emphasized the national priorities and strategic orientations in the country, explicit in a number of documents. Nevertheless, as referred to in section 2.1.1, Greek regions have maintained a degree of autonomy in designing and implementing Regional Operational Programmes. Annex I presents the priorities and support measures in Greek regions (the table presents regions by order of contribution of regional R&D to the national R&D). As it can be inferred, priorities in the Regions present a diversified picture, dependant on the degree of regional R&D. The most dynamic regions (Attica and Central Macedonia) align their priorities with the national ones by emphasizing on priority sectors and the creation of innovation poles, while less dynamic regions only pay marginal attention to R&D activities with infrastructure and support of business plans. A common denominator of policies include the creation of innovation poles, the strengthening of public R&D infrastructure, support of R&D activities within firms, the strengthening of linkages between private and public research actors and the creation of start-ups and spin-offs. Nevertheless, in many regions, such as Central Macedonia, there are supportive measures that reinforce innovation based activities, although the majority of companies are SMEs, mainly family-owned with a low-tech profile, and low degree of orientation towards higher added-value activities (14).

2.2.5 Policy-specific issues

An agreement seems also to emerge among opinion leaders that the 'green economy' offers a large potential for development in the country and is thus considered a strategic priority, especially by the elected government of 2009 (1), (11). It is thus expected that most of the existing research priorities will be affected by strengthening the "green" elements of each area of national priority to allow Greece to turn its comparative advantages in this area. The restructuring of the production base can take place in agriculture, tourism, energy and eco-friendly, businesses, recycling, waste management and use of resources. The green agenda is a horizontal strategy that cuts across different that seeks to bridge demand and supply side innovation policies.

In addition, according to the updated National Reform Programme (NRP) for 2010-2013 the focus is on strengthening the knowledge triangle "research-innovation-education". The focus of the public policy is on "knowledge triangle" policies and green development. In addition, the strengthening of the role of the public sector in research and the introduction of evaluation procedures for the results are major priorities.

Environment: The Ministry of Development and Ministry of Environment, Regional Planning and Public Works emphasizes on issues relating to climate change and the environment (20). In addition The Ministry of Foreign Affairs promotes green entrepreneurship in sectors where the country has an international comparative advantage, such as construction, consulting and steel production with the aim to achieve environment-friendly, beneficial solutions. More specifically, the Secretariat General for International Economic Relations and Development Cooperation supports joint actions by signing frameworks of cooperation, as for instance the Memorandum of Cooperation with the United States for International Development (USAID), regarding programmes of renewable energy investment and energy saving in buildings (21) .

Research and technology transfer: A main example of the encouragement of research and technology transfer is the support measure "Innovation Vouchers for SMEs".

Cluster development: There are some measures that consist of integrated initiatives to support activities such as research, technology transfer and innovation development which have a sectoral or a technological orientation (regional innovation poles, national thematic poles, Innovation zone of Thessaloniki and clusters). GSRT has undertaken the action "Creation of innovative enterprise clusters- a Greek product, a single market: the planet", that aims at the creation innovative clusters of enterprises and research institutions in fields that present competitive advantage for the country so as to reinforce the innovation activity and the development of innovative services and products of high added value and to achieve economies of scale through the specialization of production and the close collaboration among the clusters

Private R&D in enterprises: Groups of SMEs for R&D support the research projects that are carried out by groups of SMEs and public research institutions in collaboration. For instance, certain programmes aim to support new businesses for R&D, collaboration and other support measures ensure the financing of new companies, medium to large research projects by

private firms and public research organizations or reinforcing new companies with no R&D experience. In this way, it is intended to reinforce the knowledge and technological capabilities of these companies and increase the participation of the private sector in R&D expenditure. The fields of priority are ICT, agriculture, biotechnology, nanotechnology, microelectronics, energy, health, environment and other (14).

Cross-border programmes: European Territorial Cooperation Programmes (former Interreg) constitute a Community initiative with the objective to promote interregional cooperation within the EU. Greece participates in these programmes with projects with Bulgaria, FYROM, Albania, Cyprus, Turkey and Italy. The Managing authority is part of the Ministry of Development, Competitiveness and Shipping. Common priority axis relates to enhancing of competitiveness, accessibility and environment.¹⁷

Tax reductions: Donations by companies to universities are tax exempt and according to Law 3296/2004 and tax incentives for R&D are provided. Moreover, through these special objectives, state subsidies are re-oriented towards quality and high-specialization entrepreneurship, while communication campaigns and education in the field of entrepreneurship are both developed.

Societal challenges: Key areas are expected to directly benefit from ICT-related research, as outlined by the document for R&D priorities within this programming period. Societal challenges represent an important aspect of priority setting therefore we elaborate further. The promotion of cultural heritage and promotion of sustainable mobility with improved services are additional concerns of the Greek government. Climate change and renewable energy and the wider understanding of the environmental process and sustainable management of the environment and natural resources are understood in the context of new technologies and production processes. Health is another priority area where deficiencies need to be addressed through prevention and diagnosis, personalized treatment and innovative pharmaceuticals. Last, the safety of citizens from threats such as terrorism, organized crime and natural disasters are acknowledged as a societal challenge (7). It has to be noted that although these priorities are acknowledged, there is no specific budget allocated but rather a bottom-up approach in funding is followed.

Other programs from the OP Education and Lifelong Learning contribute to improving Greek people skills and promoting innovation and entrepreneurship by introducing relevant courses in the curricula. These interventions are of horizontal nature and can either promote business ideas, support young people ventures or support curricula, traineeships and networking.

In addition, recent trends of a new development strategy with regard to innovation is based on the expansion of the production base, the exploitation of competitive advantages and the orientation of Greek firms towards exports of products and services of higher value added. During 2011, a legislative framework went to public consultation with the objective to set a

¹⁷ www.interreg.gr

clear framework for entrepreneurial activities that cater for social needs, target regional development and support the employment and inclusion of vulnerable social groups into the labour market (social economy).

2.3 Mapping the major actors in ICT R&D

This section presents the major actors implementing the main policy mix, some basic information on the linkages of policies as well as ICT networks, degree of ICT penetration and sophistication as baseline information on the technological infrastructure.

2.3.1 Overview of main actors

According to the General Secretariat for Research and Technology, the main policy mix for the promotion of RTI policy in Greece consists of:

Institutional funding by the Ministry granted to Public Research Organizations, like Higher Education and Technological Centres and Institutes. Some other Ministries allocate institutional funding to certain public research centres operating under their auspices.

Direct funding of RTI activities, mostly on a competitive basis, follow public call for proposals. These activities are run by several Ministries and other organizations involved and are undertaken with the support of national and structural funds, which constitute the basic funding mechanisms in the research and innovation field.

Investment Law 3299/2004 provides a set of incentives (grants and others) for attracting private investments. Particular action is taken for attracting FDI, aiming at transforming Greece into a major hub of entrepreneurial and investment activity in Southeast Europe.

General University Funds

The Public Research Centres are mainly supervised by GSRT. There are several research centres of varying size, structured in about 56 Institutes. The main disciplines covered are Natural Sciences (33 Institutes), Engineering (7 Institutes), Information Technologies (7 Institutes), Social Sciences (4 Institutes) and Humanities (5 Institutes).

Notwithstanding the general structure of STI policy, according to ERAWATCH (7) the main research performers in Greece are the Universities, attracting about half of government expenditure in R&D. Technological Educational Institutes make a marginal contribution to research, despite some endeavours to incorporate research and innovation in their mission in 2001. Universities and public research centres attract about 72% of government expenditure in R&D while private R&D performers have a very low share.

An overview of the main research-related organisations follows below (9):

Table 2-3: Main Research Institutes and related R&D fields (supervised by GSRT) (Source: GRST)

Name	Main R&D components
Athena Research and Innovation Center	Promotion of ICT innovative technologies in industry and service
National Observatory of Athens	Astronomy, geology and meteorology
The National Hellenic Research Foundation	Funding and research on Humanities and Natural sciences. Main fields relate to Greek and Roman Antiquity, Byzantine Research, Neohellenic Research, Biological Research and Biotechnology, Theoretical and Physical Chemistry, Organic and Pharmaceutical Chemistry.
Center for Research and Technology Hellas (CERTH)	Fundamental and applied research with emphasis on development of novel products and services of industrial, economic and social importance: Chemical and Biochemical Processes and Advanced Functional Materials Informatics and Telecommunications Land, Sea and Air Transportation Agrobiotechnology and Food Engineering Enviromental Friendly Technologies for Solid Fuels and Alternative Energy Sources and Biomedical Informatics, Biomedical Engineering, Biomolecular Medicine and Pharmacogenetics
Demokritos National Centre for Scientific Research (NCSR)	The Centre is active in an impressive array of research fields such as: nanotechnology, microsystems, integrated telecommunications and informatics technology systems, modern technologies for cultural heritage, control of environmental pollutants, nuclear technology and radiation protection, accelerative systems technologies and detector devices, generation and characterization of innovative materials, bioactive molecules, natural products and biotechnology, medicines and diagnostics technologies, telemedicine, etc.
National Centre for Social Research	Political sociology, electoral behaviour, anthropological studies.
Hellenic Pasteur Institute	Basic Research, Education and public health services. Focus on prevention and treatment of infectious diseases
Hellenic Centre for Marine Research	Marine research, oceanography, marine research, fisheries, aquaculture, marine genetics, inland waters.
Alexander Fleming Biomedical Sciences	Immunology, molecular biology, genetics, molecular oncology,

Research Center	cellular biology.
Foundation for Research & Technology Hellas (FORTH)	Computer Science, Molecular Biology, Lasers, Telecommunications, Medical Engineering, Microelectronics, Robotics, Biotechnology, Materials, Chemical and Biological Engineering, Applied and Computational Mathematics, Biomedical Technologies, Bioinformatics as well as Historical and Cultural Studies
Centre for Renewable Energy Saving	Environmental studies and sustainable development with emphasis on new energy technologies
Center for Research and Technology Thessaly	Metatronics, agricultural ecosystems, biomedical research and technology, Human Performance

There are public research centres under the supervision of other ministries, such as the National Agricultural Research Foundation, the Research Academic Computer Technology institute and the Institute of Geology & Mineral Exploration. The Academy of Athens also contributes to R&D in Greece especially in terms of supervision. The promotion of excellence in the Research Centers/Institutes supervised by GSRT constitutes a key policy priority. Top performers include:

- Chemical processes Engineering Research Institute (FORTH)
- Centre for Research & Technology Hellas (CERTH)
- Molecular Biology & Biotechnology Foundation for Research & Technology (FORTH)
- Computer Science Institute Foundation for Research & Technology (FORTH)
- Greek and Roman Antiquity (National Hellenic Research Foundation)
- Electronic Structure and Laser (FORTH)

In similar terms, the GSRT evaluation of public research centres demonstrates that the thematic areas and research fields recognized as areas of international excellence are: ***Chemical engineering, Molecular biology, biotechnology and genetics, Agrobiotechnology, Computer Science, Roman and Greek antiquity, Byzantine studies, Applied and computational mathematics, Immunology, Astroparticle physics and Oceanography.***

However, ERAWATCH (3) identifies ***agriculture*** as the sector with the second longest tradition in research. Another conceptualization of research institutions is possible with regards to societal challenges. Specifically:

- The National Agricultural Research Foundation aims at indirectly promoting innovation in agricultural R&D
- The Hellenic Pasteur Institute aims innovation in the area of health

Although there is no explicit policy for environment and regional planning, any competent Ministry can support studies.

In terms of academic institutions, Greek universities started to conduct systematic research in the 1980's. The most important Universities are presented here by order of expenditures in R&D (3):

- The Aristotle University of Thessaloniki
- The National and Kapodistrian University of Athens
- The National Technical University of Athens
- The University of Patras
- The University of Ioannina
- The University of Crete

The newly established International Hellenic University based in Thessaloniki is Greece's first state university where programmes are taught in English so as to create a diverse community to foster understanding between cultures and nations.

Another evaluation of the R&D effort of Greek universities derives from the number of publications in the Web of Science of Reuters Thomson. An earlier evaluation performed by the National Documentation Center for the period 1993-2008 (22) reveals that the National and Kapodistrian University of Athens received the majority of publications and citations, followed by the Aristotle University of Thessaloniki. Six major fields demonstrate the Greek advantage in terms of publications: ***natural sciences, engineering and technology, medical & health sciences, agricultural sciences, social sciences and humanities***. It has to be noted that FORTH and NCSR Demokritos also indicate a successful record of publications. The same study demonstrates a sharp increase of both publications and visibility of publications in the international community.

The industry presents an unequal picture of research, with few players and several hundreds of small investors in R&D (23). The top R&D spenders include ***pharmaceuticals, travel and leisure, construction, materials and software***. The 2010 scoreboard only includes companies that best score in R&D investments in the European landscape; however there are some smaller investors that perform remarkably on the research landscape.

From the present analysis we cannot exclude some additional actors in R&D that present potential in reinforcing their role in R&D:

- Innovation zones and technopolis.
- Incubators and clusters (Athens, Thessaloniki, Chania and Heraklion)
- The Hellenic Venture Capital Association (about 20 investors)
- Business Angels Networks (4)
- Chambers and Association of Industries

The following table recaps the major scientific strengths of Greece and the sharp differences presented in R&D among research institutions, educational institutes and industry.

Table 2-4: Greek Scientific Strengths

Research centres	Universities	Industry
Chemical engineering	Natural sciences,	Pharmaceuticals
Molecular biology, biotechnology and genetics	Engineering and technology	Travel & leisure
Agrobiotechnology	Medical & health sciences,	Construction and materials
Computer Science	Agricultural Sciences,	Software
Roman and Greek antiquity, Byzantine studies	Social sciences and humanities	
Applied and computational mathematics		
Immunology		
Astroparticle physics		
Oceanography		

2.3.2 Partnerships and Collaborative Participation

Although R&D and innovation policy became the kernel for regional development and competitiveness, the links between research policies and other policies among the main actors remain quite weak. This holds particularly for the research community and the business sector (7) (3) (12). Research centres are considered as “inward-oriented” and circulation of knowledge between university and non-academic organizations is viewed as insufficient. Some possible links were identified by the National Reform Programme and the strategic development plan for RTDI, where the development of thematic research networks and collaboration is planned based on multiannual research agreements as discussed in section 2.2.

Another aspect of partnerships is indicated by the Greek co-authored scientific publications. This trend appears to constantly increase (22) (Indicatively, publications as products of scientific collaborations increased by 20%). According to the data, publications produced exclusively by a single Greek organization declined, while those produced as a result of collaboration at the national or international level increased significantly. The greatest increase was observed in collaborations between Greek institutions while the degree of international collaboration differed significantly among universities.

2.3.3 R&D and ICT Infrastructure

Any NIS is also characterised against existing infrastructure which might hinder or spur the development of specific sectors. In this section we differentiate between hard infrastructure

(ICT networks) and soft (degree of ICT penetration and sophistication) to outline the country readiness.

The main hard R&D infrastructure available in Greece is briefly presented as follows (24) :

- ◆ The Greek Research & Technology Network (GRNET): The network interconnects academic and research institutions, primary and secondary schools among themselves and with relevant academic networks world-wide. It builds upon a sustainable broadband network with 7000km optical fibres.
- ◆ National Portal of Public Administration “Ermis”: it consists of the governmental portal of public administration which ensures the use of eGovernment services. The portal is linked to Citizen Service Centres released upon modern technological interoperable infrastructures. The portal maintains a high eSophistication level.
- ◆ National Public Administration Network “Syzefxis”: the network ensures communication by telephone, data and video, covering the entire Greek territory and links about 6000 bodies in a modern broadband network for public administration. In July 2007, ‘SYZEFXIS’ became the fourth national network which has been connected to the modern **European public administration network ‘s-TESTA’**,
- ◆ Metropolitan Area Networks: The previous network is complemented by optical rings infrastructures in 75 municipalities across Greece and wireless networks in cities
- ◆ Some regional initiatives in eHealth exist (e.g., in the Region of Epirus and Crete) providing integrated environments for health care delivery through telematics networks.
- ◆ Development of research infrastructures and establishment of research infrastructures via the FP7 Programme and the scheme for unlocking and developing the Research Potential of research entities established in the EU’s Convergence Regions and Outermost regions (REGPOT)
- ◆ Greece also participates in 23 Joint Technology Platforms Initiatives, with the most important in terms of national priority and budget being ARTEMIS, ENIAC, Innovative Medicine Initiative and Clean Sky.

