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Executive Summary

In terms of GDP, Greece is classified as a medium-sized European Union country with 1.9% of the EU's GDP, while it comprises 2.3% of the European Union's population for 2010. Due to the crisis, GDP per capita decreased from €20,700 in 2009 to €20,100 in 2010, which amounts to 82% of average GDP per capita of EU-27. With regard to R&D expenditure, Greece falls in the category of small countries, with 0.57% of EU-27 GERD (2007). Since 2000, GERD has stagnated around 0.58% of GDP, while BERD, which is among the lowest in EU-27, slightly shrank from 0.19% of GDP in 2001 to 0.16% in 2007.

However, the productivity of the public research sector has improved in the past five years. Based on the number of publications per capita, it has even surpassed the EU27 average in 2007 (109%). Conversely, at 76% of the EU27 average, the impact of publications is relatively low, as indicated by the citations per publication. Contrary to the trends in publications, the number of applications for patents has remained very low, with 10.6 applications per million of inhabitants in 2009, while the EU-27 average was 115.8.

The country's severe debt crisis in 2010 led to a bailout agreement with the IMF, the ECB and the European Commission, followed by a stringent austerity and consolidation programme which in turn brought about cuts in public expenditures and investments. These cuts, together with projected tax increases and the persisting impact of the international financial crisis, led to a 3.5% decline of the GDP in 2010, and a further downturn of 5.5% in 2011.

The General Secretariat for Research and Technology (GSRT) remains the main body responsible for research and innovation policy, although the Ministry of Development, Competitiveness and Shipping[1] has taken on a more important role now in innovation policy, as several programmes of its General Secretariat for Industry (GSI) in support of business investments have shifted their focus from traditional activities towards innovative ventures. At the same time, the management of the National Strategic Reference Framework was transferred from the Ministry of Finance[2] to the Ministry of Development Competitiveness and Shipping.

Aiming at improving the coordination between education and research policy, the General Secretariat for Research and Technology (GSRT) was moved in 2010 from the Ministry of Development, Competitiveness and Shipping to the Ministry of Education Lifelong-learning and Religious Affaires, at the expense of coordination between research and innovation policy.

Investments in R&D in absolute terms increased in the period 2000-2007, following the rate of growth of GDP. As a result the ratio of GERD/GDP stagnated (with only slight fluctuation) at around 0.6%. Due to the low level of private investments (below 0.2% of GDP), the share of public funding of GERD in relative terms was higher than the EU-27 average. However, it has been far from the optimum, as the share of GBAORD in general government expenditures (0.59% in 2008) and the percentage of BERD financed by government (4.7% in 2007) has remained significantly below the European average (1.51% and 6.8%, respectively).

Competitive and institutional funding for R&D and innovation originate from different sources and are therefore subject to different cycles and constraints. 95% of the competitive funding for R&D and innovation are financed by Structural Funds (SF). The

[1] This is the former Ministry of Development.

[2] This is the former Ministry of Finance and Economy.

budget for competitive funding for the period 2007-2015 amounts to approximately €1.5m. Out of this sum, 81% were allocated to programmes that started between 2009 and 2011. 37% of the total was given to programmes that started in 2011.

Institutional funding is financed through national resources. Between 2005 and 2007, it increased from 46.3% of government budget appropriations for R&D to 62.8%. Due to the delays in the deployment of the competitive funding programmes that started in 2009, a similar ratio can be assumed for 2008 and 2009. After 2010, however, a reversal of the trend is to be expected as a result of the reductions in the institutional funding and the increasing number of competitive programmes that were launched after 2009. The contribution of Structural Funds to R&D amounts to 42% of the national funding, if general university funds (GUF) are excluded. The overall low public budget for R&D and innovation and the reliance on Structural Funds for public R&D investments and competitive funding reflect the low priority of research in the policy agenda.

The impact of the current debt and economic crisis has been magnified by the structural deficiencies of the Greek economy and the national innovation system. Greek research and innovation policy faces four major structural challenges:

- The demand for research-based knowledge by the business sector is very low, mainly due to the underlying structural characteristics of the economy, the significant institutional and bureaucratic obstacles, and the volatile policy and economic environment.
- As a result of fiscal constraints and public policy priorities, public funding of R&D and innovation remains low. At the same time, it has gradually become heavily dependent on Structural Funds. As strategic orientation is lacking and resources are spread thinly, the research system remains without any specialisation.
- With regard to human resources, especially the supply of graduates is misaligned with the demand in terms of skills, fields of study, and level of education. This mismatch can be attributed to both, the insufficient demand of the private sector and the inappropriate response of the education system to economic and societal needs.
- The governance of the national innovation system suffers from the weak coordination among policy making units and their low authority, from complex administrative rules, inefficient management and capacity, as well as from the lack of efficient monitoring mechanisms and of systematic evaluation.

Since 2007, when the "Strategic Development Plan for research, Technology and Innovation" (SDP) was published, the research and innovation strategy has been changed twice, another case in point illustrating the lack of continuity in policy design. The latest strategy was published in May 2011 and focuses mainly on research. An important element of the strategy is the reduction of the number of research priorities, halving them from twelve to six. Envisaged is the reform of the governance of the innovation system by strengthening scientific/research human resources and infrastructure; improving the links between science and industry; supporting European and international collaboration; and by linking science with society. In its current form, the strategy only partially addresses the challenges of the national innovation system, as it requires the close coordination with other policy domains. However, at least at the rhetoric level, the priorities are relevant to the structural challenges, although they are formulated in a very general way that does not allow for a consistent assessment of their relevance.