In terms of broadband and ICT take-up, Greece has achieved an increase in broadband performance and broadband take-up but still lags behind the European average. More than 40% of the population uses the Internet regularly and nearly one third of them are frequent users. However, there are internet services where Greece scores the lowest use, such as eCommerce. The take-up of internet services by the population is mainly for seeking information about goods and services, reading newspaper and looking for information, education, training etc. Internet banking, content upload and seeking health information are not within the priorities of Greek users. eBusiness indicators have deteriorated between 2008 and 2009, while the country lags significantly behind in eCommerce usage. The availability of eGovernment services are one of the lowest of the EU despite the recent support given by the Government and the substantial growth in recent years (25).

Greece scores above the EU average in ICT expenditure as percentage of GDP in communications but ICT expenditure as percentage of GDP in Information Technology is still low in the country, revealing a relative shift of focus on increased expenditure for telecommunication hardware, equipment, software and other services as a percentage of GDP than expenditure for IT hardware, software or equipment. Despite the introduction of the Digital Strategy and the progress in the ICT field, Greece emphasized on the deployment of broadband technology to catch up with the rest of the European countries. The underlying rationale was that the deployment and usage of ICT applications in domains such as education, health, finance etc. needs to be based on the latest technology and connectivity (26). Therefore, digital convergence was on the priorities of the political agenda. This partly explains the continuous efforts of regional authorities to keep investing in R&D infrastructure. The regulatory framework for electronic communications has been implemented to encourage infrastructure-based competition. One can also conclude that the country ranks in eGovernment demonstrate sufficient use on behalf of enterprises but not citizens. Interaction with public authorities and e-Commerce (and e-Business) are still underdeveloped despite increasing investments in the field. The following tables present the progress of the main indicators and the country's positioning compared to EU averages.

Table 2-5: ICT infrastructure in Greece

Indicator	European Union (EU27)				Greece			
	2007	2008	2009	2010	2007	2008	2009	2010
Broadband penetration rate	16,2%	20.2%	22.7%	24,7%	4,4%	9,1%	13,4%	17%
Percentage of the ICT sector on GDP	5.00%	N/A	N/A	N/A	2.71%	N/A	N/A	N/A
Information technology expenditure as a percentage of GDP	2,4%	2,4%	2,5%	N/A	1%	1%	1%	N/A
Online availability and interactivity of public services / e Government availability	58,27 %	N/A	72,87%	84,28 %	45	N/A	45	47,5
Percentage of ICT personnel on total employment	N/A	N/A	N/A	N/A	1.39%	N/A	N/A	N/A
ICT expenditure as % of GDP in communications	2,9%	2,9%	3%	N/A	3,5%	3,3%	3,3%	N/A
Promoting e-Commerce for individuals -- Last	30	32	37	40	11	14	16	18

online purchase: in the 12 months								
Proportion of individuals who have used the Internet for interaction with public authorities	N/A	35%	38%	41%	N/A	13%	14%	16%

Source: World Bank and Eurostat

Table 2-6: ICT infrastructure in Greece (continued)

Broadband	2007	2008	2009	EU -27	Rank
Total DSL coverage (% of population)	86.3	88	91	94	21
DSL coverage in rural areas (% of population)	50	55	60	79.9	21
Broadband penetration (% of population)	9.1	13.4	17	24.8	23
% of households with internet connection	25	31	38	65	25
% of households with broadband connection	7	22	33	56	25
% of enterprises with broadband access	72	74	84	83	13
% of population using a mobile phone to access the internet	1	1	1	4	23
% of population using laptop wireless connection to access the internet	1	3	3	17	25
Internet usage	2007	2008	2009	EU -27	Rank
% of population regular internet users (at least once a week)	28	33	38	60	26
% of population frequent internet users (every day)	19	23	27	48	26
% of population who have never used the internet	62	56	53	30	26
eGovernment indicators	2007	2008	2009	EU -27	Rank
% of basic public services for citizens available online	33		33	66	21
% of basic public services for enterprises available online	63		63	86	25
% of population using eGovernment services	12	10	12	30	25
% of enterprises using eGovernment services	82	83	81	71	11
% of enterprises using eGovernment for	10		10	11	16

eProcurement					
eCommerce	2007	2008	2009	EU -27	Rank
eCommerce as % of total turnover	2	3		13	
% of enterprises purchasing online	8	10		24	
% of enterprises selling online	6	7	6	12	20
eBusiness (as % of enterprises)	2007	2008	2009	EU -27	Rank
Using applications for integrating internal business processes		46	38	41	19
Exchanging business documents		22	18	26	22
Sending/receiving e/invoices	10	15	12	23	22
Sharing information electronically with customers/suppliers		21	12	15	20
Using analytical CRM	15	17	16	17	13

Source: World Bank and Eurostat

2.4 The ICT Sector and RTDI Sector in National Economy

This section covers a broad spectrum of analysis of the national ICT sector, providing an overview of the country's positioning in competitiveness, ICT and RTDI indicators, firm-specific information on ICT and RTDI and finally presents some disparities in regional performance and the consequences of the financial crisis on national positioning and how it might affect future performance.

2.4.1 Overview

The European Innovation Scoreboards (EIS) (2009-2011) classify Greece in the group of moderate innovators with about 1% average annual growth in innovation performance. While the Greek innovators are rapidly improving in marketing or organisational innovations and resource, sales of new products and the export of knowledge-intensive products are well exceeding the EU averages while employment in high-tech manufacturing and knowledge-intensive services and exports of medium- and high-tech products are lagging behind (3).

Economic growth in the recent years has been marked by the liberalization of financial markets in the 1990's and the accession to the Eurozone, leading to increases in investment and consumption, as a driver for domestic demand (12). The inflow of European structural funds and the expansion of industries such as shipping and tourism take account to the inflow of investments. However, as analysed in subsequent sections, the current economic downturn is expected to bear important repercussions for the Greek ICT RTD system. The global economic crisis combined with high public deficit and debt amplifies the weakness of the Greek NIS

which is affected by strict consolidation policies and depression which in turn affects the multiplying effects of investments.

Mobilisation of resources by the private sector is very low. Business sector's funding of GERD as a percentage of GDP is among the lowest in the EU. The low investment in research by the private sector is a result of the very poor demand for research-based knowledge, reflecting the structural characteristics of the Greek economy. A combination of factors including dominance of low-tech sectors, significant institutional and bureaucratic obstacles and a volatile policy environment orient business activities towards less knowledge intensive and lower added-value segments of the economy. Also, the low absorptive capacity of the business sector is both a cause and effect of the low demand for knowledge (7).

2.4.2 Structural aspects of the Greek economy

Greece is dominantly a service economy with the services sector representing 78.8% of GDP, whereas industry represents 17.9% and agriculture 3.3%. The valued added in services as percentage of total value added is 77.25%, while in industry it is 19.03% (27). Still, Greece is a major beneficiary of the Common Agricultural Policy of the European Union. An increase has been noted in organic farming and fisheries. Concerning services, shipping, tourism and transport are considered key components of the services sector. According to the National Statistical Service of Greece (28), those employed in the primary sector of the economy account for 13% of the total workforce, 23% for industry and 65% for the service sector. The agricultural sector is still a highlighted important sector of activity for the Greek economy; nevertheless it is the tertiary sector that boasts a major employment increase in the recent years.

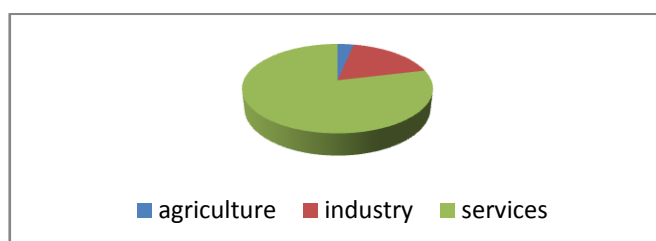


Figure 3. The Greek economy by GDP sector breakdown

As for the FDI inflows, the total FDI inflows in services (2003-2010) consisted of post and telecom services, financial intermediation (40 and 32% respectively), trade, real estate, tourism, education and health) revealing promising market prospects for these areas and the FDI inflows in manufacturing consist of chemical products, food, beverages and tobacco, machinery and metal products (29).

The tables below reflect some of the key characteristics of the Greek economy, as well as some aspects related to major societal challenges in the country. In specific, one of the challenges is the percentage of population residing in the country's capital (Athens), representing about half of the population while rural population is gradually diminishing. Inequality of (disposable) income exceeds the EU average, indicating contrasts between the top and lowest quintiles of

income. This entails an increased percentage of population at risk of poverty, which however had a decreasing trend until 2009, nevertheless the risk of poverty after social transfers remains at about 20% (2009 data) and is expected to aggravate due to further cuts in government transfers. Equally, energy consumption appears to be at relatively high levels, a congruent trend with the EU societal challenges dictating that Community climate and energy targets should be met. It has to be noted that other indicators relating to the objectives of the Europe 2020 strategy and its objectives towards sustainable and inclusive growth, such as percentage of GDP invested in R&D, employment and education are discussed throughout this section in relevant subheadings. Public expenditure for health and education data are unavailable for Greece, rendering comparisons and evaluations in transfers difficult.

Table 2-7: Major Societal Challenges

Indicator	European Union (EU27)				Greece			
	2007	2008	2009	2010	2007	2008	2009	2010
Rural population (% of total population)					39,2%	39%	38,8%	N/A
Population in the largest city (% of urban population)					47,63%	47,37%	47,10%	N/A
Inequality of income distribution (income quintile share ratio)	4,9	5	4,9	N/A	6	5,9	5,8	N/A
Population at risk of poverty or exclusion	24,5	23,6	23,1	N/A	28,3	28,1	27,6	N/A
Net migration	3,9	2,9	1,7	1,8	3,6	3,2	3,1	1,3
Energy intensity of the economy - Gross inland consumption of energy divided by GDP (kilogram of oil equivalent per 1000 Euro)	168,7	167,4	165,2	N/A	171,43	170,97	167,8	N/A

Source: World Bank, 2011 and Eurostat, 2020 indicators, 2011

The current financial turmoil affecting the global economy had severe ramifications for Greece. An upward trend of GDP increase has been abruptly disrupted during 2010 and the real GDP growth rate is inconsistent with the EU mean values, as in 2010 the negative growth rate has almost tripled. One of the structural problems of the Greek economy is the chronic external sector deficit, a result of a drop in competitiveness. It is significant that the current account deficit as a percentage of GDP rose from 1.1% over the 1980s to 2.5% in the 1990s, reaching 10% in 2003 and 10.6% in 2011 (1).

As shown in the table below, most of the structural economic indicators in the country have been reversed from 2009 onwards, as inflation rates and government debt have been increasing. Macroeconomic projections until 2020 present a gloomy perspective with recent austerity measures triggering further recession and unemployment in the country¹⁸. As concerns employment aspects, Greece lags behind the EU average in employment rates which follow a decreasing trend, especially in female employment. Employment growth has deteriorated, however on a different path from the rest of the EU countries. One of the persistent structural deficiencies of the economy is the unemployment rates, especially in females in terms of approximately an annual 3% growth. Labour productivity is lower than the EU average and together with the employment rate constitutes the main factors explaining the low per capita income. Unemployment has been high in Greece since 1998 due to the phenomenon of “stagnation”, referring to high unemployment and inflation rates. Gradual job losses are linked to the shrinking primary sector and manufacturing industries.

In addition, inflation rate in Greece has been one of the highest in the Eurozone. A substantial reduction first took place during the 90's, but it has been affected by the common currency and market conditions, such as international oil prices. (12)

Table 2-8: Structural indicators of the Greek economy

Indicator	European Union (EU27)				Greece			
	2007	2008	2009	2010	2007	2008	2009	2010
GDP at market prices (% and per capita)	100	100	100	100	81	84	89	83
	25000	25000	23500	24500	20300	21100	20800	20400
Real GDP growth rate (%)	3%	0,5%	-4,3%	1,8%	4,3%	1%	-2%	-4,5%
General government gross debt, relative to GDP (%)	59%	62,3%	74,4%	80%	105,4%	110,7%	127,1%	142,8%
Public expenditure on education (as % of GDP)	4,96%	5,07%	N/A	N/A				
Gross capital formation (% of GDP)	N/A	N/A	N/A	N/A	21,8%	20,5%	16,17%	N/A

¹⁸ An extensive discussion of the impact of the financial crisis on the Greek innovation system is discussed in section 2.4.7

Inflation rate (%)					3%	4,2%	1,3%	4,7%
Employment rate (20-64) (Total, male and female)	70%	70,4%	69,1%	68,6%	66%	66,5%	65,8%	64%
	77,8%	78%	75,8%	75,1%	80,4%	80,4%	78,8%	76,2%
	62,2%	63%	62,5%	62,1%	51,6%	52,5%	52,7%	51,7%
Employment growth (%)	1,8%	0,9%	-1,8%	-0,5%	1,7%	0,2%	-0,7%	-2,1%
Labour productivity	100	100	100	100	97,7	100,4	99,4	95,7
Unemployment rate (total, male and female)	7,2%	7,1%	9%	9,6%	8,3%	7,7%	9,5%	12,6%
	6,6%	6,6%	9%	9,7%	5,2%	5,1%	6,9%	9,9%
	7,9%	7,6%	8,9%	9,6%	12,8%	11,4%	13,2%	16,2%

Source: World Bank, 2011 and Eurostat, structural indicators, 2011

2.4.3 Competitiveness aspects

According to Tsipouri (13), the Greek RTDI policy is characterised by a paradox indicated by economic growth and improving RTDI policies which were however insufficient to restructure the economy and cross the threshold to a knowledge-based society. As implied from the following tables, the increase in growth was loosely coupled with improving competitiveness and business innovation. Despite increasing investments as percentage of GDP, the competitiveness of the country has significantly declined since 2001.

The tables below mirror several aspects of the country's competitiveness and help form a concrete view of structural strengths and weaknesses. In term of ease of doing business, the country's position has aggravated in 2010 with only some stagnating indicators. In particular, protecting investors and registering property have quite alarming values, positioning the country in the lowest quartile of the total of economies.

In terms of ease of doing business the ranking of the country in the World Bank's yearly reports has either stagnated or worsened, depending on the indicator analysed. Transparency International ranks Greece much lower than any other member state. In all rankings Greece has stagnated or deteriorated. Permanent administrative inadequacies and structural characteristics have further deteriorated during recent years and this climate is unfavourable to entrepreneurship and innovation. This determines the limits of innovation policy (13). The

Innovation Capacity index (2010-2011), based upon an assessment of aspects such as the regulatory and legal framework, R&D, ICT usage, institutional environment and human capital positions Greece on the 64th position globally, below most of the SEE and European countries. In particular, Greece is low-ranked in the institutional environment and the regulatory environment pillars, while it scores admirably in education, ICT infrastructure and social inclusion. In terms of R&D and ICT usage, Greece is positioned mid-way of the more “mature” economies in the EU. It is explicit that the institutional and regulatory frameworks seem to be deterrent factors in the country’s competitiveness, despite the progress made in R&D infrastructure, education etc.

Table 2-9: Doing Business in Greece rankings

World Bank (total: 183 economies)		
	2011	2010
Starting a Business	149	146
Dealing with Construction Permits	51	51
Registering Property	153	107
Getting Credit	89	87
Protecting investors	154	153
Paying Taxes	74	74
Trading across borders	84	81
Enforcing contracts	88	89
Closing a business	49	43
Total rank	109	97

Source: World Bank, 2011

Table 2-10: Innovation Capacity index of Greece

Pillars	General Rank and Sub-indicators		
Institutional Environment	General Rank	Good Governance	Policy Assessment
	83	50	127
Human Capital, training and social inclusion	General Rank	Education	Social inclusion and equity policies
	20	11	27
Regulatory and legal Framework	General Rank		Doing Business
	107		107

	General Rank	R&D infrastructure	Patents and trademarks	
R&D	35	40	39	
Adoption and Use of ICT	General Rank	Internet, computers and TV	Government ICT usage	Quality of infrastructures
	36	45	39	20
General ICI rank	64/131			

Source: ICI rankings (30)

The Global Economic Forum's rankings (2010-2011) produce similar results. Greece is ranked at the 83rd position on a global competitiveness scale out of 139 countries, pointing to a deterioration compared with previous ranks (71/133 in 2009-2010 and 67/134 in 2008-2009).

The burden of government regulation, number of procedures to start a business, lack of government procurement of advanced technology products, and a whole set of low marks in labour market efficiency indicators compose the weakest points. Many indicators relate to the institutions' strength, goods market efficiency, and financial market sophistication. On the relatively positive side are infrastructures, primary education and only partially higher education. Technological readiness and business sophistication are assessed around the average rank, with FDI and technology transfer as well as cluster development lagging far behind. In the innovation set of indicators, most of them rank between the 70th to 90th positions with Greece scoring 105th in the capacity for innovation. One of the handicaps of Greek competitiveness is the perception for widespread corruption. Greece scores very low (3.5/10 along with Serbia) in Transparency International (corruption index), which entails a high level of corruption in the country.

Table 2-11: Global competitiveness ranks, Greece

GCR Rank	Greece
Public institutions	82
Private institutions	101
Infrastructure	42
Macroeconomic environment	123
Higher education and training	42
Quality of education	84
On the job training	100
Goods market efficiency	94
Competition	112
Quality of demand conditions	66

<i>Source:</i>	Labour market efficiency	125	<i>Global</i>
	Efficient use of talent	114	
	Financial market development	93	
	Technological readiness	46	
	Technological adoption	92	
	Availability of latest technologies	59	
	Firm level technology absorption	91	
	FDI and technology transfer	109	
	ICT use	39	
	Internet users	50	
	Broadband internet subscriptions	37	
	Internet bandwidth	44	
	Innovation and sophistication factors subindex	73	
	Business sophistication	74	
	Innovation	79	
	Capacity for innovation	105	
	Quality of scientific research institutions	88	
	University industry collaboration in R&D	112	
	Government procurement of advanced technological products	108	

Economic Forum

The data above advocate towards the argument that the paradox previously described i.e., that the policies and macro-indicators were unable to redirect Greece to a competitive track. This is also validated by the figure below which demonstrates that contrasting Greece to other innovation-driven economies leads us to conclude that future reforms need to be oriented to the framework conditions supporting innovation and the support of the private sector and institutions to exceed the current backdrop of interlinked deficiencies.

Stage of development

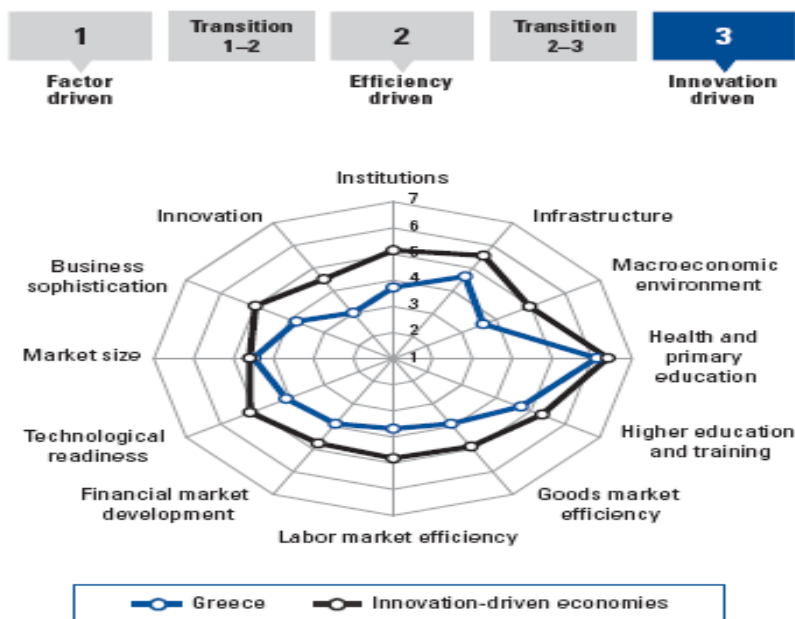


Figure 4. Greece's stage of development

Source: Global Competitiveness Report 2010-2011

Tables 5 and 6 present the R&D profile and R&D intensity projections until 2020. The projections indicate that given the circumstances, Greece will not be able to follow the EU (and subsequently Greek) targets by 2020. In particular table 6 juxtaposes major indicators to illustrate the Greek R&D profile. Greece, along with Latvia, Lithuania and Malta constitute a reference group that lags significantly behind most of the R&D indicators. The difference is especially overt in R&D intensity (GDP) and Business expenditure on R&D, as well as patents, licence and trading aspects. These are discussed in subsequent sections.

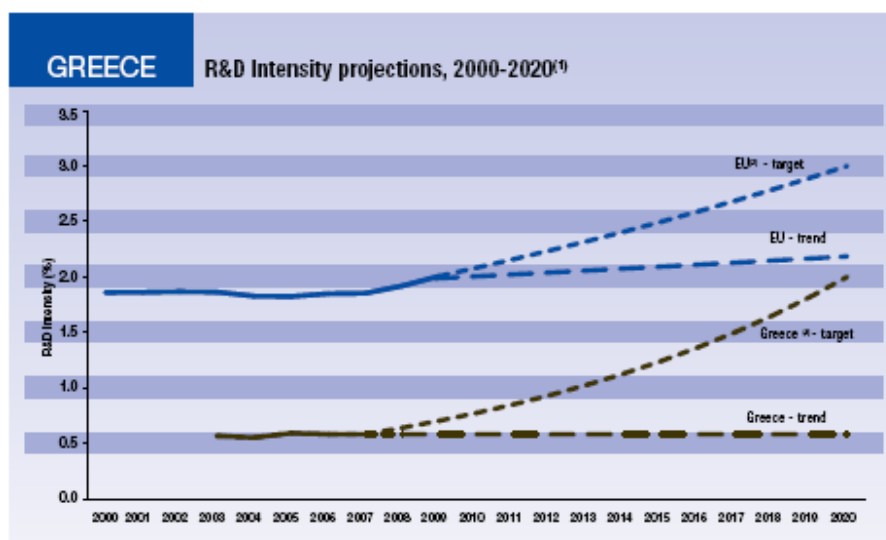


Figure 5. R&D Intensity projections 2000-2020

Source: Innovation Union Competitiveness Report 2011

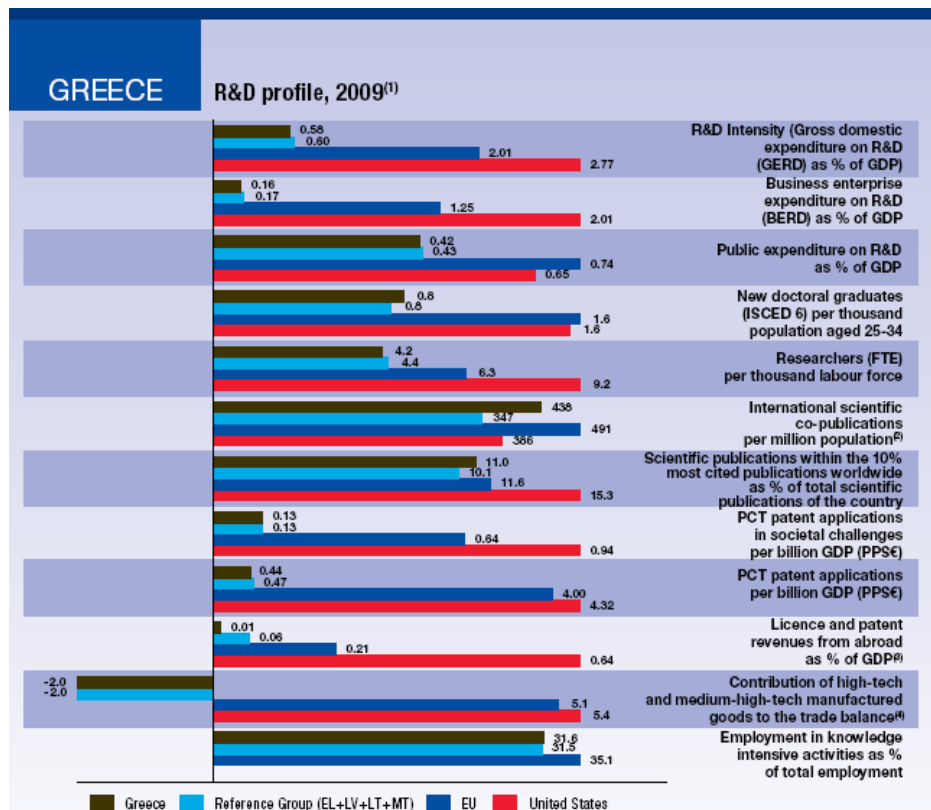


Figure 6. R&D profile 2009, Greece

Source: Innovation Union Competitiveness Report 2011

2.4.4 ICT/RTDI National Positioning

Import to export coverage ratios have deteriorated in recent years. Based on Eurostat figures, exports of goods and services account for about 20% of GDP, compared to other countries where the rate varies from 27% to 85%. This trend might be attributable to the small size of the Greek businesses and their limited innovative capacity and the displacement of direct exports from Greek FDI to neighbouring Balkan countries (1). ICT, food- and service-related exports only represent about ¼ of total exports of the economy. ICT exports and imports are a minor component of international trade. Trade remains the most important sector in terms of value added in the Greek economy, brought by internal consumption patterns. Total high-trade as a percentage of imports and exports is also remarkably low, as compared to other European countries. However, an encouraging trend is the exports in knowledge-intensive services which are slightly exceeding the EU average. Greece is not ranked high in terms of FDI attractiveness, as referred to previously the structural weaknesses of the Greek economy, despite the notable FDI outflows to Balkan countries. Another chronic factor of low

competitiveness of the economy is the external sector deficit with the exception of exports in services, attributed to shipping and tourism growth. The following table captures these trends:

Table 2-12: Position in International Markets, Greece

Indicator	European Union (EU27)				Greece			
	2007	2008	2009	2010	2007	2008	2009	2010
Average of FDI inflows and outflows, relative to GDP (%)	4,4%	3,1%	2,4%	0,9%	1,7%	0,7%	0,6%	0,4%
Trade (% of GDP)	N/A				57%	59%	47.9%	N/A
Imports of goods and services, relative to GDP (%)	39,6%	41%	35,6%	39,7%	34,6%	36,3%	29,6%	29,4%
ICT goods imports (% of total goods)	N/A				6.2%	5.6%	5.8%	N/A
Exports of goods and services, relative to GDP (%)	40,2%	41,3%	36,6%	40,6%	22.7%	23.4%	18.8%	21%
ICT services exports (% of exports)	N/A				1.61%	1.68%	2.17%	N/A
ICT goods exports (% of total goods exports)					2.97%	3.21%	3%	N/A
ICT service exports (% of service exports, BoP)					1,61%	1,68%	2,17%	N/A
Total high-tech trade as a percentage of total imports					8.2%	8.4%	10.6%	N/A
Total high-tech trade as a percentage of total exports	16,1	15,3	16,9	N/A	4.7%	5.8%	6.7%	N/A
Knowledge intensive services exports as % of total services exports	N/A	N/A	48.8%	49.43%	N/A	N/A	52%	57.01%

Source: Eurostat and World Bank

Greece lags behind with respect to many R&D indicators, with one of the lowest percentages in R&D investments. As reflected in the table below, BERD and GERD expenditure are quite low in contrast to other European countries, which renders Greece's ambition to reach the 3% of GDP in R&D target almost unattainable. Non-R&D innovation expenditures however

present a different picture, as the 0.74% score has exceeded the EU average. Business investment in R&D appears to follow the overall trend of R&D expenditures and remained stagnant below 0.2% during 2007-2007 (7). The lack of data for the period 2008-2010 burdens an estimation of trends and variations. Average BERD accounts for 0.16% of GDP while the European (EU-27) average approximated 1.17% which leads us to conclude that the gap between Greece and the EU is ever persisting. GERD percentages are also discouraging, especially considering that the main player of RTD activities is the public sector and universities in particular. The productive sector's participation is rather low and it seems to stabilize around 30% of GERD in the last years (12).

Table 2-13: R&D finances, Greece

Indicator ¹⁹	European Union (EU27)				Greece			
	2007	2008	2009	2010	2007	2008	2009	2010
Business R&D expenditure as a % of GDP	1,18%	1,21%	1,25%	N/A	0.16%	N/A	N/A	N/A
R&D expenditure (BERD) of businesses in ICT sector as % of total R&D expenditure in all sectors	N/A	N/A	1,03%	0,71%	1.57%	N/A	N/A	N/A
Non- R&D innovation expenditures as a total number and as a % of total turnover	N/A	N/A	1,03%	0,71%	N/A	N/A	0,74%	0,74%
Gross Domestic Expenditure on R&D (GERD) as % of GDP	1,85%	1,92%	2,01%	N/A	0.58%	N/A	N/A	N/A
Total GBAORD ²⁰ as a % of total general government expenditure	1,49%	1,47%	1,48%	N/A	0.64%	N/A	N/A	N/A
Total GBAORD as	0,68%	0,69%	0,75%	N/A	0.3%	N/A	N/A	N/A

¹⁹ BERD and GERD values are available for the subsequent years only on an EU general scale

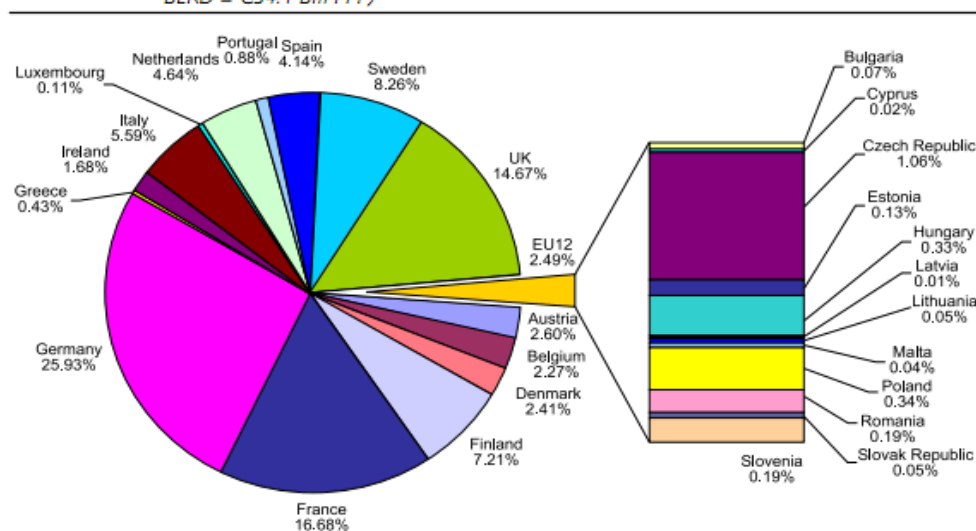
²⁰ Government Budget appropriations or outlays on R&D

percentage of GDP by total R&D appropriations								
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Source: Eurostat and World Bank

The following figure provides a clearer and specific view upon the distribution of ICT BERD shares. It is explicit that SEE countries represent a small percentage (2.5%) of total EU ICT BERD. Greece, as an older Member State does not significantly differ from the rest of SEE countries and is considered a minor contributor with 0.43% of EU share of ICT BERD.

Figure 5-1: Distribution of ICT BERD shares in EU countries % of total EU ICT BERD, 2007 (Total EU BERD = €34.1 Bill PPP)



Source: JRC-IPTS based on data from Eurostat, at Purchasing Power Parities (PPP).

Figure 7. Distribution of ICT BERD in EU countries

Source: JRC-IPTS, Eurostat

2.4.5 Innovation in Enterprises

The previous discussion on BERD presents a gloomy picture concerning innovation in enterprises. Nevertheless, some aspects of innovation in the private sector need to be elucidated so as to assess general trends and market potential.

In general terms, private R&D funding is considered as the weakest area in the Greek research system. BERD as a percentage of GDP was stabilized since 2000 with small fluctuations around 0.16% per annum. Moreover, BERD is covered 6.3% by national government and 7.8% by European sources (3). GSRT findings suggest that as regards the entrepreneurial activity type and quality, Greece has a rather low High Potential Entrepreneurship Indicator, and ranks very low among EU-25 member states (only 16.14 % out of all entrepreneurial endeavours made in

Greece can be characterized as high-potential i.e., contributing to market expansion, new job creation, increasing exporting orientation, etc.) (12).

Greece does not provide official data on business demography i.e., birth and death rate of enterprises so as to assess some structural trends of the role of enterprises in the economy. In general, there is an increased tendency towards entrepreneurship, with the self-employed occupying an increased share of the total workforce, therefore this indicator is elevated (12). Notwithstanding this trend, the quality dimension of entrepreneurship needs to be assessed against other criteria as well.

The sales of new-to-market and new-to-firm innovations (measuring the sum of total turnover for all enterprises) is about the double of EU average (25.65% against the EU-27 average of 13.26% for 2010), which in turn signifies potential commercialization routes of the innovation process (19). According to ERAWATCH, business activity has been concentrated in less knowledge-intensive and low added-value segments, thus the demand for research-based knowledge is not spurred. Demand in the private sector is driven mainly by the prominent sectors of the Greek economy such as chemicals, trade and food as well as IT services and electrical equipment. For instance, the largest telecommunications equipment and software industry in Greece (Intracom SA) had financed about 10% of industry-financed BERD in 2005. In addition, Greece has a notable specialization in community services, food, IT services, electronic equipment, trade, shipping and construction. It is also noted that the biggest spenders of business RTD are in the areas of ICT and biotechnology. In the same line, sectors with enterprises involved in cooperation consist of electricity, ICT, telecommunications and the share of enterprises with activities in process innovation (than in product innovation).