Public funding for R&D and innovation for the current programming period 2007-2015 started actually in 2009. Since then, a shift of the research and innovation policy over five dimensions can be observed:

- Innovation policy has become further integrated with industrial and entrepreneurship policy, as the traditional tools for mobilising investments in companies now give priority to and provide additional incentives for investments that support innovation. Moreover, organisational and other non-technological aspects of the innovation process are supported.
- Innovation in services has gained significance on the policy agenda, as services have become one of the most important sectors of the Greek economy.
- Tendentially, the role of new financial instruments in support of innovation is increasing. On the contrary, subsidies remain the only type of support for R&D.
- Emphasis is given to the development of a new growth paradigm for Greece towards "green development", mainly based on demand side policies.
- Instruments that are considered too complex for Greece, or integrate multi-actor initiatives, which are foreseen in the SDP, are abandoned in favour of more traditional and tested programmes.

As to the components of the policy mix, the main shift between 2009 and the previous programming period (2000-2006) has been towards strengthening competitive funding of academic research, thus rendering it the second most important policy area in terms of budget. Notwithstanding, support of R&D and innovation in the business sector and the strengthening of business-private collaborations in R&D also remain key components of the policy mix.

With regard to national research policy, ERA not only provides the opportunity to tap into additional sources of funding, but also to benefit from international knowledge and to increase local research capacity through collaborations and the use of European research infrastructures in areas of national priority. In 2010 and 2011, the main efforts of the Ministry of Education have been, on the one hand, to formulate a new strategy for education, research, and internationalisation of the research system and, on the other hand, the introduction of reforms for the implementation of the strategies. Among these priorities, the formulation of the research and internationalisation strategy has been delayed due to changes in the Ministry. In 2011, a new law for the reform of the higher education system was introduced and, in January 2012, another new law concerning the governance of the research system is going to be published for consultation. The former was inspired by the ERA policy objectives and has introduced radical changes targeting the increase of accountability, an improvement of the management and an increase of the autonomy of HEIs, as well as an improvement of the quality of teaching and research. The reform also includes the involvement of non-academics in the management of the institutions, as well as changes in the organisation of the studies and of the funding mechanisms. Furthermore, quality and performance have become linked now with funding incentives.

The new law and the budget increase for the participation in ESFRI, for European collaborations, and for science-industry collaborations address most of the ERA pillars and objectives. Some areas, however, mainly related to human resource issues, remain problematic, such as the little attractiveness of research careers or lack of mobility of researchers. Underlying these problems are basic structural deficiencies of the economy and the national innovation system, which go beyond the range of influence of education and research policy.

In the short run, a new strategic plan addressing both research and innovation should be prepared and widely discussed among the stakeholders. This plan should feed into the preparation of the new programming period of Structural Funds. Improvement in the

coordination of education, research, and innovation policy is also a priority for the immediate future, while in the medium run basic structural changes are necessary. The research and education infrastructures can be consolidated only at the medium or long term, as thorough planning aiming at optimising the use of resources and maximising performance is necessary. Given the failure of supply side policies to stimulate business demand for research-based knowledge, the role of demand side policies in the policy mix should be increased.

TABLE OF CONTENTS

1 Introduction

In terms of GDP, Greece is classified as a medium-sized European Union country with 1.9%[3] of the EU's GDP and 2.3% of the EU's population in 2010. GDP per capita is €20,100, which amounts to 82% of the average GDP per capita of EU-27. With regard to R&D expenditure, however, Greece falls in the category of small countries, with only 0.57% of the EU's GERD (2007)[4]. GERD in 2007 represented only 0.6% of the GDP while, in the same year, the EU-27 average was 1.85%. Private R&D investments on R&D (BERD) as a percentage of the GDP are among the lowest in EU, amounting to only 0.17% of GDP compared to 1.18% for the EU-27 (2007). Prospectively, BERD is likely to further diverge from EU-27, as between 2005 and 2007 it shrank by 1.9% p.a. on average, while in EU-27 it grew by 0.9% p.a.

Economic and R&D performance

Between 2000 and 2007, Greece's growth rates of 4.1% on average surpassed the EU-27average of 2.2% by far. This growth was mainly achieved by boosting internal consumption, rather than by increasing exports. According to OECD (2007), main drivers of growth were the improvements in the product market regulation; the liberalisation of the financial market; Greece's membership in the European Monetary Union (EMU); the stimulus provided by the 2004 Olympic Games; a dynamic presence in the export markets of south-eastern Europe; and a high number of low cost unskilled immigrants.

The country's growth slowed down with the international economic crisis starting in 2008. This mostly affected the tourism and shipping sectors, but overall growth rates remained still higher than the EU-27 average (1.3% in 2008 compared to 0.5% of EU-27). However, due to the high debt (126.8% of GDP in 2009) and the large public deficit (15.4% of GDP for the same year), Greece entered a severe debt crisis that led to a bailout agreement with the IMF, the ECB and the European Commission in 2010. The initial agreement granted a €110b bailout package, conditioned on a strict austerity programme aiming at cutting down the public deficit below 3% of GDP by 2014, and on the implementation of structural reforms. As the deficit target could not be reached, the European Council decided on restructuring Greece's debt and allocated an additional €130b in October 2011. The severe cuts in public expenditures, together with projected tax increases and the persisting impact of the international financial crisis, led to a 3.5% decline of GDP in 2010, and a further downturn of 5.5% in 2011[5] (Ministry of Finance, 2011).

Despite the low public and private expenditures on R&D, the productivity of the research system in terms of publications has been high compared to other European countries. Between 1993 and 2008, the number of Greek publications grew by 298%, while the increase for EU-27 was 87%, and 65% for the OECD countries (Sachini et al, 2010), Greece thus ranking 5th among the OECD countries. In terms of publications per capita Greece caught up with the rest of Europe in 2006, and in 2007 publications per

[3] Unless stated otherwise, all quantitative indicators are based on Eurostat data sourced in November 2011.

[4] Data series on R&D for Greece stop for most of the indicators in 2007.