The above trends synthesize a contradictory picture but tend to outline the market potential of innovation outputs especially with regards to ICT RTD. Some additional trends regarding innovation in enterprises are described as follows:

- ✓ A steady decrease over time of the self-employed in total employment. Self-employment in Greece used to attract the highest percentage among OECD countries (27.2%). According to the OECD, tertiary education graduated show a low propensity to establish a firm.
- ✓ Greek NIS composed of small and very small firms with low-medium technological orientation
- ✓ Low “in-house” RTD performance
- ✓ Majority of innovative firms are relatively newly established
- ✓ Reliance on public funding sources to perform research
- ✓ Costs of HSRT (Human Resources in Research and Technology)
- ✓ Low mobilization of enterprises. According to GSRT, the low contribution of the enterprises in research activities might be attributed to the structural weaknesses of the economy’s productive base, characterized by a plethora of small enterprises, dominance of traditional sectors and low potential in sectors with technological innovations etc. These factors lead to a risk-averse behaviour on behalf of enterprises. (12)

An interesting aspect of innovation within enterprises is the role of non-R&D innovation. About 50% of all innovations in Greece (and in most of the SEE countries) is attributed to non-R&D innovation which may include acquisition of extramural R&D, advanced machinery, equipment, computer hardware or software, acquisition of licenses and inventions, training and design of new goods or services (14). According to the General Secretariat for Research and Technology, the Greek industry relies on imports of machinery and equipment (forms of embedded technology) to achieve technological upgrade and productivity improvement. This appears to amplify the gap in links of the “knowledge triangle” and interactions for knowledge exchange. According to the results of the Innovation Union Scoreboard 2010 (23) non-R&D innovators consider universities and research institutes as less important sources of information for innovation activities. This is a perspective with major implications from a policy perspective since R&D performers are the target of most policy actions. Thus, failing to discriminate between non-R&D and R&D innovators reduces the effectiveness of both the analyses of innovative firms and the effectiveness of public policies to stimulate innovation. In addition, a significant deficiency is found in foreign direct investment, which has been a source of concern, ineffective incentives and ineffective effort for improvement.

The following table discusses some major trends of Greek innovation enterprises with regards to the competencies valued, open innovation, partnership and cooperation trends. Open innovation practices appear to be quite attractive to Greek enterprises, as the use of internet-based forums, free access to testing and IPR exchange are valued practices, as compared to other EU countries. In-house involvement of users however is not that common, taking into consideration the low percentage of in-house R&D activities. Greek enterprises also score highly in their stance towards strategic partnerships to support innovation, especially in terms of strategic relationships with customers and suppliers as well as educational and research institutes. This percentage varies from 1/4th to 1/5th of respondents and in many cases exceeds the EU average. Cooperation is another component which is perceived as a factor of strategic importance as outsourcing, liaising with local partners and testing in other countries are usual practices. This however might be explained by the amount of enterprises that hold outward FDI to neighbouring countries or novel tools that permit them to reach a more mature customer base. Based on the results of the Service innovation yearbook, it appears that Greek enterprises especially in the service sector are open to new paradigms of collaboration and linkages; however the percentage of respondents might be low to compensate for the overall rankings of the country.

Table 2-14: Strategic trends of Greek enterprises

	Europe27	Greece
Skills-Competencies that enterprises look for		
Companies targeting team working capacity in support of innovation	56%	41%
Negotiation skills	46%	35%
Successful communication with other cultures	32%	32%

Creativity	48%	45%
Knowledge management		
Knowledge management systems in support of innovation	35%	48%
Internal mechanisms for employees to submit innovative ideas	46%	43%
Staff rotations and secondments	40%	38%
Creation of cross-functional teams on innovation projects.	35%	28%
Indicators of open innovation		
Creation/participation in internet-based forums in support of innovation	13%	19%
Allow free access to test products or services to users	26%	34%
Involving potential users in in-house innovative activities	24%	21%
Share/exchange of intellectual property in support of innovation	22%	29%
Strategic partnerships to support innovation		
Str. Relationship with specific customers	39%	46%
Str. Relationship with suppliers	42%	48%
Str. Relationship with other companies active in their field	29%	28%
Str. Relationship with research institutes	15%	19%
Str. Relationship with educational institutes	24%	24%
Co-operation trends		
Outsourcing tasks to enterprises located in other countries	10%	18%
Making investments in enterprises in other countries	6%	7%
Other forms of cooperation with local partners in other countries	17%	30%
Recruiting employees from other countries	16%	17%
Market testing innovative products in other countries	13%	19% (7th rank)

Source: Innobarometer 2009 and Service Innovation Yearbook 2009-2010

In addition, while Greek enterprises develop synergies and cooperation with other organizations to enhance their innovation performance, they engage in less joint publications than leading countries, which is indicative of a rather short-term cooperation perspective (17). Cooperation is notable with research organizations, customers and suppliers but limited with educational organizations and similar sectoral enterprises. Furthermore, the innovation system's outputs focus on small and medium enterprises. The percentage of Greek SMEs having adopted innovation do exceed the EU-27 average while SMEs that have adopted organizational and marketing innovation gain the second position in the EU. Enterprises that claim that innovation is their major source of income are less than 10% of total while those

that claim that innovation is an essential source of income approach the EU average (Innobarometer 2009).

An older survey in Greece (31) determined the major factors of innovation and argued that the most important determinants of innovation are highly context specific. Major deterrents are as the intensity of R&D, strength in marketing and the quality of personnel. This includes proportion of university graduates and engineers in total staff, proportion of managerial staff and incentives offered to employees. Innovative companies manage to overcome the traditional rigidities of the institutional context and adopt unique practices to face limited financial resources in conjunction with the traditionally low level of competition. In similar terms, Komninos et al. (32) identify small size, self-employment patterns, transitional organizational structure and limited start-up capital as enterprise specific deterrents of innovation that in turn yield low production potential, limited capacity for large scale investments and failure to follow innovative developments in other markets. ERAWATCH (7), (3) identifies a general risk-averse culture as a major factor that deters the productive fabric to adopt innovation or develop an innovative base. From a systemic point of view, low investments to RTD can be attributed to the dominance of SMEs (entailing lack of resources) and low demand for technology services and subsequent links between academic and research organization that are not conducive to raising awareness.

The policy mix stimulated by the Greek government has identified several routes to stimulate R&D investments such as: facilitating firms in accessing research facilities and groups through collaborative research and collaboration schemes, promoting the establishment of new R&D performing routes through funds, tax investments and access to finance, new measures and innovation vouchers for SMEs and stimulating the public sector's role in extramural R&D and R&D in the public sector itself. This policy mix appears to address most of the major deficiencies in the research policy domain, but focus and priorities remain unclear (7).

2.4.6 Regional Aspects

Regional aspects of RTDI need to be further explored to provide an additional perspective to the analysis of the national innovation system of the country. As referred to section 2.2.3, regions maintain some autonomy in designing and implementing innovation policies, thus it is important to assess specific regional aspects of competitiveness so as to assess the factors that contribute to regional competitiveness and provide prospects for future markets, which in turn are perceived as essential to a foresight exercise. According to Komninos et al. (32), the economic performance of the regions appears loosely coupled with the country's innovation activity. Hence, there seems to be a limited correlation between the country's overall economic performance with the respective performance on knowledge creation and innovation.

R&D aspects in regions present a diversified picture, characterized by regions relying on gradual capacity building and regions with long-term prospects in innovation. By contrasting regional indicators, one can infer that some regions appear to be wavering far away from the country's average, due to some structural characteristics of the local economy

(unemployment, dominance of traditional sectors, low share of GDP etc.) and deficiencies in terms of infrastructure and linkages with Universities. The Region of Attiki concentrates the bulk of public and private R&D actors and expenditure in the country, absorbing 60% of the national GERD and 41% of national BERD, although, there is still a gap to the EU-27 average due to limited demands from industry. The region of Crete also demonstrates high potential, but one of the obstacles these regions face is the slow rate of restructuring of the local economy and the weak alignment of technological demand by firms with the supply by the public sector (33). In general, the common denominator of the deficiencies of Greek regions to convert themselves into growth dynamos are a combination of limited demand from the industry, reflecting the low-to-medium technology structure and of low level of extroversion. At the same time the limited formal linkages between the research and business sector, the low level of public funding and the fragmentation of the research efforts across numerous disciplines constitute important barriers to further increasing R&D expenditure in most of the regions. Detailed indicators on R&D activities of the regions are presented in Annex I.

Some notable examples that illustrate these contrasts are (14):

- The region of Anatoliki Makedonia demonstrates limited absorbing capacity and demand by firms for RTDI services and the absence of infrastructures for enhancing technology transfer limit the potential for spillover effects and the creation of long-term linkages between regional firms and the Higher Education sector in the region.
- Kentriki Makedonia on the other hand, started to enervate its position to the knowledge economy by overcoming limited demand for RTDI services by firms by implementing initiatives such as incubators, innovation zones and clustering based on new technologies and innovation.
- By contrast, the regions of Thessalia and Ipeiros, despite the existence of Universities and technology parks and innovation poles only remain peripheral nodes within the National innovation system.
- Dytiki Ellada remains an important region due to the plethora of public research organizations and innovation poles, collaboration practices and skilled personnel.

Thus, the majority of Greek regions belong to the category of “knowledge absorbing innovating regions”. Recent reforms making Greek regions more autonomous have a questionable and ambiguous effect on the R&D sector and capacity building in regions (14).

2.4.7 Ramifications of the Current Financial Crisis on the Greek NIS

The impact of the global credit crisis on the innovation activity and innovativeness of the enterprises in a national economy and on the competitiveness of the economy as a whole significantly varies from country to country, according to the dominant patterns of growth and competitiveness. In Greece, the credit crisis brought on a deep recession, characterized by inflation, unemployment, political instability and excessive debt and deficit (3).

Innovation and entrepreneurship in Greece are hampered in this programming period not only by persistently unfavourable structural characteristics but also by macroeconomic tensions

and the difficulty of the state to provide funding. Greece is among the countries where the responsiveness of R&D to the business cycle entail a response in R&D expenditure 1.5 to 3.5 times the change in GDP, meaning that the current crisis could lead to significant drops in R&D intensity after 2009 (19).

The measures that each government is introducing to counter-effect the financial crisis are not directly linked with a view to innovation policy (for instance, the reinforcement of the banks), however they entail a recoil of measures of the framework conditions to innovation, such as subsidies to youth, female, R&D and general investment incentives due to major budgetary restrictions and additional taxes imposed. According to a survey of research ministries in Member States conducted by the European Commission in 2010, 16 Member States planned to increase their R&D budget in 2010, while 4 Member States planned to decrease it.

The adverse conditions the country is facing are demonstrated by the percentage of Greek enterprises that have rearranged their expenditure with regards to innovation. Half of the enterprises state that they are willing to increase the expenditure on R&D while the other half will reduce expenditures verifying the dual nature of the Greek economy with one section aiming at modernization and the other receding from innovative ambitions (34). More specifically, almost one in two innovative companies states that there will be a decrease in expenses on innovation and almost none supports an increase on the sector (17). In addition, while 42% of Greek businesses had estimated an increase on funding expenses during the period 2006-2008, the actual increase occurred only in 1.8% of the businesses due to the recess factor. The challenge of the Greek policy makers is thus the willingness to support with minimum resources available, all the sectors equally or to select the more dynamics so as to minimize competition. This in turn will have major repercussions in the economy, as it leads to a restructuring of the country's productive base (17). An important effect (verified by the relevant tables in sections 2.4.2) is a retardation of adverse effects felt in the economy of the financial crisis in comparison to other European countries.

According to the Innovation Union Competitiveness Report (2011) there are no available data for Greece related to the government budget appropriations for R&D (GBAORD) for 2007-2010. Recent projections had indicated an increase in total investments on research to 2% of GDP by 2013, mainly coming from the public budget, reflecting the intention of the government to set the knowledge triangle policies at the centre of public policy. With the latest developments it is highly unlikely that this target can be met. The overall cut of public expenditures for 2010 amounts to €5.8b representing 2.5% of GDP. The cut amounts to €9.65b for 2011 (4.3% of GDP), in 2012 the reduction will amount to €5.57b (2.4% GDP), while in 2013 it will reach €4.775b (2% of GDP). Though the target of 3% (expenditures on R&D as a percentage of GDP) was unrealistic for Greece before the outburst of the crisis, the Stability and Growth programme prepared in 2010 raised the target to 2% until 2013 by increasing the contribution of Structural Funds to the support of R&D. Nevertheless, with the deterioration of public finances, with the public debt reaching 144.9% of GDP in 2010 and the public deficit as 10.6% of GDP, it is not explicit whether these commitments can be favourably sustained (35).

Hence, the government priorities have been re-directed towards fiscal consolidation by reducing government deficit and increasing taxes and cutting government's expenditures. This is expected to affect the ability of the government to co-finance Structural Funds funding for research (7). Institutional funding is also expected to be reduced due to the recent cuts in researchers and academics salaries.

Figure 8 below demonstrates most of the adverse effects brought about by these developments and the specific dynamics that lack of funding is expected to impede. In specific, the growth of patent applications, publications and researchers and graduates during the period 2000-2009 showed a remarkable growth, surpassing the growth of the European average. On the contrary, BERD, GERD and employment growth rates were limited and a risk obviates that they might be further jeopardized.

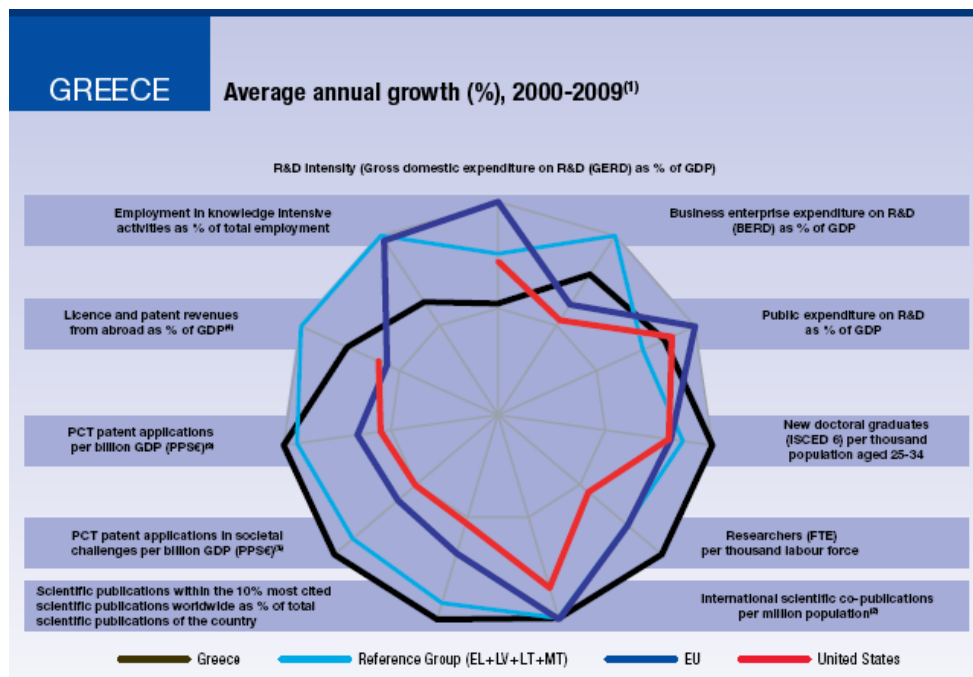


Figure 8. Average annual growth of R&D intensity, 2000-2009, Greece

Source: Innovation Union Competitiveness Report 2011

2.5 Main components and interactions of innovation systems (barriers and drivers)

Weak linkage between the private and public research sectors constitutes a problem acknowledged and stands on high priority for RTDI policies. Introversion of public research and low demand have created imbalances in the way than knowledge-generating and utilizing actors respond to knowledge needs. It is thus essential to investigate the linkages and interactions between sectors and the development of services to serve these interactions as well as framework conditions that underpin the innovation process.

2.5.1 Main Regulatory Framework Conditions

In Greece, the regulatory framework towards ICT/R&D tends to reinforce in a relatively small degree new initiatives and R&D investments through Investment Laws and certain favourable regulations. In addition, there is a tendency for a more inclusive approach towards the issue of R&D and Innovation, as research, education and training are gathered under one Ministry. The challenges in this area are long-lasting since Greece has been indicated to have taken minor steps towards lifting the barriers to competitiveness and ranks among the group of countries with the most restrictive regulations on competition. This trend has also been discussed in the context of the “Doing Business” rankings discussed earlier.

Tax incentives for RTD activities undertaken consist of favourable measures to indirectly improve the environment and legal framework for innovation. For instance, Law 3296/2004 provides a significant deduction of expenditures made for scientific and technological research from taxable profits. Investment Law 3522/2006 provides enterprises with subsidies for investments in the development of high-tech products and infrastructure and the Investment Law 3296/2004 improves tax incentives for R&D (7). Furthermore, the New Investment Incentives Law (3908/2011) reinforces the investment processes by improving speed, transparency and results (36). More specifically, the sectors covered are: Tourism, Logistics, Manufacturing, Renewable Sources of Energy, Production and Processing of Agricultural Products and more (8). Moreover, the regulatory framework of the National Strategic Development Plan 2007-2013 provides regions with freedom regarding the implementation of their own policies within the framework; however, this freedom is not defined by a law.

Other important improvements since 2009 include the applications European Patent diplomas for community industrial designs and the large increase of companies with access to broadband services (17). “Start up Greece”, a new online interactive platform assists the communication between new entrepreneurs and the Ministry of Regional Development and Competitiveness and the access to funding by the NSRF or the Operational Programme “Competitiveness and Entrepreneurship”.

Other framework conditions derive from the OP “Digital Convergence” 2007-2013 within NSRF 2007-2013, which presents new actions for public administration, citizens and businesses related to e-security, e-government, cloud computing, Digi-retail and Digi-content, thus the uptake of new technologies is reinforced. Through this programme the strategic objectives of the Greek Digital Strategy are supported and the contribution to the Lisbon objectives with 95% of its total budget (37).

Finally, antitrust rules have been set by the EU primary legislation so as to guarantee healthy competition and relevant Greek authorities abide by this legislation. Regarding the Intellectual Property (IP) Rights for inventions, there is a legal protection of inventions (Patents Act, Law 1733/1987) and the Hellenic Industrial Property (38).

2.5.2 Favourable Conditions and Access to Finance

The venture capital market in Greece has shown considerable progress over the last years with recent initiatives supporting access to finance. Since the 1990's, the Greek venture capital and private equity were the main instruments along with private and semi-private funding institutions such as TANEQ (new Economy Development Fund). In 2003, the Hellenic Venture Capital Association (HVCA) was founded so as to promote and develop the venture capital industry (39). During the period 2000-2006, certain Venture Capital Funds were created to support spin-offs in incubators and within the period 2007-2013, similar measures to the above are expected to be supported and a High Risk Seed Capital fund is due to be established for the support of R&D investments since the seed stage. The support of the sector is reinforced by initiatives such as TANEQ S.A. and the Digital Leap Venture Capital Fund (7). As the "Benchmarking European Tax and Legal Environment" study shows, in Greece, the legal and the tax environment for the development of the venture capital market and private equity is considered favourable. The country ranks above the EU average since 2003 (European Private Equity Association (EVCA) (40)²¹. However, Greece also ranks 18th rank in EU-25 as regards the availability of venture capitals that leverage the development of new, high-risk companies.

Other actions taken into this direction concern new investment funds and the 'Guarantee by Credit Guarantee Fund Inc.' to achieve new forms of investment practice and innovative entrepreneurship (venture capital, start up and seed capital, business angels network, support of startups via seed funding) mainly through the support of Operational Programmes. A Greek Business Angels Network was recently established with the support of various stakeholders (41). Nevertheless, the venture capital market is still immature in the country lacking large scale investments and positions the country to the 19th position among the rest of the EU countries. Pension funds are consist of an immature market and the major investors are still banks and individuals (39), while seed capital and start-up capital have not become widespread due to high risk, local entrepreneurial activity etc. Moreover, a new 'Entrepreneurship Fund' (ETEAN SA), established in 2011 for the provision of €1,2 billion of funding for venture capital, start up and seed capital, business angels) for new ventures, is another newcomer in the same policy area. Complementing that fund is the Jeremie initiative, with an overall budget of €120,000,000, providing increased access to finance for micro, small and medium-sized enterprises in order to implement their investments and expand their activities. (11)

²¹ In addition, the early stage venture capital investments as a percentage of the GDP for Greece were 0% in 2005, 0.001% in 2006, 0% in 2007 and 2008 and 0.002% in 2009, when the respective EU15 percentages are 0.022% in 2005, 0.053% in 2006, 0.018% in 2007, 0.022 in 2008 and 0.017 in 2009

Fund capital is primarily invested in firms which are related to “new economy” activities such as telecommunications, IT, e-commerce, biotechnology, new materials and in companies with a ‘new-technologies’ competitive advantage (42), and more specifically during 2007-2013 a total of 100m euros is expected to be offered for seed ICT fund and Early Start ICT Fund, co-funded by Operational Programmes.

2.5.3 Links between Research Actors

The main problem that characterizes the situation in Greece regarding the cooperation between industry and academia, private enterprises and research organizations is the fact that research priorities are defined in terms of funding opportunities and not driven by the demand of the market. Hence, there is lack of a dynamic type of relationship between the private sector and research centres and universities and the intermediary units and the liaison offices are considered inadequate. Past innovation reports have highlighted that although Greece normally achieves a better performance in innovation inputs (education, investment in innovation, etc.), it scores lower in output measuring indicators (firm turnover coming from new products, employment in high tech sectors, patents, etc.), which possibly signifies absence of links and interactions among the knowledge sharing elements of the system. In addition the fragmentation of the system is partly due to the traditional orientation of productive sectors which fail to create dynamic markets for educational and research output of public research. Thus, the implications of linkages shortage can be seen across a wide spectrum of policies (7), (3).

Another obstacle is the lack of a dynamic market for the research output of universities and research centres so as to cooperate with the private sector. Although there have been attempts to use intermediary mechanisms in order to reinforce collaboration, the results were limited and knowledge exploitation and circulation was not achieved properly. However, during the past years certain progress has been made as there are new programmes and frameworks that encourage this kind of relationships.

The strengthening of such links with organizations abroad was rendered possible with the participation of Greece in the EU Framework Programmes for research. During the period 2004-2006, the number of innovative firms that collaborated with universities increased by 6% (7). Some national initiatives of the Operational Programmes based on the rationale of the European paradigm have been designed to rectify this deficiency in terms of linkages, such as:

- new knowledge-intensive clusters are created in areas with competitive advantages, such as the cluster Corallia in microelectronics
- regional innovation poles
- networking of private companies with technological providers and research centres as well as collaborative projects in selected strategic fields such as Energy-Environment-Climate, ICT and Manufacturing, Nanotechnology, Health and other.
- creation (43) of innovation offices and intermediary organizations and support of spin-off and spin-outs

- measures supporting the mobility of researchers from university to market for the exploitation of knowledge (via spin-offs)
- Technology transfer from research organizations to SMEs with limited R&D activities⁽¹⁴⁾. This is mainly achieved through technology brokers (SMEs)
- collaboration of SME's groups with R&D performers in high technology fields such as ICT, nanotechnology, biotechnology, microelectronics, health, energy, space and security technologies and other
- creation of libraries and databases and documentation networks
- support of research units for standardization and commercial exploitation of research results and the establishment of new businesses
- Creation of the Hellenic Technology Clusters Initiative (HTCI) which provides support in addressing policy measures to resolve deadlocks in innovation and R&D
- Liaison offices in academic, technological and research centres
- Centres of Entrepreneurial and Technological Development (KETA) which support especially SMEs to increase competitiveness and act as mediators between firms and funding sources.
- Networks of Intermediaries supported by the EU, such as 2 Innovation Relay Centres and 5 Business Innovation centres for support of entrepreneurship. The centres for diffusion of information and know-how encouraging the creation of links among actors is the establishment of Business Innovation Centres (BIC's)

Most of these measures are still under design and an evaluation of their effectiveness is not rendered possible. Additional government failures recognized by the Greek political spectrum has not allowed all initiatives to flourish. A small improvement has been noted regarding the distribution of information to SMEs and investors, due to the creation of the Centres for Entrepreneurial and Technology development (44). Some networks (such as EMAKI²² in Patras and PRAXI²³ network, the liaison office of CERTH) also play an important role in forging links between organizations and academia as well as in commercialization. Past ERAWATCH innovation reports reveal some key disadvantages of similar endeavours to reinforce links:

- Science and Technology parks face few incentives for installation of companies, legislation for commercialization and weaknesses in financing.
- Low ranking with respect to cluster dynamics (7) (3)

In 2008, the EU average for business funding public R&D is 0.05% of GDP which shows the contractual cooperation between the public and the private sector. The respective Greek

²² EMAKI is the Economics and Management of Knowledge and Innovation, a research network founded at the University of Patras (<http://emaki.upatras.gr/>)

²³ The PRAXIS network (HELP-FORWARD Network = HELlenic Project FOR WiderApplication of R&D) provides services to SME's, research labs and public administration with respect to technology transfer, innovation and research partnerships (<http://www.help-forward.gr/el/index/index.php>)

average is 0.03% of GDP while other SEE countries also score low. Greece is not considered having a significant position in co-publications despite the progress achieved. Some of these aspects will be discussed in section 2.6.

2.5.4 Public Sector Innovation in the Delivery of Public Services

Public Private Partnerships (PPP) are an important tool for the delivery of public services to citizens but so far they have been targeted towards the construction of public infrastructure.

With regards to public procurement and pre-market public procurement strategies, conditions are not yet mature enough to enable the understanding of the long-term benefits of such strategies and the multiplying effects on innovation. Although, public procurement can trigger innovation by attracting multinational companies, improving local infrastructure and public services and readdressing failures of the system and can lead to the creation of actual markets for innovation, (19) Greece does not take proper advantage of such strategies. Many suggestions have been geared towards the direction of public procurement and its contribution to the development of technology and innovation through demand-generating mechanisms (17), (12) and new regulations regarding public procurement and the health sector are expected to modernize the system. According to the 2009 Innobarometer (45), Greece is an average innovator in terms of business participation in public procurement (purchase of products, services from the public sector and other organizations). Hence, there is room for developing the pre-commercial procurement market in a way to leverage innovation and related costs. According to the report “Strategic Use of Public Procurement in Europe (2010), conducted by (46)“adelphi” Green Public Procurement (GPP) is a sector for which Greece along with Liechtenstein, Bulgaria, Norway and Luxembourg has not formulated any policy and has not set any target whereas Iceland, the Netherlands and Finland have set ambitious goals close to the recommended EU level. In addition, only Greece and Liechtenstein have not adopted Green Public Procurement criteria for product groups (47).

The government is now reorganising the procurement system by increasing central control and improving procedures in specific areas such as the health system (7) as well as the commitment towards “Green Growth” that is expected to align demand with supply side innovation policies (11). In this context, there is an objective to create a National Action Plan for the promotion of Green Procurement, including measure for Green Tourism, Green Infrastructures, Green Business and Energy Performance. Cross-border procurement schemes or joint public procurement are not yet envisaged in Greece.

2.5.5 Other Framework Conditions

In Europe, societal changes are being addressed through the Lead Market Initiative (LMI) and Joint Programming. According to the Innovation Union Competitiveness Report, Lead markets are the markets for a service or a product in a given geographical region where the diffusion process began as successful innovation of international level. Although the importance of the Lead Market Initiative is an important concept for EU, there is only a small participation to such projects. In Greece, the negative role that the business sector plays in innovation is

demonstrated by the mistrust of the business sector in the country's market and the lack of massive grant position do not favour the flourishing of Lead Market prospects. A Lead Market initiative has been adopted at the regional level by the Region of Western Greece in the areas of e-Health, sustainable construction, recycling, bio-based products and renewable energies. The recent acknowledgement of the need to introduce demand-side innovation policy measures since the supply side measures were not able to improve the overall innovation performance of the private sector.

The Green Infrastructures 2010 measure creates some prerequisites for the environment and its protection in order for this area to boost entrepreneurial activity.

2.6 Cross-Cutting issues and Challenges

As inferred from the previous sections, under-investment in knowledge capacity from the private sector reduces the demand for technology and the capacity for interactions and knowledge flows inside the system. The sectoral and regional asymmetries lead us to conclude that innovation related activities are not embraced by a big part of the economy. It has been argued that Greece follows the technological development of the most advanced countries with a time lag of several decades, and thus, it is unable to take advantage of the high added values resulting from the commercial exploitation of new knowledge, produced either in companies or public research organizations.

An efficient innovation strategy calls for innovation creation instead of innovation absorption and strong linkages and interactions with the various technological resources and a skilled human capital able to absorb and effectively use knowledge and technology. In addition, it has been previously argued that the Greek innovation system is typically supply driven with orientations and priorities driven by funding and not market demand (7). This further affects the exploitability of knowledge exploitation patterns. Thus, this section aims to describe the intermediary mechanisms that facilitate collaboration and flow of knowledge within the systems such as Human Resource policies and mobility, the responsiveness of the education system, gaps between supply and demand, international linkages and commercialization aspects. Further challenges transcending the current political landscape are also outlined.

2.6.1 Channels for Commercializing Research and Knowledge Exploitation

Results in R&D activity are mainly distinguished in scientific publications, citations and patents. The country scores 82% of EU average in scientific publications per million inhabitants and about half as much as the leading countries in terms of citations (1). The number of publications has increased from 1995 to 2005 and improved in comparison to the OECD average (12). In patents, Greece diverges significantly from the European average, mirroring an orientation to applications and adoption of technology rather the creation of new technology. As for the co-publications between public and private organizations, in 2008, the EU average is 36.2, the top performing countries are the Netherlands, Denmark, Finland and Sweden. Another way of collaboration is that between public research organizations and innovative

firms, top performing countries are Finland, Belgium, Sweden Poland and the Netherlands. Information about the position of Greece is not available (19).

The situation in Greece regarding the commercialization of public research is characterized by limited actions. Although there are some reforms, certain programmes and specific initiatives for the reinforcement of the exploitation and dissemination of new knowledge, the results are inadequate primarily due to the lack of capabilities and lack of interest. There is also the need for the creation of a strategy of the public engagement of the universities.

In 2001, the first reforms were introduced by the Ministry of Development with the reward and the promotion of researchers who exploit and disseminate research results and the collaboration in research projects between companies and public research centres (3). Some further support measures in the Ministry of Education aimed to increase the absorptive capacity of new knowledge in enterprises as well as the improvement of research capabilities inside the companies (ibid). As analysed, at the regional level, local research organizations demonstrate only partial interest in the commercialization of their results as the low patenting average indicator as well as the lack of a proper regulatory environment and the capabilities of the stakeholders to mobilize the resources needed (14).

As for patenting, the Intellectual Property Rights for Inventions are under the Hellenic Industrial Property (OBI) which has as a goal the protection of patentable inventions. An example of a channel of commercializing public research is that of FORTH (Foundation for Research and Technology) Liaison office which is a division of the FORTH Central Administration unit under the supervision of the GSRT, it is supported by the HELP-FORWARD network and has a strategic alliance with the FGI (Federation of Greek Industries) and the FING (Federation of Industries of Northern Greece). Through these collaborations there is access to supporting networks such as the Innovation Relay Centre Network and the National Contact Point. It also collaborates with the Science and Technology Park of Crete where its spin-off activities are hosted. Its aim is the commercialization of research results through licensing agreements, establishment of spin-off companies and by providing specialized services both to the private and the public sector. The liaison office of CERTH in Thessaloniki also organized brokerage events and serves as a bridge for commercialization.

2.6.2 Human Resources and the Educational System

Human resource policies in Greece include incentives to increase mobility of technical personnel and researchers among research centres and enterprises in Greece and to support inflows from abroad (48). Programs mostly aim to reinforce collaboration with researchers from abroad (ibid). The only action taken by Greece regarding Human Resource Policies in Science and Technology relates to the attempt to harmonize the Greek legal framework with the EU directives regarding the social security of professional researchers, their recognition and the scientific visa for researchers coming from third countries (43).

The incentives and the policies available in the country for the reinforcement of the supply of (post)graduates in science vary and origin from many institutions. GSRT has founded the

Hellenic Observatory for Research and Technology Specialties (HORT) to identify the inadequacies in the R&D sector (44). However, there is some critical effort during the last decade in ICT activities related issues. In particular, the Aristotle University of Thessaloniki and the Center for Research and Technology Hellas (CERTH) have taken action so as to gather resources in the area and create an adequate well-trained HR base (14). Some unbalances between the education systems and the changing demands of firms has been acknowledged in Human Resources in Science and Technology HSRT policies (1) which aim to produce highly skilled personnel, attract talent from abroad, enhance the geographical mobility of researchers, enhance employment of highly-skilled personnel, mobilize social groups in the RTD systems and support entrepreneurship.

Some initiatives by the Ministry of Education such as “Arhimedes” and “Thales” or “Heraclitus” support researchers in a number of disciplines such as engineering and ICT fields or interdisciplinary research projects or reinforce research teams of Greek universities in order to achieve economies of scale, become competitive and strengthen the networking relationships among universities (43).