[5] The slowdown of the economy is expected to continue in 2012, albeit at a lower rate of -2.8% of the GDP, as internal consumption is still on the decline (Ministry of Finance, 2011).

capita amounted to 856 compared to 785 in EU-27 (Logotech, 2009). The productivity of R&D expenditures (GERD), which is measured as publications per million Euros of GERD, is very high in Greece compared with EU-27. In 2007, 7.3 publications were produced per million euros while the average in EU-27 was only 1.7. However, the impact of Greek publications is relatively low, as indicated by the citation statistics. Between 2004 and 2008, EU-27 publications received on average 5.03 citations per publication, whereas the average for Greek publications was 3.82 (Sachini et al, 2010). The production of patents is very low in comparison, which reflects the low knowledge intensity of innovation activity in the country. In 2009, the number of patents per million of inhabitants in Greece was only 10.6, while the EU-27 average was 115.8.

Limited business expenditures on R&D and the small number of patents are the flipside of concentrating on business activities in less knowledge intensive and low value added segments of the economy. Driven by internal consumption, trade remains Greece's most important sector in terms of gross value added[6] (VA) and employment. The average annual value for the whole decade 2001-2010 amounted to 15% of the total VA, while for the EU27 the share was 11.4% for the same period. The average annual share of trade in total employment amounted to 21.7% (EU27 15.1%). Due to the crisis, value added started to converge with EU27, declining from a peak of 18.2% in 2003 to 12.5% in 2010 (EU27 11.1% in 2010). Employment has remained at the same level. The second largest sector is real estate with an average annual VA of 11.6% of the total VA. Manufacturing accounts for 9.7% of VA, followed by transport with 6.9% and the construction sector with 6.6%. Among manufacturing sectors, food products increased their share in total VA from 2.5% in 2002 to 3.3% in 2010 (annual average 2001-2010 2.6%). The share of metal products fluctuated around 1.2%, recovering tendentially after a decline to 0.9% in 2008. Rubber and plastic products follow a downward trend from 1.4% in 2001 to 0.8% in 2010. Similarly, textiles-apparel decreased from 1.4% in 2001 to 0.5% in 2010.

The R&D activity of the prominent sectors such as trade, transport, and construction represented only 3.15% of BERD in 2007. Thus, the private sector's demand for R&D is driven mainly by manufacturing (31.6% of BERD, of which chemicals represent 15.7%, fabricated metal products 7%, electrical equipment 4%, and food 2.5%) and by IT services. The latter is the most dynamic and important sector as regards R&D, accounting for 41% of BERD in 2007, which represents an increase of 111% compared to 2003.

Main actors and institutions in research governance

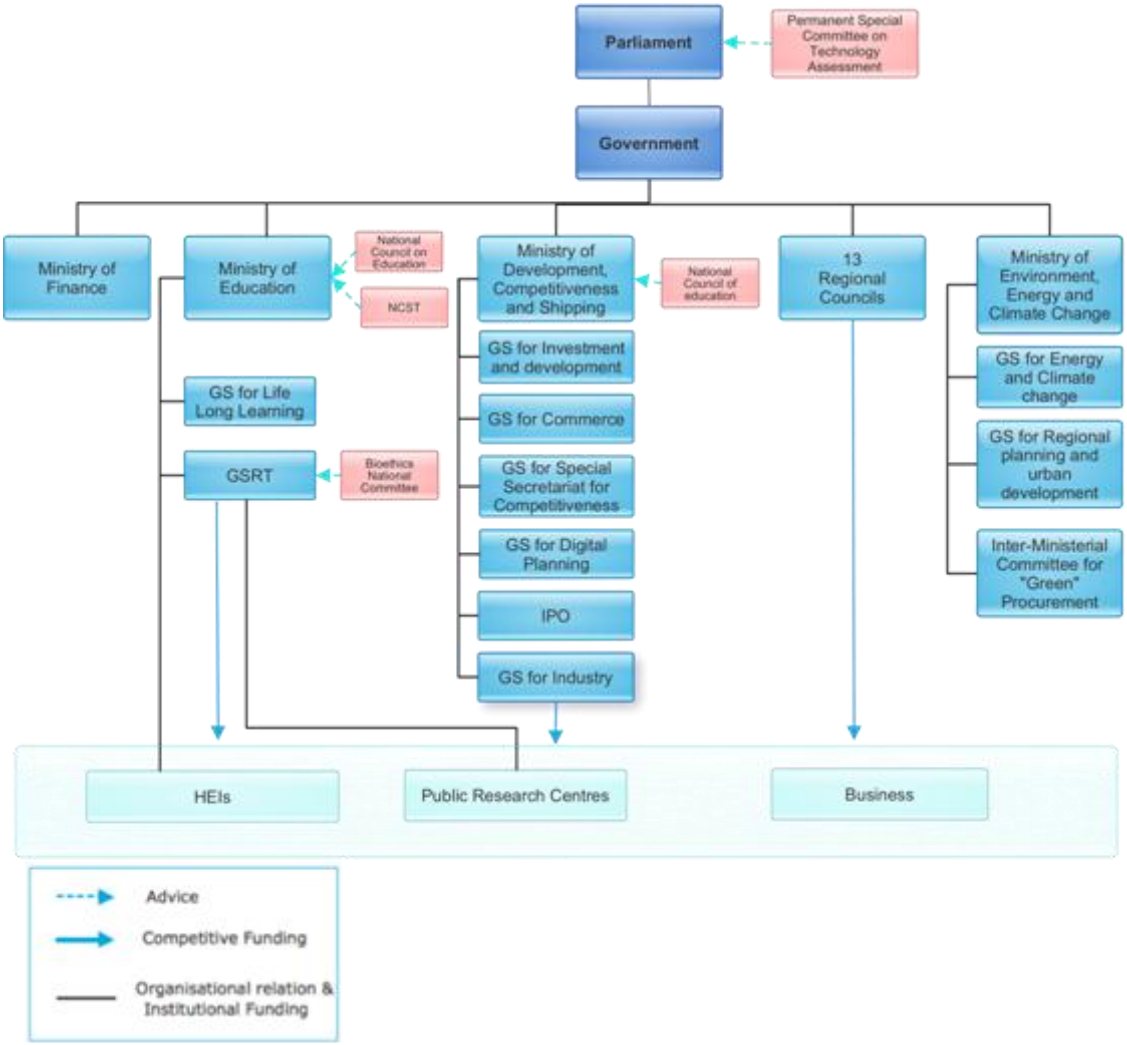
At the political level, the main actors are the Greek government and the Parliament with its Permanent Special Committee on Technology Assessment (PSCTA). The PSCTA has no decision making power in the policy making process. Within the current structure, two ministries share the responsibility for innovation policy. The coordination at government level is weak, however, as both policy design and implementation of research and innovation policy are mainly implemented at the operational level of General Secretariats.