In addition, under the Operational Programme for Competitiveness and Entrepreneurship 2007-2013, there will be 12.500 positions in training programs, studies programmes and exchange programmes in the sector of tourism (9). Some other policies include subsidies to enterprise for hiring high level S&T personnel, incentives for increasing mobility or researchers and technical personnel among enterprises and support the acquisition of doctoral degrees through scholarships. Higher education research and development expenditure (HERD) increased significantly in absolute values from €376.3m in 1999 to €660.5m in 2007. However, expenditures as a percentage of GDP declined slightly from 0.33% in 1999 to 0.29% in 2007. Annual expenditures experienced fluctuations during the six year period, following inflows from the Structural Funds.

In the same context, labour market policies aim to reinforce employment and entrepreneurship of young people and increase the number of sustainable enterprises established by self-employed reducing unemployment inflows. Greece is also opening-up the labour market to researchers but not specific measure exists to enhance the attractiveness of the country for research careers.

2.6.3 Links between the Educational System and RTDI

Coordination among the different aspects of knowledge triangle policy is underdeveloped and weakened (Research, innovation and education) (7). The Government intends to allocate institutional funding to research organisations and universities on the base of multi-annual programming agreements with the organisations and through a multi-annual framework programme (NFPRI), a role which today is played by the Structural Funds (SFs) Operational Programmes.

Table 2-15: Employment and Science and Technology Indicators

Indicator	European Union (EU27)				Greece			
	2007	2008	2009	2010	2007	2008	2009	2010
Percentage youth aged 20-24 having attained at least upper secondary level education	78,1%	78,4%	78,6%	79%	82,1%	82,1%	82,2%	83,4%
Tertiary educational attainment, age group 30-34	30%	31,1%	32,3%	33,6%	26,2%	25,6%	26,5%	28,4%
Tertiary graduates in science and technology per 1000 of population aged 20-29 years	18,6	19,2	19,2	N/A	9,1	12,5	N/A	N/A
	9	9,6	9,4	N/A	7,8	9,8	N/A	N/A
New doctorate graduates per 1000 population aged 25-34					1,4	0,3	N/A	N/A
Life-long learning: share of persons aged 25-64 having participated in education and training	9,4%	9,4%	9,3%	9,1%	2,1%	2,9%	3,3%	3%
Employment in high-technology manufacturing and knowledge-intensive high-technology services as a percentage of total employment	4,4%	3,73%	3,73%	N/A	2,22%	2,12%	2,13%	N/A
Employment in Knowledge-Intensive high technology services	3,29%	2,58%	2,62%	N/A	1,95%	1,66%	1,72%	N/A
Employment in total knowledge-intensive activities at the national level	33,13 %	36,94 %	38,2%	N/A	25,51 %	32,52%	32,88 %	N/A
HRST % of total employment	40,8%	41,2%	42,1%	N/A	31,9%	32,3%	32,8%	N/A

Percentage of ICT personnel in total employment					1,39%			
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Source: Eurostat, 2011 and World Bank statistics

As shown in the above table, Greece scores very well in completed upper secondary education and tertiary educational attainment but still lags in HRST and lifelong learning. The current mismatch of supply and demand in terms of HRST is also indicated by the percentage of employment in high-technology and knowledge-intensive services. Percentage of PhD graduates (25-34 years) are about 0.5% for Greece, one of the lowest in EU-27 (1.03%). HSRT as percentage of total employment is about 10 percentage units under the EU average, which is quite discouraging considering the percentage of tertiary education attainment. On the regional level, the data are also very discouraging as in the majority of the regions, HRST hardly surpasses 30% (except the regions of Crete, Attica and Central Macedonia) (14).

The indicator of Greece for the average annual growth of tertiary graduates in Science and Engineering for the period 2000-2008 is 6.9 with 12.326 graduates in 2000 and 16.120 in 2008. As for doctoral degrees (tertiary degrees at level ISCED 6 and doctoral degrees in Science and Engineering), Greece presents low intensity with an average annual growth indicator of tertiary graduates (IESCED 6) of 2.1 and in Science and Engineering of -10.8 for the period 2000-2008, when the respective EU averages are 3.8 and 4.0 (19). Greece has a strong negative balance of non-national to national grantees in institutions related to research, meaning that the country sends out more excellent researchers than it receives in its institutions. Greece, along with Switzerland, Israel, Netherlands, Lithuania, Latvia, Cyprus and Iceland, is one of the most open countries to outward mobility of researchers. On the contrary, inward mobility is very low (49). The Greek government facilitates outward mobility of researchers in the short term, via bilateral agreements or working within European infrastructures or through the Greek Mobility Centers Network (and other programs which were launched within the EU Framework Programs (Marie Curie, training networks). In addition, GSRT offers funds to universities and research centres which take part in programs of the European Space Agency and in EU FPs (12). It is significant to highlight that certain research centres follow independent strategies so as to enhance their international presence and the collaboration with other European research centres such as FORTH/CHNA, NAGREF/INRA, HCMR/IFREMER (12).

Concerning lifelong learning, the internationalization of markets and technologies necessitates the update of the labour force's skills, but this concept is not very widespread in Greece, as it is positioned at the bottom position in EU-25 rankings as regards participation of citizens in lifelong learning programmes (1). Greece has the highest unemployment rate among people of 25-29 years old with a tertiary degree. Greece has not adopted a knowledge-based model as 6.1% of people without secondary education are unemployed, 9.2% of people with upper secondary education are unemployed and 14.6% of people with tertiary education are unemployed in the ages 15-29. A 7.5% of tertiary graduates remain unemployed for more than 6 months comparing to 3.5% of people without upper secondary education. The above facts

advocate to the conclusion that the educational system cannot efficiently address the changes of the labour market. The supply-demand ratio is very unbalanced as 500-700 new researchers are not absorbed by the R&D system per year (48).

Last, but not least, the level of training regarding the support of technological innovation that companies offer to their employees is considered inadequate. However, some action towards the improvement of the situation is being taken by institutions such as the Technological Park of Thessaloniki which offers programmes for the vocational training of employees. The position of Greece in relation to the goals of companies' training in the fields of Group work skills, Negotiation Skills, Intercultural Communication. According to CEDEFOP (50), in most European countries, 50% of all the enterprises which deal with technological innovation, deal with supporting training activities as well. Greece does not appear among the countries whose enterprises train the workforce to be able to support technological innovation. In addition, support for R&D via scholarships is feasible through Greek State Scholarship Foundation (there are some for postgraduate and early postdoc positions) and private funds and bequests.

Regarding scarcity of talent in specific domains, scarcity is noted in specific fields such as: professional sales, technicians, employees for senior positions, employees for accounting services, labour workforce, employees for administrative and secretarial positions, mechanics, operators of heavy transport vehicles, sales managers and supervisors. According to the Global Talent Index Report (51), Greece ranks in the same position as Italy (23rd), with a score of 46.7/100 in the 2011 rank and it is expected to fall in the 33rd position in 2015. The report further reveals that 41% of employers state that there is a difficulty in covering specific employment positions due to shortage of talent in these areas. This percentage has increased by 12% since last year. The main reasons reported for staff shortages are the lack of experience, lack of market/academic knowledge and the lack of relevant qualification. It is explicit that RTDI is not one of the sectors where scarcity is in existence.

In Greece, only 3% believes that NGOs should be partners in research in scientific and technological fields and is far below the average EU indicator which is 8% and very close to the lowest indicator which is 2% for Ireland and Cyprus (19). On the other hand, in Greece 53% supports that decisions related to scientific and technological matters should be made by politicians, engineers and researchers and the public should be informed about these decisions, 23% supports that the public should be consulted when making decisions about science and technology research, 16% supports that the public opinion has to be binding in this decisions, 3% supports that NGOs should be partners in scientific and technological research and 4% supports that the public does not need to be involved in such decisions. The respective indicators for the EU are 36%, 29%, 14%, 8% and 7%. Charitable foundations participate in a very limited way in R&D funding, and non-for-profit organizations account for 1% of GERD (7).

2.6.4 Access and Use of International Knowledge and Internationalisation in RTDI

Access to international knowledge is a crucial element of the Greek NIS, especially taking into consideration the small size of the research system. The main mechanism promoted by the public policy for cross-border cooperation is the EU Framework Programmes (3). Greek research teams have demonstrated considerable participation in EU research as 564 FP7 contracts establishing more than 6.700 links have been signed (48). The participation of the private sector is not widespread and support of individual mobility of researchers has not received much attention. Greece's participation in FP's contributes about 10% of GERD, equivalent to about a half of the average annual public competitive funding for research. (11)

The internationalization in RTDI has been adhered to a large extend to the European paradigm of completion of the ERA. The most active FP7 research priority areas in the country are Information and Communication Technologies, Marie-Curie Actions, Research Potential, Transport, Nanosciences and Nanotechnologies and Health (26). The participation of Greece in the European Research Area is adequate, as its position is close to the EU average (Greece average: 438 co-publications per million population, EU average: 491). Moreover, Greece average is higher than EU average in scientific publications within the top 10% most cited publications revealing sufficient quality of research dynamics and a leading position in FP7 collaborative links with EU countries (14).

Table 2-16: International Knowledge and Internationalisation of R&D

Indicator	European Union (EU27)				Greece			
	2007	2008	2009	2010	2007	2008	2009	2010
International scientific co-publications per million populations				266				439
Public-private co-publications per million populations			36.1	36.2			11.9	12.5
Innovative SMEs collaborating with others as % of SMEs ²⁴			9.5%	11,16 %			13.3%	13.3%
High-tech patent applications to the EPO by priority year	20,216	10,802	N/A	N/A	1,233	0,862	N/A	N/A
ICT patent applications to the EPO by priority year at the	28,848	16,514	N/A	N/A	1,447	1,204	N/A	N/A

²⁴ 2009's statistics refer to 2006

national level IPC: Total ICT								
Trademark applications, direct resident					6416	6412	N/A	N/A
Community designs			121,2			11.4		
PCT patents applications per billion GDP				4				0.44
PCT patent applications in societal challenges per billion GDP				0.64				0.13
License and patent revenues from abroad as % of GDP				0,21%				

Source: Innovation Union Scoreboard 2009 and 2010 and Eurostat. Trademark applications source: World Bank Statistics

The Table above also exhibits that the Greek performance in technological collaboration through co-patenting applications is modest related to the EU average (more than 65% of total patent applications: single inventor, less than 35%: in collaboration, 7.4%: co-patents with a non-EU country). Since March 2011, Greece participates in 1.205 signed grant agreements with 14.476 participants and ranks 9th in number of participations and 9th in budget share. The top 3 countries with which Greece collaborates are Germany, United Kingdom and Italy. Due to Greece's participation in the FPs, 246 technological offers and 709 exploitable results have emerged (43). Patents on the other hand present a different picture, as Greece finds itself in a disadvantaged position, despite the considerable growth in patenting. The landscape outlined in the access and use of international knowledge is subject to an additional limitation: the high percentage of GERD through EU projects. Thus, exchange of knowledge and technology, as inferred, is mainly acquitted through academic and research networks.

Some of the challenges outlined in section 2.2.2 can now bear a different significance as the structural organization of the research sector, the development of the "knowledge triangle", the unification of all the research activities of universities and research centres, the increase of the participation of the private sector in research and the increase of performance of excellence and quality research are predominant characteristics that need to be addressed by stakeholders. The reforms that need to be undertaken cut across many policy-making levels and different Ministries, as research, life-long learning and innovation in the society through a beneficial way needs to be based upon a unified basis. Some of the current reforms (e.g., the National Action Plan for the Support of Research, Technological development and Innovation, Programme of Excellence by GSRT and the reinforcement of Human Resources in Research and the creation of other incentives) have touched upon the structural organization of the research sector in Greece in terms of the knowledge triangle (52).

3 National PESTLE and SWOT analysis

Science and technology issues cannot be considered without taking account of the broader context of social and economic dynamics in terms of barriers and obstacles to technological development. As scientific and technological knowledge evolves in ways shaped by social structures and process, we employ a PESTLE analysis to lay down the Political, Economic, Social, Technological, Legal and Environmental factors that cut across the spectrum of inter-nation characteristics that might bear an impact or orientation upon the foresight processes. PESTLE analysis takes into consideration the macro-environment of the country and discusses the operating environment and the organisation of the country (structure, culture, competencies, resources) in a number of areas.

In addition, this section includes a SWOT approach (Strengths, Weaknesses, Opportunities, and Threats) to identify key generic issues upon which the main part of the foresight study will be based. SWOT is perceived as a benchmarking and evaluation exercise of different components of the national innovation system, the productive nexus, existing knowledge infrastructure, competencies which enables a forward-looking approach to proactive public policies. For the better illustration of the components, SWOT is structured on a grouping based on NIS components, i.e., governance and policy system, public policies and actors, the ICT sector and cross-cutting issues. Last, this section encompasses a self-evaluation tool to complement this analysis, elaborated by the European Commission.

3.1 Political, Economic, Social, Technological, Legal and Environmental analysis of the emerging innovation system

Table 3-1: PESTLE analysis-Greece

Social , cultural and demographic	Technological	Environmental	Economic and market issues	Political /legal institutional
Slow Population Growth rate (2011): 0.083% Net migration rate: 2.32 migrants/ 1,000 population	Modes of internet use (2010) 1 in 2 people uses a PC, 44% of population uses the Internet, 25% uses 3G services through mobile phones, 25% buys products online, 13% uses e-banking, 1% sells products and services online. 157% increase of the use of social media since 2009 (53) Profile of main users of the Internet: 16-24 years old, high	Greece is a member of many environment international agreements: Air Pollution, Ozone Layer Protection, Ship Pollution, Hazardous Wastes, Marine Dumping, Air Pollution-Nitrogen Oxides, Climate Change-Kyoto Protocol, Climate Change etc. (55)	Extremely advert macroeconomic circumstances (High debt of the country, High Inflation rate (2009: 1.2%, 2010: 4.7%), Real GDP growth is estimated to -4.5% , Expanding General Government Debt: (56) (2010: 148.2% of GDP) Austerity measures and macroeconomic policy subject to scrutiny by the International Monetary Fund and the European Union. Greece needs to decrease future yearly spending and further increase future taxes to avoid further increase of the government debt to	Greece participates in International organizations: EU, OECD, NATO, ISO, UNESCO, Interpol etc. Political instability, changes in leadership due to differences of political parties towards the austerity measures²⁵ November 2011:new government of national unity, PM L. Papademos Elections are expected in the beginning of 2012.

²⁵ Cable, J. 2011 Euro zone periphery faces years of struggle: Reuters poll, 24th November 2011, <http://www.reuters.com/article/2011/11/24/us-economy-eurozone-poll-idUSTRE7AN1GK20111124> , accessed in 2nd December 2011

	education, residents of big urban centers (54)		GDP. Reduction in the VAT rate for tourist accommodation and in corporate tax rate (56)	
Threatening percentage of population below poverty line: 20% (2009 est.) Increasing unemployment rates (2010: 12%) (56), especially among young people, tertiary graduates and female	2008-2010 households: 100% increase in Internet connections, 162% increase in broadband connections, 50% increase in Internet regular users (53) Increasing broadband penetration (19,9% January 2011) Broadband services: strong growth area (investment of more than 1 million Euros in infrastructure) (2008) ²⁶	In the Environmental Performance Index (EPI) the score of Greece (71st in 163 countries) is 60.9 for 2010, when the EU score is 71.5 (EPI 2010) Documents for more resource-efficient economy and climate change Green entrepreneurship	Recent reforms in taxation in 2010 (Increase in indirect taxes and excise duties, 70% of price increases is due to taxation, increase in VAT rates in taxes on luxury goods, Increase in excise taxes on fuel, tobacco, alcohol, special levy on high value real estate, unified progressive tax scale, elimination of special taxation rules Temporary “crisis levies” on firms with high profits “Green tax” on CO2 emissions (56)	Greek regions have become more autonomous, regional authorities have more responsibilities Encouragement of research and technology transfer through policies on a national and regional level Investment Laws promote the development of high tech products and R&D through tax incentives Transparency and performances of excellence are supported

²⁶ http://www.investingreece.gov.gr/files/publications/liG_InvestmentOverview_2008_EN.pdf, accessed 29th November 2011

		in fields of comparative advantage is promoted.		
Increasing Life expectancy: male: 77.36 years, female: 82.65 years Reducing trend in health and education expenditures due to austerity measures (55) Good literacy levels (96%, 2001census)	Increasing mobile penetration 95% of Greek people (16-74 years old) are owners of a mobile phone device (2010) (53) eGovernment usage is relatively high and stable among businesses (57) but not citizens.	Greece follows the EUROPE 2020 targets “Resource Efficient Europe”: shift towards a resource-efficient, low carbon economy²⁷	Decreasing expenses in the public sector due to wage and pension cuts, suspension of recruitments as well as working expenses (drop in purchasing powers and consumption). Privatization schemes in place to create revenues for the country Full privatization of spectrum of frequencies in telecoms and train operators (56). State Asset Management and Privatisation Plan 2011-2015: restructure of firms and sectors of the economy, opening of markets, redesign of state asset management	Action for the reduction of bureaucracy in the establishment of new businesses Inability to foresee upcoming needs of the country in the long term, public procurement strategies inefficient Reforms of public management are difficult to be implemented in the macro-level (58) Innovation policy needs to get a prominent position in the government’s priorities,

²⁷ <http://ec.europa.eu/resource-efficient-europe/>, accessed 25th November 2011

			Portfolio of state-owned assets: Enterprises, Infrastructure, Monopolistic Rights, Real Estates Substantial Reduction of state shareholdings in state-owned companies.	continuous assessment and benchmarking with competitors is needed (59)
Greek researchers are mainly absorbed in academic positions Researchers per thousand labour force (2009): GR: 4.2 vs EU: 6.3 (19) Scarcity of talent in specific sectors High outward mobility of Greek researchers, low inward mobility	Limited amount of clusters and innovation poles but current policies encourage such ventures		Greece adheres to EUROPE 2020 targets to support smart growth, sustainable growth and inclusive growth as well as ERA and the “Innovation Union” aims to promote excellence in education and skills development, enhance access to finance for innovative companies, European Innovation Partnerships, reform research and innovation systems and more ²⁸ as well as to the creation and maintenance of a strong, competitive industrial base ²⁹	Contradictory aims of austerity measures and EUROPE 2020 targets and flagship initiatives to achieve growth through the raise of employment, raise of public and private investment in R&D, reduction of greenhouse emissions, increase of energy efficiency, reduction of school drop rates, increase of tertiary graduates, reduction of the

²⁸ http://ec.europa.eu/research/innovation-union/index_en.cfm?pg=action-points, accessed 25th November 2011

²⁹ <http://ec.europa.eu/enterprise/policies/industrial-competitiveness/industrial-policy/>, accessed 25th November 2011

				risk of poverty ³⁰
Existence of scholarships and grants schemes by certain institutions to support post graduate studies	ICT is a priority field for the country ICT human capital at “a fraction of the cost” (60) Human Resources: Good ICT development skills (60)		Public sector contributes more than private sector in funding R&D Limited contribution of the public sector in funding R&D Very limited contribution of the private sector in funding R&D High dependence of R&D on Structural Funds	Regional discrepancies and role of regions in both priority setting and policy mix in R&D of each region. Profiles of regions with regards to R&D focus vary significantly.
Specificities of the Greek labour market: 22.6%: self-employed and 62.5%: waged or salaried Labour mobility is limited compared to EU Migrants account for	ICT is central in OP “Digital Convergence” and “Digital Strategy 2006-2013” to improve the quality of life through the use of information technologies ³²		Decline in imports due to lower consumption and investments and rise of exports due to the recovery of world trade and not due to improved competitiveness Low share of ICT and knowledge intensive activities in trade mix.	Greece’s proximity to developing regions and technology advanced non-EU countries such as Israel (12) Strategic intersection for expansion in SEE and Central Asian markets

³⁰ http://ec.europa.eu/europe2020/targets/eu-targets/index_en.htm, accessed 25th November 2011

³² Epracitce.eu: eGovernment in Greece, 2010, http://www.observatory.gr/files/meletes/eGovernment_in_GR_April_2010_en.pdf, accessed in 2nd December 2011

9.4% of total employed population mainly without education (Albania Bulgaria, Georgia, Romania, mainly) ³¹				
Adherence to European social and educational policies such as “An agenda for new skills and jobs” that envisages increase amount of people in higher education, decrease drop-school rates, decrease risk of poverty ³³ “European Platform against Poverty” ³⁴ and	IT sector major contributor in the economy in 2009 Support of 31,691 highly skilled, high-paying jobs 58% of software installed on PCs was pirated.		Low level of FDI inflows Total FDI inflows in services (2003-2010) consisted of post and telecom services, financial intermediation (40 and 32%), trade, real estate, tourism, education and health), promising market prospects for these areas FDI inflows in manufacturing attract chemical products, food, beverages and tobacco, machinery and metal products Promising prospects for attracting	

³¹ <http://ec.europa.eu/eures/main.jsp?catId=2589&acro=Imi&lang=en&countryId=GR®ionId=GR0&nuts2Code=null&nuts3Code=null®ionName=National%20Level>, accessed 29th November 2011

³³ <http://ec.europa.eu/social/main.jsp?catId=568>, accessed 25th November 2011

³⁴ <http://ec.europa.eu/social/main.jsp?langId=en&catId=961>, accessed 25th November 2011

“Youth on the Move”: improve education and training systems, improve youth employment, increase youth mobility ³⁵			FDI in the future from Russia, Eastern Europe, Middle East, Arab Countries, China (in energy, telecommunications, tourism, transport, logistics) ³⁶ Greece has strategic partnerships with China and Russia ³⁷	
New doctoral graduates (ISCED 6) per thousand population aged 25-34 (2009): GR: 0.8 vs. EU: 1.6 (19)	From the research centres , about 7 institutes are dedicated to Information Technologies The Technological Educational Institutions contribute to research marginally Computer Science,		Financial Stability Fund (FSF): provides equity capital for the maintenance of the stability of the Greek banking system (56) Gloomy projections for structural budget structure, debt and deficit and dropping consumption. (56)	

³⁵ http://ec.europa.eu/youthonthemove/about/policy-actions/index_en.htm, 25th November 2011

³⁶ <http://www.investingreece.gov.gr/default.asp?pid=21&la=1>, accessed 29th November 2011

³⁷ <http://www.investingreece.gov.gr/default.asp?pid=25&la=1&n=1048> and <http://www.investingreece.gov.gr/default.asp?pid=25&la=1&n=1063>, accessed 29th November 2011

	Applied and computational mathematics, Biotechnology and genetics are among the areas of international excellence of Greece			
	Insufficient circulation of knowledge between universities and non-academic organizations Increasing collaborations between Greek institutions			

3.2 Strengths, weaknesses, threats and opportunities of/for the emerging innovation system

Table 3-2: SWOT analysis-Greece

Clustering	Strengths	Weaknesses
ICT RTD governance and policy system	GSRT under the Ministry of Education, Life Long Learning and Religious Affairs unites academia with research to serve the “knowledge Triangle” (61)	High dependence on EU, Structural Funds, small participation of the private sector in funding research (1) Dispersed innovation actions in dispersed civil service units.
	Competitive EU funding (61)	Bureaucratic and institutional obstacles
	Pockets of interdisciplinary and inter-institution collaboration (61)	Weak transfer of knowledge, Low innovation performance in many significant sectors (62), inadequate linkages of enterprises with research (1)
	Inter-regional disparities are decreasing (1)	Lack of prioritization on the basis of national needs, priorities are set by EU due to the dependence of EU funding (61)
		Lack of support for youth and female entrepreneurship with potential dynamics in R&D
	Support of venture capital market by a favourable legal and tax environment	Insufficient liaison offices, innovation not based on the production and exploitation of new knowledge

ICT RTD priority setting, public policies and actors	Increase of cooperation between research centres and innovative firms	Limited RIS and RITTS actions, limited exploitation of R&D funding by regions
	Increasing number of institutions that contribute to innovation and research (1)	
	Reduction of bureaucratic obstacles for the entry of new businesses in the market (1)	Unfamiliarity of the country with Lead Market Initiative and other EU –central innovation spurring initiatives. Inability of government to foresee needs in new services and products in the long term
	ICT-dedicated public research centres as well as university strength in research.	Lack of “trust” of Greek people towards the Greek market
		Civil service is under politically assigned staff management and thus is weak in effectiveness and selecting priority fields and overlapping of competencies (59)
		Introversion of public research organizations and limited responses to economic and societal needs (12)
		Limited participation of NGO’s in R&D agenda and superficial involvement of potential stakeholders.
	Research is of good quality	Lack of dynamic relationships between public and private sector, poor collaboration between industry and universities and between research centres

ICT RTD sector features	Broadband penetration and mobile penetration are high (60)	Poor demand for research based knowledge, low patenting performance (Chapters 1.7.3, 1.8.7)
	Top ICT talent “at a fraction of the cost” (60)	Venture capital market is not mature, lack of pre-incubators and mature and developed incubators
	ICT presents significant growth (60)	Lack of big companies to buy out smaller companies and promote the assimilated new technologies to the European market
		Low competitiveness of markets and products at international levels (1)
		Limited spending of firms on innovative activities based on scientific and technical progress
		Lack of clear focus of RTD effort in specific areas of national strength
ICT RTD cross cutting issues	High service innovation rates	Direct acquisition of technology from abroad and absorption rationale , low performance in high technology product and service exports
		Production base consists of mainly SMEs and family-owned businesses with low competitiveness and knowledge-intensive ventures are scarce
		Employment is more prominent in sectors of low to medium technology , lack of high technology

		industries
	Establishment of links and policies for SME's) innovation vouchers, links etc)	Weak production base, with the majority of SME's demonstrating risk averse behaviour and limited innovation potential as well as introversion , dominance of traditional sectors
	Average annual growth of researchers is good (1)	Low inward mobility of researchers
	Scholarships and programmes support post graduate studies and doctorate diplomas	Mismatch of supply and demand of HRST, mismatch of degree of studies and type of work
	High percentage of population with at least secondary level education completed (1)	High unemployment rates among people 25-29 years old with a tertiary degree (Chapter 1.8.2)
	High percentage of population (20-24) acquiring higher education (1)	Lack of active NGOs participation
	Adequate supply of skilled labor force (1)	Lack of systematic training of HR in new technologies, poor life-long learning policies , unresponsive educational curricula to actual needs
	BERD RTD strength in the areas of ICT and biotechnology	Heavy bureaucracy and very politicized academic management in universities; reforms change the situation at a very slow pace (62)
	Greek enterprises open to new paradigms of collaboration and open innovation	

	Greece performs better in the transfer and diffusion of innovation than knowledge creation (12)	
	Encouraging trends of enterprises participation in research based on HSRT rates and rich scientific production	Weak technology transfer mechanisms
	ICT competitive teams in FP programmes	
	Opportunities	Threats
ICT RTD governance and policy system	GSRT defines ICT as a top priority area for funding	Recession may further decrease public and private sector funding
	Increase of transparency	Turbulent, unsteady government and financial landscape
	Reduction of bureaucracy in the establishment of new businesses may increase new initiatives	Lack of a law to define the implementation of policies of the National Strategic Development Programme by regions creates the danger of improper implementation and misuse
	Emphasis at the international presence of Greece, education , technology and innovation as well as respect of the environment as emerging issues	
	Need for change is recognized (61)	

ICT RTD priority setting, public policies and actors	Attraction of more innovative companies in innovation zones through the provision of incentives Creation and development of clusters	Reactions to reforms in academic culture.
	Promotion of cross-border entrepreneurial partnerships in profitable for the country sectors (1)	Salary cuts will affect block funding in research, General University Funds and OP costs in R&D
	Fill the gaps in R&D and define allocation of resources by creating priorities for public investments, informing the publics and follow strategic planning ("Technology Foresight in Greece" Policy)	Due to recession one part of businesses is increasing funding on R&D and another decreases it. (Chapter 1.7.7)
	Mobilization of private initiatives, networking and increase of sensitivity to market demands ("Financial Support of knowledge-intensive businesses/spin-off companies" Law)	Decrease of expenditures for education
	Detection and exploitation of sector with a comparative advantage to serve national needs (e.g., Agro-food, information and communication technologies, materials/chemicals, energy/environment, health/biomedicine) (61)	Legal limitations may hinder future reforms (61)
	Create industry demand for research via	Misallocation of resources due to the big size of the

	procurement (61)	public sector, regulations, restrictions and monopolistic practices of economy, easy borrowing, tax evasion, corruption (61)
	Emphasis on “green” development in terms of technology, materials, public procurement	Capital drain to other countries due to difficulty of investing in Greece (1)
	Promising reforms and initiatives in support of VC sector and educational reform	Cross-cutting elements (education, etc) are not directly linked to policy orientations. Knowledge triangle underdeveloped.
	Support to investment activities and commitment upgrade of the business environment at the regional level	
ICT RTD sector features	Programmes that support research may encourage more intensive research activity, absorptive capacity of enterprises and attraction of foreign researchers	Increasing competition for EU funding (61)
	Creation of new regional innovation poles and intermediary organizations (Chapter 1.8.9)	Brain drain due to low morale of staff (61)
	Introduction of digital services to more enterprises, restructuring of private and public sector, constant technological advance in digital media (1)	Unemployment rate is expected to reach its peak in 2012 (1)
	Exploitation of niches in high technology sector	

	(61)	
	Reduction of PC software piracy for 4 years (2009-2013) by 10% can result in 1,313 new jobs, \$512m in new economic activity, \$157m in additional tax revenues by 2013 ³⁸	Inadequate policy skills and unbalanced innovation focus in Greek regions
	Potential commercialisation routes based on the percentage of sales of new to market and new to firm innovations	
ICT RTD cross cutting issues	Prospects in innovation in the services sector and non-technological innovation	Slow commercialisation and investments not linked to new technologies
	Performances of excellence of research centres and universities can be reinforced by specific action taken (Chapter 1.8.9)	Bottom-up operation of research may cause exploitation of the orientation of research by professors in universities (Chapter 1.7.3)
	Towards the smooth development of all of the “knowledge triangle” aspects (Chapter 1.8.9)	High outward mobility of Greek researchers resulting in domestic talent shortages.
	Responsiveness of high quality research to funding incentives (61)	Few incentives to retain young researchers in the country and risk-averse behaviour of scientists. (61)

³⁸Piracy impact study, the economic benefits of reducing software piracy, 2010 http://portal.bsa.org/piracyimpact2010/cps/cp_greece_english.pdf, accessed in 25th November 2011

	Promotion of entrepreneurship in areas that use new technologies and the broadband and digital environment	
	Highly educated workforce available (1)	Constraints of hiring new workforce (61)
	Increase education about the value of Intellectual Property (IP) can reduce piracy rates ³⁹	Ageing research workforce may not be replaced when retired due to existing arrangements ⁴⁰
	Significant amount of Greek scientists living abroad (1)	Slow adaptation of educational system to knowledge intensive entrepreneurship (12)
	Concentrate on exports of new products to Asia and Africa instead of competing with demanding European markets (17)	Neighbouring countries offer low labour costs (1)
	Development of synergies in high performance sectors (1)	Dominance of traditional sectors over ICT and slow adaptation of policy agenda to prominence, failure to keep up with innovative developments in foreign markets

³⁹ Piracy impact study, the economic benefits of reducing software piracy, 2010 http://portal.bsa.org/piracyimpact2010/cps/cp_greece_english.pdf, accessed in 25th November 2011

⁴⁰ A rapid review of the Greek research and development system, 2011, RAND, http://www.rand.org/content/dam/rand/pubs/documented_briefings/2011/RAND_DB631.pdf, accessed in 22nd November 2011

	Promotion of innovation in the backdrop of globalization lies within the policy agenda (12)	Lack of evaluation of innovation related projects and systematic assessment mechanisms
	New commercialisation routes from EU funded R&D projects	Techno phobic behaviour of the general public and lack of shared vision (12)
	Key areas in societal challenges such as health , education, transport and tourism are expected to directly benefit form ICT related research. Strength in FP ICT, transport, nanosciences, nanotechnologies and health.	