At the operational level, the main research policy maker and authority for research funding is the General Secretariat for Research and Technology (GSRT). Being affiliated to the Ministry of Education, the GSRT coordinates between two poles of the knowledge triangle, education and research. The coordination with innovation is rather weak, however, as the responsibility is shared with the General Secretariat for Industry within the Ministry of Development, Competitiveness and Shipping. The latter is also

[6] Gross value added is calculated by Eurostat at basic prices.

responsible for the management of the National Strategic Reference Framework (NSRF)[7], which is the main source of research and innovation funding.
Most public research centres are supervised by GSRT. The main advisory body on research, the National Council for Research and Technology (NCRT), is associated with the Ministry of Education and contributes to setting the priorities for research funding. It is also responsible for evaluating research policy and all public bodies and organisations involved in the research system.

Figure 1: Overview of the Greek research system governance structure



Source: Logotech

In addition to the funding that is distributed by GSRT, the Ministry of Education contributes to R&D funding through the general university funds (GUFs). Likewise, the Ministry of Rural Development and Food and the Ministry of Defence provide some funding for research.
The new Ministry of Environment, Energy and Climate Change is indirectly involved in innovation policy by fostering demand in the areas of renewable energy production, energy saving and environmental friendly technologies and processes.
Despite the recent reform of "Kallikratis", regions play a minor role in R&D policy making, due to their limited policy making and implementation capacity (GSRT, 2007).

[7] Approximately 95% of NSRF are financed by Structural Funds.

Most of their budgets have been relinquished to GSRT in order to finance national research measures, but a certain amount is reallocated to the regions.

Main research performer groups

The country's 24 universities are the main research performers and account for approximately 50% of GERD (2007). The 16 Technological Educational Institutions (TEI) are mainly active in teaching with a limited, although rapidly growing focus on research. Among the HEIs, two institutions, namely the Aristotle University of Thessaloniki and the National and Kapodistrian University of Athens, produce approximately 44% of the country's research publications (Sachini et al, 2010). In addition, there are 24 public research centres, 12 of which are supervised by GSRT. Together, HEIs and public research centres are responsible for 71.7% of GERD, while private R&D performers have the lowest share (approximately 27% of GERD) among the EU member states. According to the Industrial R&D Investment Scoreboard (JRC-DG RTD, 2011), only five Greek companies are among the top 1000 European companies with a view to the level of investment.

2 Structural challenges faced by the national system

According to the Innovation Union Scoreboard, Greece is characterised as a moderate innovator, ranking 19th in terms of its overall innovation performance. Most striking is the low R&D intensity, which has stagnated at 0.58% of GDP in the last decade, reflecting the very low business and public expenditures on R&D (see chapter 1). The latter is directly related to the low priority of R&D policy in the policy agenda and the high public deficit and debt, which restrict the available public budget. The fiscal constrains became most palpable after 2010, when expenditures for public investments and salaries were cut in the course of the strict austerity programme, driving further down the already relatively low public expenditures and funding of R&D.

The impact of the current debt crisis on the economy has been magnified by the structural deficiencies of the Greek economy and of the national innovation system, and aggravated by the limited availability of tools for government intervention. Within this negative environment the main challenges are to increase business demand for new knowledge, to ensure better-focused and long term public funding of R&D, to align supply and demand of human resources, and finally to improve the governance of the national innovation system.

Increase business demand for new knowledge

All R&D and innovation performance indicators related to the business sector have remained well below the EU-27 average (European Commission, 2011; Pro Inno Europe, 2011), which reflects the structural deficiencies of the Greek economy. A combination of structural problems and significant institutional and bureaucratic obstacles, together with a volatile policy environment induce businesses to invest in activities with either high rates of return in the short-term or very low risk (Bartzokas, 2007). Thus, business activity has largely shifted towards less knowledge intensive and low value added activities. The demand for research-based knowledge by the private sector has remained very low even in sectors with relatively high innovation performance; the latter focusing their innovation efforts mainly on non-R&D and non-technological aspects such as marketing and organisational improvements. Consequently, the small increase on BERD after 1995 was reversed after 2000.

From 2000 onwards, the declining R&D and innovation performance went alongside high growth rates (see chapter 1), that were mainly driven by the high internal public and private consumption which in turn was financed through loans. The limited exposure to international competition[8] and privileged access to public sector procurements, allowed significant segments of the economy to grow without investing in R&D and innovation.

As the business sector's lacking interest in increasing its competitive position by investing in R&D and innovation affects all aspects of the national innovation system, major challenges for public policy include:

- shaping the conditions that influence the business demand for R&D based knowledge by opening up the internal market to competition,
- eliminating the factors that hamper entrepreneurship, and
- shifting emphasis from supply to demand side policies

Ensure better-focused and long term public funding of R&D

Due to fiscal constraints and public policy priorities, public funding of R&D and innovation has remained low while gradually becoming heavily dependent on Structural Funds. GBOARD is around 0.3% of GDP, which is half of the EU-27 average[9]. The contribution of Structural Funds to R&D represents approximately 10% of GERD. If general university funds (GUF) are excluded, funding from Structural Funds amounts to 42% of the direct government funding of R&D (Maroulis, 2011).

As the design and management of the Structural Funds is complex and the management capacity of the Greek administration is limited, the dependence on Structural Funds has resulted in fragmented planning and thus funding budgets being distributed across various sectoral and regional Operational Programmes. In addition, the funding is lacking focus and strategic orientation and, therefore, the budget is spread along a wide spectrum of scientific and technological fields. For years the lack of priorities and the scarcity of public funding have created an opportunistic supply driven research system (Bartzokas, 2007). This system often followed the priorities of the EU Framework Programmes (Grant et al, 2011), which were not always related to the needs of the country. Even worse, lack of focus hindered the creation of a critical mass in research areas of national relevance and importance (Grant et al, 2011). The first efforts to set priorities started in 2007. However, since then the priorities have been revised quite a few times, preventing a consistent and long-term orientation of the system.

The current debt crisis and the severe budget cuts increase the importance of consolidated and better targeted funding toward few and well-defined priority areas.

Align supply and demand of human resources

According to Lianos (2007) and Lambrianidis (2011), there is a mismatch between supply and demand of human resources. This misalignment can be attributed to both, the insufficient demand of the private sector and the inappropriate response of the education system to the market needs. On the one hand, according to the data for 2006[10]

[8] As it is pointed out in the 1st quarterly report of the Task Force for Greece (TFGR, 2011) "Many sectors of the Greek economy have been sheltered from strong competition by extensive regulatory, administrative and price controls". Moreover, sectors with high growth and holding dominant positions are those with relatively low exposure to international competition, such as retail trade, construction and services.

[9] The average Greek GBAORD for the years 2004-2007 was 0.32% of GDP while the EU-27 average for the same period was 0.7% of GDP.

[10] No data for Greece for the CIS 2008 has been published yet.

of the 6th Community Innovation Survey (CIS6), the share of innovative Greek firms that consider the lack of qualified personnel as a significant obstacle to innovation is the highest in EU-27. An earlier study of the Federation of Greek Enterprises (2004) analysing future trends in demand in the business sector, identified problems in the supply side. It observed excess demand for engineers, while the qualifications of business and economic studies graduates did not meet the needs of medium to large companies. Conversely, Lambrianidis (2011) argues that the overabundance of highly educated individuals relative to overall demand is due to the low demand of the private sector for highly qualified personnel.

The demand for researchers is also low compared to the EU-27 average. The share of researchers (in full time equivalents) as a percentage of total employment in Greece was 0.46% in 2007[11], much lower than the EU-27 average of 0.66%. Compared with EU-27, the demand from the business sector is especially low (Maroulis, 2009) and, therefore, most PhD graduates pursue academic careers. . Approximately 85% of PhD holders are employed by the university sector and by research organisations and only 7% by the business sector[12], although the share of the latter has almost doubled since 2001 when it was only 3.6%. The remaining percentage of graduates tends to go into non-research jobs or abroad.

The challenge for public policy is to increase the responsiveness of the higher education system to the needs of the economy and to increase the demand of the private sector for highly qualified personnel as well as the demand of R&D-based knowledge in companies.

Improve the governance of the national innovation system

Although no systematic assessment of the R&D and innovation policy has been implemented so far, apart from some piecemeal efforts from time to time, the evolution of the main R&D and innovation indicators and the gap between targets and achievements[13] reveal low effectiveness and impact.

The concentration of design and implementation of the R&D policy within a single agent (GSRT) has been repeatedly criticised (Tsipouri and Papadakou, 2005; Maroulis, 2009a). Furthermore, due to its position within the overall structure, GSRT does not have the necessary authority to influence or coordinate policies of other bodies and Ministries. The increased involvement of the Ministry of Development, Competitiveness and Shipping in innovation policy necessitates even more coordination efforts.

At the operational level, complex administrative rules, inefficient management structures, and low administrative capacity inhibit the consistency of competitive funding. Grant et al (2011) list several cases where funding decisions were delayed or committed research funds were not paid on time. As a result, competitive funding for the period 2007-2008 was virtually zero (Maroulis, 2011).

The lack of efficient monitoring mechanisms and of systematic evaluation has hindered policy learning and does not allow for improvements of the design and implementation of policies. There is also no systematic training for the civil servants involved in policy design and implementation (INNO-Policy TrendChart, 2009).

Despite the urgent need for improvements at all levels of governance, budget cuts and reductions of personnel are disincentives for improvement and increase tension within the existing organisational structures.

[11] The latest available data on researchers provided by Eurostat for Greece is in FTE for 2007. The latest data on head counts is for 2005.

[12] The latest available data by GSRT is for 2005.

[13] For example, the Lisbon targets

3 Assessment of the national innovation strategy

3.1 National research and innovation priorities

The national strategy for research and innovation follows the programming cycle of the Structural Funds, since they are the main funding instruments. The strategy for the current programming cycle was developed in 2007 and is described in the "Strategic Development Plan for Research, Technology and Innovation" (SDP) and the OP "Competitiveness and Entrepreneurship". The main goal defined in the SDP was the **support of the objective of sustainable development by investing in knowledge and excellence**. More specifically, the following objectives addressing R&D investments were set:

- Catching-up with Europe in terms of research investments;
- Increasing private investment in R&D and linking research and business sectors more effectively;
- Giving support to research in areas that will contribute to a reorganisation of the Greek economy and strengthening the country's competitive advantage and thus improving the quality of life for people and the environment;
- Exploiting economies of scale in research by creating a critical mass of research capabilities in selected areas of economic interest;
- Improving the quality and quantity of human resources, especially those related to research and technology, and increasing the mobility between research organisations and companies;
- Promoting integrated interventions for the development of innovation in (geographical or thematic) areas combining business and public research agglomerations.