3.3 Features of well performing national and regional research and innovation

This methodology derives from the European Innovation Scoreboard which is grouped into 3 main blocks covering enablers, firm activities and outputs. According to Pro-Inno Europe this approach gives a balanced assessment of the innovation performance in each dimension. The building blocks have been designed to accommodate the diversity of different innovation processes and models that occur in different national contexts

Table 3-3: Features of a well performing NIS-Greece

Indicators for the innovation Union 2010		
ENABLERS –Human Resources	value	
New doctorate graduates (ISCED 6) per 1000 population aged 25-34	Eurostat	0.3 (2008 data)
Percentage population aged 30-34 having completed tertiary education	Eurostat	28,4%
Percentage youth aged 20-24 having attained at least upper secondary level education	Eurostat	83,4%
ENABLERS-Open, excellent and attractive research systems		
International scientific co-publications per million population	Thomson/Scopus	439 for 2010 (surpasses EU average)
Scientific publications among the top 10% most cited publications worldwide as % of total scientific publications of the country	Thomson/Scopus	0.09
Non-EU doctorate students per million population	Eurostat/OECD	1% (below EU average)
ENABLERS -Finance and Support		
Public R&D expenditures as % of GDP	Eurostat	0.58% (2007 data)
Venture capital (early stage, expansion and replacement) as % of GDP	EVCA/Eurostat	0.002% (2009 data)
FIRM ACTIVITIES-Firm Investments		
Business R&D expenditures as % of GDP	Eurostat	0.16% (2007 data)
Non-R&D innovation expenditures as % of turnover	Eurostat	0.74% (surpasses EU average)

FIRM ACTIVITIES-Linkages & entrepreneurship		
SMEs innovating in-house as % of SMEs	Eurostat	32.7% (surpasses EU average)
Innovative SMEs collaborating with others as % of SMEs	Eurostat	13.31% (surpasses EU average)
Public-private co-publications per million population	Thomson/Scopus	12.5
FIRM ACTIVITIES-Intellectual Assets		
PCT patents applications per billion GDP (in PPSE)	Eurostat	0.44
PCT patent applications in societal challenges per billion GDP (in PPSE) (climate change mitigation; health)	OECD	0.13
Community trademarks per billion GDP (in PPSE)	OHIM/Eurostat	32.2 (far below EU average)
Community designs per billion GDP (in PPSE)	OHIM/Eurostat	11.4 (far below EU average)
OUTPUTS –Innovators		
SMEs (more than 10 employees) introducing product or process innovations as % of SMEs	Eurostat	37.31% (surpasses EU average)
SMEs (more than 10 employees) introducing marketing or organisational innovations as % of SMEs	Eurostat	51.29% (surpasses EU average)
High-growth enterprises (with more than 10 employees) as % of all enterprises	Eurostat	
OUTPUTS -Economic effects		
Employment in Knowledge-Intensive Activities (manufacturing and services) as % of total employment	Eurostat	1.72% (below EU average)
Medium and High-tech manufacturing exports as % total product exports	UN/Eurostat	n/a
Knowledge-Intensive Services exports as % total service exports	UN/Eurostat	57.01 (surpasses EU average)
Sales of new to market and new to firm innovations as % of turnover	Eurostat	25.65 (surpasses EU average)

Licence and patent revenues from abroad as % of GDP	Eurostat	0.01% (far below EU average)
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4 Conclusions

All in all, at the time being Greece is being considered as a “catching up” country regarding RTDI compared to other European Union member states. European strategies such as the Lisbon agenda heavily influence the policy mix for the planning and implementation of innovation in the country and only recently have they “inspired” a shift of the Greek political agenda towards a “knowledge-based economy” as a means of improving the levels of competitiveness in the country.

The main orientation and strategic priorities of all the practices of RTDI are influenced by external sources of funding as the state heavily depends on the Structural Funds and the EU Framework Programmes leading to a lack of prioritization on the basis of national needs. In addition to this, the current financial crisis and its important implications on the Greek economy have set further obstacles in the planning and implementation of RTDI policies as well as in entrepreneurship and new investments and could signify a possible inability of the Greek government to fulfil the goal of setting in the centre of the public policy the knowledge triangle policies. However, the long-term objectives of the country which target at the improvement of the business environment, the efficient performance of the public administration and the creation of a sustainable economic environment remain top priorities for Greece even though the Greek Ministries are characterized by limited budgets and in some cases conflicting priorities. In fact, the gathering of research and education under one Ministry highlights the tendency towards a more inclusive approach regarding RTDI. Another significant issue is the regional disparities regarding RTDI interest and activities; this has resulted in creating a gap between dynamic and less dynamic regions and hinders the overall progress of the country towards higher added value activities.

The prospective priorities of Greece aim at dealing with the inability of the country to transform into a knowledge-based economy, which is mainly a result of the lack of business confidence, and provide motivation for the creation of a more extrovert economy. These priorities focus on the simplification of the regulatory framework, the support of life-long learning and of performances of excellence as well as on the support of entrepreneurship, new investments and new knowledge dissemination.

Throughout the document it becomes rather obvious that the role of education, training and life-long learning do not contribute to the creation of a new economy, especially because the education system fails to respond to the changing demands of the labour market and the new challenges that emerge. Moreover, the links between the research community and the business sector are considered rather weak and the circulation of knowledge is viewed as insufficient. However, the main research performers in the country which are the universities and certain research centres/institutes present a sharp increase in publications and visibility of publications in the international community.

As for the private sector, its contribution to RTDI practices and funding is very limited and the low absorptive capacity of the businesses is the result of the vicious circle created by the low

demand for knowledge. Moreover, the weak coordination of the aspects of knowledge triangle policy and the relatively small amount of training inside companies in combination with a risk-averse behaviour are further factors hindering the progress of the RTDI sector in the country and especially in the private sector.

Last but not least, there is adequate supply of skilled and educated workforce and the average annual growth rate of researchers is satisfying. The levels of population acquiring higher education are increasing and scholarships and programs are in place to support post-graduate studies and doctorate diplomas. In addition, the responsiveness of high quality research to funding incentives is perceived as good. However, the implications of the financial crisis resulted in very high unemployment rates, especially among people with a tertiary degree and as a consequence Greece faces brain and capital drain to other countries. Furthermore, few incentives are in place to attract foreign researchers and to retain Greek young researchers in the country.

Therefore, the current situation in Greece calls for an inclusive, strategic approach of innovation which will enable the country to deal with the current obstacles and move towards an innovation and knowledge-based era. The National Innovation System of Greece needs to find the way to escape the traditional patterns and focus on the exploitation of the opportunities that can arise through the proper implementation of the national policies in RTDI.

5 Abbreviations, Glossary, References

5.1 Abbreviations

Abbreviation	Full name
BERD	Business Expenditure on Research and Technology
BICs	Business Innovation Centres
EC	European Commission
ERA	European Research Area
EU	European Union
FDI	Foreign Direct Investment
FGI	Federation of Greek Industries
FING	Federation of Industries of Northern Greece
FORTH	Foundation for Research and Technology
FP	Framework Programme (EU)
GDP	Gross Domestic Product
GERD	Gross Domestic Expenditure on R&D
GPP	Green Public Procurement
GSRT	General Secretariat for Research and Technology
HERD	Higher Education Research and Development Expenditure
HSRT	Human Resources in Research and Technology
HVCA	Hellenic Venture Capital Association
ICT	Information and Communication Technologies
IPR	Intellectual Property Rights
KETA	Centres of Entrepreneurial and Technological Development
MEF	Ministry of Finance
MinDev	Ministry of Development, Competitiveness and Shipping
MinEdu	Ministry of Education, Lifelong Learning and Religious Affairs
NCRT	National Council for Research and Technology
NGO's	Non-Governmental Organisations
NPFRI	National Programming Framework for Research and Innovation
NPRT	National Programme for Research and Technology
NRP	National Reform Programme

NSRF	National Strategic Reference Framework
OBI	Hellenic Industrial Property
OP	Operational Programme
OPCE	Operational Programme Competitiveness and Entrepreneurship
PESTLE	Political, Economic, Social, Technological, Legal and Environmental Analysis
PPP	Public Private Partnership
ROP	Regional Operational Programme
SEE	South East Europe
SPCTA	Special Permanent Committee on Technology Assessment
SWOT	Strengths, Weaknesses, Opportunities and Threats
TANEO	New Economy Development Fund
RTDI	Research and Technology Development and Innovation
USAID	United States for International Development
WP	Work Package

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Annex I: Priorities and support measures in Greek regions

Region	Dominant Sectors	Priorities	Specific actions
Region of Attiki (GR30)	Services (trade, financial service, transport, ICT, Health, real estate, business services)	Strengthening the public R&D infrastructures Promotion of technology transfer mechanisms and improvement of collaborative networks for SME's. Provision of advanced support services for firms (Venture funding, Business Angels, Mentoring, seed capital etc.) Green innovation actions Support of firms at the pre-incubation phase and spin -off and spin out creation Development of thematic innovation poles Improving the linkages of enterprises with public research organizations and higher education institutes. Transforming research results to innovative products and services	Innovation vouchers for SMEs Development and support of new highly knowledge intensive innovative enterprises Collaboration Support newly established firms in R&D Support groups of SME's in their R&D activities
Kenriki Makedonia (GR12)	Services (financial services, transport and communications, tourism)	Bridging of the public research system with the private sector. Transformation of knowledge into innovative products and services. Support of technology transfer towards firms Promotion of the extroversion of the public research centers Development of the human capital	Support newly established firms in R&D Development and support of new highly knowledge intensive innovative enterprises Collaboration Innovation Vouchers for SMEs Support Group of SME's in R&D Strengthening regional infrastructures (innovation Zone of Thessaloniki, Innovation Pole for Central Macedonia, incubators, spin-offs, technology clusters)

Region of Dytiki Ellada (GR23)	Services	Consolidation of region as an national RTDI node Strengthen public research institutions and support the creation of linkages between public research organizations and firms in traditional sectors Establishment of new technology based firms and attraction of FDI	International Collaborations of companies of the region of Dytiki Ellada Establishment of Regional Innovation Poles Support Group of SME's in R&D
Region of Kriti (GR43)	Services (tourism and transport) and agriculture	Strengthening the existing network of public research infrastructures Establishment of the Regional Innovation Pole of Crete	Establishment of Regional Innovation Poles Cluster framework policies R&D cooperation Knowledge Transfer
Region of Ionia Nisia (GR22)	Services (tourism and trade)	Innovation activities of firms directed towards the tourism sector Horizontal actions aiming at improving technology transfer to enterprises, networking etc.	
Region of Sterea Ellada (GR24)	Industry and construction	Improve R&D infrastructure Creation of start-ups and spin-offs in technology and knowledge intensive economic sectors Promotion of technology transfer and collaboration networks between science and industry	Development and support of new highly knowledge intensive innovative enterprises (Spin-offs and Spin outs) Support newly established firms in R&D Collaboration Innovation Vouchers for SMEs Support Group of SME's in R&D
Region of Peloponnisos	Services and industry	Support the development of public R&D infrastructure	

(GR25)		Funding of business plans Technology transfer mechanisms	
Anatoliki Makedonia- Thraci (GR11)	Agriculture and services towards regional needs	Support to innovative investment and business plans. No funds allocated explicitly to RTDI measures in the region.	Innovation vouchers for SMEs Support groups of SME's in their R&D activities (horizontally through GSRT) Improve existing public research infrastructure
Region of Notio Aigaio (GR42)	Services (tourism, trade and real estate)	Creation of clusters Creation of technology based firms funded by VC's Funding of incubators and the establishment of an innovation pole within the region Collaborating networks	Development and support of new highly knowledge intensive innovative enterprises (Spin-offs and Spin outs) Support newly established firms in R&D Collaboration Innovation Vouchers for SMEs Support Group of SME's in R&D
Region of Thessalia (GR14)	Services (tourism, transport, retail) and agriculture	Public R&D infrastructure in priority areas of the local economy	Establishment of Regional innovation poles
Region of Ipeiros (GR21)	Services (tourism and trade) and construction	Support public R&D infrastructures in priority sectors and technological fields important for the regional economy Development of an Innovation Pole	R&D development projects in universities and public research organizations
Region of Voreio Aigaio	Services (retail trade, real estate, transport, financial services)	No public funding planned to be directed towards RTDI measures over the 2007-2013 period Focus of regional policy will be mainly on technological	Support of selected public R&D infrastructures

(GR41)		upgrading and innovative investment projects for firms.	
Dytiki Makedonia (GR13)	Energy production, agriculture and services	Green Innovation Development of new Knowledge (R&D) Exploitation of research results Diffusion of research results into society	Support of new highly knowledge intensive innovative enterprises (Spin –offs and Spin outs) Establishment of Regional Innovation Poles Support newly established firms in R&D Collaboration <i>Policy measures concernin excellence and management of research in Universities</i> <i>Policy measures concernin excellence and management of research in public research organisations</i> Innovation Vouchers for SMEs

Annex II: Main Structural Reforms in Progress

Completed in 2010	
Independence of the Hellenic Statistical Authority	✓
Overhaul of the tax system	✓
Fiscal Management and Responsibility Act	✓
Reform of local public administration ("Kallikrates")	✓
Private and public sector pension reform	✓
Labour market reform	✓
Financial Stability Fund	✓
Allocation of the private insurance sector supervision to the Bank of Greece	✓
Restructuring of the railway sector (OSE)	✓
Liberalisation of road freight transport	✓
"Fast-track" important investments	✓
Horizontal legislation on the Services Directive	✓
Single Payment Authority for the wage bill in the public sector	
Online publication of all decisions involving commitments of funds in the general government sector	✓
New investment law	✓
Liberalisation of closed professions	✓
Healthcare reform	✓
Restructuring of the urban transport entity (OASA)	✓
Law on combating tax evasion and restructuring of the tax services	✓
Establishment of a commitment registry for the general government	✓
In progress	
Simplification of the start-up of new businesses	✓
Simplifying licensing procedures for technical professions ,industrial activities and business parks	
Single remuneration system for public sector employees	✓
Restructuring plan for Public Enterprises	✓
New Law for the Hellenic Competition Authority	✓
Privatisation Plan	✓
Liberalisation of the wholesale electricity market	✓
Single Public Procurement Authority	✓

Source: National Reform Programme, 2011,
http://ec.europa.eu/europe2020/pdf/nrp/nrp_greece_en.pdf accessed in 30th November 2011

Annex III: Diachronic Progress of Main NIS Indicators

	2001	2002	2003	2004	2005	2006	2007	2008	Growth
SII				0.271	0.279	0.295	0.332	0.361	4.3%
ENABLERS									5.8%
Human resources									0.1%
1.1.1 S&E and SSH graduates	--	--	--	21.1	25.3	--	--		4.6%
1.2.2 S&E and SSH doctorate graduates	--	--	--	0.65	0.58	--	--		-3.1%
1.1.3 Tertiary education	17.2	17.9	18.6	20.6	20.6	21.5	22.0		4.3%
1.1.4 Life-long learning	--	--	2.6	1.8	1.9	1.9	2.1		-5.2%
1.1.5 Youth education	80.2	81.1	81.7	83.0	84.1	81.0	82.1		0.1%
Finance and support									13.3%
1.2.1 Public R&D expenditures	0.39	--	0.39	0.37	0.40	0.39	0.41		1.3%
1.2.2 Venture capital (3-year average)	--	--	0.022	0.009	0.002	0.004	0.008		-1.6%
1.2.3 Private credit	0.57	0.60	0.64	0.70	0.77	0.83	0.91		9.1%
1.2.4 Broadband access by firms	--	--	13.0	21.0	44.0	58.0	72.0		51.6%
FIRM ACTIVITIES									1.3%
Firm investments									-10.2%
2.1.1 Business R&D expenditures	0.19	0.18	0.18	0.17	0.18	0.17	0.15		-4.5%
2.1.2 IT expenditures	--	--	--	1.3	1.2	1.2	--		-2.0%
2.1.3 Non-R&D innovation expenditures	--	--	--	2.06	--	0.74	--		-22.7%
Linkages & entrepreneurship									6.4%
2.2.1 SMEs innovating in-house	--	--	--	33.4	--	32.7	--		-0.6%
2.2.2 Innovative SMEs collaborating with others	--	--	--	8.4	--	13.3	--		12.2%
2.2.3 Firm renewal (SMEs entries + exits)	--	--	--	--	--	--	--		--
2.2.4 Public-private co-publications (2-year avg.)	--	4.7	5.0	5.5	8.2	8.7	--		8.0%
Throughputs									6.8%
2.3.1 EPO patents	6.5	6.7	7.9	5.9	6.5	--	--		0.1%
2.3.2 Community trademarks	13.5	17.9	23.0	24.8	21.5	34.4	41.9		6.8%
2.3.3 Community designs	--	--	1.4	1.1	2.5	3.2	7.0		26.2%
2.3.4 Technology Balance of Payments flows	--	0.18	0.16	0.19	0.18	0.15	--		-3.4%
OUTPUTS									6.1%
Innovators									1.9%
3.1.1 Product/process innovators (SMEs)	--	--	--	34.5	--	37.3	--		1.9%
3.1.2 Marketing/organisational innovators (SMEs)	--	--	--	45.6	--	51.3	--		
3.1.3 Resource efficiency innovators									
3.1.3a Reduced labour costs	--	--	--	13.7	--	26.2	--		
3.1.3b Reduced use of materials and energy	--	--	--	9.3	--	20.7	--		
Economic effects									9.0%
3.2.1 Employment in medium-high/high-tech manuf	2.18	2.21	2.04	2.23	2.13	2.27	2.38		3.9%
3.2.2 Employment in knowledge-intensive service	10.18	10.19	10.38	11.01	10.97	11.05	11.06		1.6%
3.2.3 Medium/high-tech manufacturing exports	--	25.3	27.2	29.2	29.7	28.3	--		2.8%
3.2.4 Knowledge-intensive services exports	--	41.3	43.8	47.6	49.4	51.8	--		5.8%
3.2.5 New-to-market sales	--	--	--	4.8	--	16.6	--		32.8%
3.2.6 New-to-firm sales	--	--	--	6.2	--	9.0	--		9.9%