The strategic plan also defined 12 priority areas for research covering a mix of economic and societal challenges.

The change of government in September 2009 was followed by an effort to redefine the policy objectives, focusing on green sustainable development based on knowledge, innovation, and human capital (GSRT, 2010). An action plan was published for public consultation in 2010. However, changes in the government and the replacement of the General Secretary of Research and Technology in early 2011 led to a new strategy and the priorities were set as follows (Ministry of Education, 2011)[14]:

- strengthening and supporting the scientific/research personnel and research infrastructure;
- improving links between the scientific/research community and the business sector for the promotion of innovation
- supporting European and international collaboration; and
- linking science with society.

[14] For a short English version see the National Reform Programme 2011-2014 (Ministry of Finance, 2011)

In the new strategy six main research priorities are defined, which focus on sectors and technology areas that are either considered key for the economy or address societal challenges:

- materials and chemicals;
- agro-biotechnology and food;
- ICT and knowledge intensive services;
- health and biomedicine;
- energy and environment;
- applied economic and social research and research on cultural heritage.

In addition, the strategy introduces two further priorities that are related to the governance of the national innovation system:

- creating a new Framework law for research
- improving the appraisal process for the selection of funding of research projects by increasing transparency and strengthening international peer review.

A new element of the strategy is that it tries to consolidate funding from different Operational Programmes into one strategic plan. However, the consolidation rather serves monitoring purposes than the coherence or coordination of policy design, given that the main priorities and the allocation of funding per priority in each of the Operational Programmes were decided prior to the creation of the new strategy. Contrary to previous practice, the formulation of the new strategy and of the research priorities was not based on a wide public consultation. A positive aspect of the followed procedure has been the involvement of the National Council for Research and Technology, which after 2010 has played a more active role in the devising of research policy. On the downside, the changes of the policy priorities during the last three years illustrate the lack of continuity of policy design, which in effect has undermined the governance system's capability to design reliable multi-annual strategies.

Consistency of the priorities with the structural challenges

Two of the main structural challenges of the national innovation system identified in chapter 2, namely the low demand of the business sector for new knowledge and the misalignment between demand and supply of human resources, can only in part be addressed by research and innovation policy. What is necessary is the coordination of various other policy fields, i.e. industrial, competition, trade, human resources and education policy, with research and innovation policy. Within the current governance system this kind of coordination can only be realised at the Cabinet level in the form of an ad-hoc ministerial coordination group. So far, however, the Cabinet has not taken any initiative. Thus, in order to address the challenge to increase demand for knowledge, "improving links between the scientific/research community and the business sector for the promotion of innovation" may be consistent, but it is not sufficient.

Furthermore, the priority "strengthening and supporting the scientific/research personnel and research infrastructure" potentially addresses aspects of the misalignment between demand and supply of human resources, providing that the direction of funding for the development of research and technology personnel is better aligned with the actual needs of the economy.

Similarly, the priority to "support European and international collaboration" would be more beneficial to meeting other challenges if the criterion for the development of

collaborations was their relevance to the economic and societal challenges of the country, not their contribution to maximising the funding.
The reduction of the number of priority research areas and the emphasis on their relevance to the imperatives of the economy is consistent with the need to create economies of scale in better-focused areas. And finally, the draft for a new law for the governance of the research system provides scope to address some of the structural deficiencies of the governance system.

3.2 *Trends in R&D funding*

Investments in R&D in absolute terms increased between 2000 and 2007, following the rate of growth of GDP and, therefore, the share of GERD in GDP stagnated (with only slight fluctuation) at around 0.6%. Due to the low level of private investments (below 0.2% of GDP), the share of public funding of GERD in relative terms was higher than the EU-27 average. However it is far from the optimum, as the share of GBAORD in general government expenditures (0.59% in 2008) and the percentage of BERD financed by government (4.7% in 2007) are significantly below the European average (1.51% and 6.8% respectively for the same years).

Greece's deficit and debt crisis has impacted on R&D in various ways. For one thing, the Memorandum of Economic and Financial Policies between Greece, the IMF, ECB and the EU stipulates a significant reduction of public expenditures in order to reduce the general government deficit from 10.6% of GDP in 2010 to 3% of GDP by 2014. According to the Budget for 2012, which was approved in November 2011 by the Greek Parliament, public competitive funding for R&D (operational costs and salaries not included) will be increased by 10.35% in 2012 due to the contribution of Structural Funds. Likewise, the total planed competitive funding of approximately €1.5b for the period 2007-2015 is also highly likely to be distributed without problems.
On the contrary, institutional funding is expected to be reduced due to the salary cuts for researchers and academics, the cutback of other operational costs, and the restructuring of the public research sector through mergers.

Table 1: Basic indicators for R&D investments in Greece

	2007	2008	2009	2010	EU average 2010
GDP growth rate	3.0	-0.2	-3.3	-3.5	2,0
GERD as % of GDP	0.6	N/A	N/A	N/A	2.0
GERD per capita	120.1	N/A	N/A	N/A	490.2
GBAORD (€m)	660.1	690.7	N/A	N/A	92,729.05
GBAORD as % of GDP	0.3	0.3	N/A	N/A	0.76
GBAORD as % of general government expenditures	0.62	0.59	N/A	N/A	1.5
BERD (€m)	383.5	N/A	N/A	N/A	151,125.56
BERD as % of GDP	0.17	N/A	N/A	N/A	1.23
GERD financed by abroad as % of total	N/A[15]	N/A	N/A	N/A	N/A[16]

[15] For 2005 GERD financed by abroad as % of total GDP is 1.9

[16] 8.4 (2009), 9.04 (2005)

GERD					
R&D performed by HEIs (% of GERD)	49.2	N/A	N/A	N/A	24.2
R&D performed by PROs (% of GERD)	20.9	N/A	N/A	N/A	13.2
R&D performed by Business Enterprise sector (as % of GERD)	28.6	N/A	N/A	N/A	61.5

Source: Eurostat data extracted on 28/2/2012

According to the National Reforms programme 2011-2014, the target to increase R&D expenditures to 2% of the GDP by 2020 is regarded as being unrealistic and, therefore, it will be revised (Ministry of Finance, 2011).[17]

Mainly due to fiscal constraints, public expenditures on R&D and innovation have become heavily dependent on Structural Funds and on the Framework Programmes, which constitute approximately 20% of GERD. Funding from these two sources is the only R&D funding obtained from abroad.[18] Although data is only available for the span of a few years, each of the sources roughly covers 9% to 10% of GERD, with some variations depending on their programing cycle. If general university funds (GUF) are excluded, funding from the Structural Funds amounts to 42% of the direct government funding of R&D (ERAWATCH Network, 2011). Investments on infrastructures and competitive funding are financed by the NSRF. 95% is obtained through the Structural Funds and only 5% comes from national sources[19]. The main funding instruments are the Operational Programmes of "Competitiveness and Entrepreneurship", "Education and Life Long Learning" and the Regional Operational Programmes of Attiki, Makedonia-Thraki, Ditiki Ellada-Pelloponisos - Ionia Nisia, and Thessalia –Sterea Ellada.

Competitive funding is mainly horizontally organised, without a thematic or sectoral focus (only 7.6% of the total budget for the period 2007-2015 are clearly marked out). Most programmes are however subject to budget quotas for research and technology areas of national priority.

Institutional funding increased from 46.3% of government budget appropriations in 2005, to 62.8% in 2007, due mainly to the gradual reduction of programme based funding after the programming period 2000-2006. Although no updated data exists, it can be assumed that institutional funding was also available in 2008 and 2009, due to the delays in the development of the competitive funding programmes that started funding in 2009. After 2010, however, a reversal of the trend is to be expected as a result of the reductions of institutional funding and the increasing number of competitive programmes that were launched after 2009.

Based on the available data[20], business funding of GERD remains marginal and fluctuates around 0.19% of GDP, following the Structural Funds programming cycle. At the same time, BERD has become increasingly dependent on public funding, including EU funding (SF's and FPs). Funding from these sources increased from 1.2% of BERD in 2001 to 5.6% in 2005 and to 4.7% in 2007. The increase of the share of public funding of BERD is combined with a shift of business funding from BERD to HEIs and to public research organisations. The ratio between business funding of HERD and GOVERED, and business

[17] According to GSRT estimates, achieving the target requires to increase GERD from €1.3b in 2007 to €4.9b by 2020.

[18] Eurostat refers to both types of funding as funding from abroad.

[19] Initially the allocation was approximately 80% Structural Funds and 20% national funding. However, due to the crisis, it was agreed to reduce the national contribution to 5%.

[20] Data on business funding of R&D is available until 2005. Only data on funding of BERD is available for 2007.

funding of BERD increased from 11.8% in 2001 to 16.9% in 2005. Thus, the increase of funding for HEIs and public research organisations by the business sector is not the result of more business investments in R&D, but merely a redirection of public funding for companies towards HEIs and public research organisations. This conclusion is supported by the fact that during the programming period 2000-2006[21] all research programmes, even those targeting the public research sector, make the participation or co-funding of the business sector obligatory. Within this context, it is valid to assume that public funded collaborations between companies and public research organisations/HEIs are mainly driven by the latter.

3.3 *Evolution and analysis of the policy mixes*

The role of research and innovation

The position of research and innovation on the policy agenda has significantly improved in the last decade as their role in enhancing competitiveness has been recognised. However, in practice this recognition was not followed by a significant mobilisation of public resources [22], as is clearly indicated by the low share of R&D funding in the general government expenditures compared to EU average (see Table 1).

The quality of R&D and innovation governance

The existing governance model originates from the 1980s. Since then, several efforts have been made to modernise and adapt it to current needs, although the reforms did not manage to address the lack of a strong coordination centre and to clearly separate the different policy levels within the existing structure. The radical changes to be introduced by a new law in 2008 were never implemented, as its coming into force was postponed until 2011. The new General Secretary for Research and Technology, who was appointed in April 2011, initiated the drafting of yet another new law that is expected to be published for consultation in January 2012.

While R&D versus innovation policy coordination remains fragmented, some improvement has been achieved by concentrating the responsibility for the management of all R&D programmes (business and academically oriented) under GSRT. Before that, academic research programmes were managed by different units of the Ministry of Education.

Overall, the volatile policy environment and the frequent changes in the leadership of GSRT during the last three years slowed down the reforms of the governance system.

Adequacy of public funding

The main dimensions of the policy mix were defined in 2007 (see section 3.1) as a result of the design of the NSRF, which is co-funded by the Structural Funds. However, due to inefficiencies in the planning and implementation of the R&D and innovation policy, the implementation did actually not start until 2009. Until then only few measures continuing from the previous programming period were re-launched.

The overall budget for research and innovation measures (institutional funding not included) for the programming period 2007-2015 amounts to €1.5b.[23] The budget of the programmes which started within 2009-2011 amounts to €1.22b, representing 81% of

[21] Funding from this programming period had been extended in 2007 and 2008.

[22] See also the speech of the General Secretary for Research and Technology in the Parliament' s Special Permanent Committee on Technology Assessment on 11/10/2011.

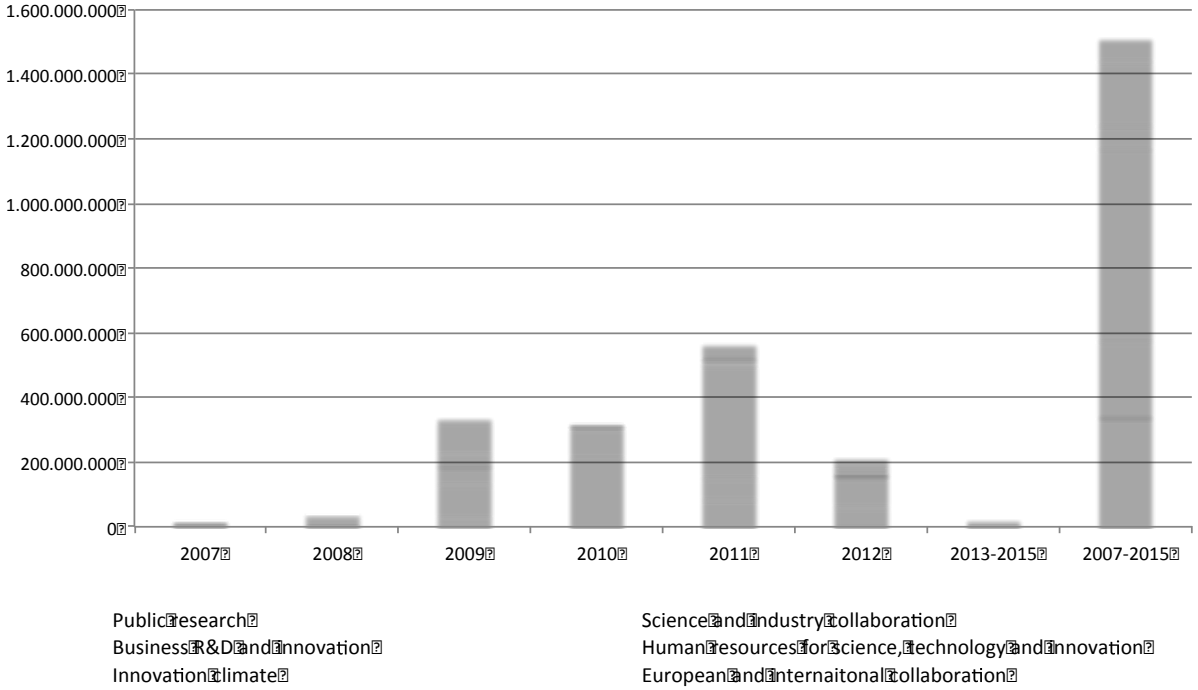
[23] The data in this section are estimations of the authors based on data of Unit A1, Special Management Service of the OP "Competitiveness and Entrepreneurship" and analysis of the database of calls of the NSRF 2007-2013 http://www.espa.gr/en/Pages/Proclamations.aspx.

the total budget for the whole period 2007-2015. Almost half of this budget (€568m, representing 37% of the total) comes from programmes launched in 2011, while for 2012 calls of around €217m are expected to be published (14% of the total).
Grants remain the only type of support for R&D. However, as regards the funding of innovation, new financial instruments such as tax allowances and soft loans are starting to play a bigger role.

The scope of innovation policy

Innovation policy is further integrated with industrial and entrepreneurship policy, as the traditional tools used for mobilising investments in companies now give priority to and provide additional incentives for investments that foster innovation. Thus, organisational and other non-technological aspects of the innovation process are supported.
Innovation in services has become increasingly important on the policy agenda, as services have become one of the most important sectors of the Greek economy. In total, €103m are directed to innovation in services.
Similarly, emphasis is given to the development of a new growth paradigm for Greece based on "green development". The efforts in this area focus on generating demand by encouraging the introduction of green technologies and applications in enterprises. In total, the budget of the programmes supporting green innovation amounts to €46m.
The above changes crosscut most of the dimensions of the policy mix. The evolution of the various policy areas and their respective shares are presented in figure 2.

Figure 2: Evolution of policy mix in terms of budget of new programmes launched each year – Euro



Source: Estimation by the authors based on data provided by Unit A1, Special Management Service of the OP "Competitiveness and Entrepreneurship" and analysis of the database of calls of the NSRF 2007-2013 http://www.espa.gr/en/Pages/Proclamations.aspx.

Promoting private investments

It is widely recognised by policy makers that the institutional and regulatory environment are rather hostile towards innovation and entrepreneurship.[24] In response to the economic crisis and under the pressure of the "Memorandum of Economic and Financial Policies", the government launched an ambitious programme of reforms in 2010, in an effort to improve the conditions that enable investments, including R&D and innovation. The reform programme included the simplification of the procedures, so that new firms can be established in one day; the improvement of the regulatory framework for the development of industrial areas and business parks; as well as the creation of a road map for removing thirty of the largest obstacles for entrepreneurship and innovation. However, the slow progress of the reforms and the deepening of the economic crisis[25] have further deteriorated the economic environment and discouraged business investments. Anecdotal evidence which is also confirmed by IOBE (2012), points to the emergence of small innovative start-ups in niche markets e.g. in services, ICT, or agriculture, as an exception to this trend.

Recognising the need to strengthen R&D and innovation in the business sector, the government has directed 39% of the budget (€592m) towards the support of R&D and innovation in companies. Grants for R&D are mainly allocated to SMEs and to new companies via two programmes that support R&D in networks of SME and in young SMEs. The budget for both programmes amounts to €44m.

The Investment Law, which traditionally had been the main instrument for mobilising private investments in the business sector, was redesigned in order to replace more and more subsidies by fiscal and financial tools and to extend its scope to support innovation. The law now also contains a green dimension, allocating €7m to environmentally oriented investments. Another new programme aimed at promoting the internationalisation of companies was launched in 2011, with a budget of €44.8m. The programme supports innovative ideas and non-technological innovations that advance Greek products in European and international markets. "New innovative entrepreneurship" is a further new programme that was launched also in 2011, which supports new innovative ventures with a budget of €30m.

Following the trend to increase the weight of financial-market-type-of-instruments, a new "Entrepreneurship Fund" (ETEAN SA), was created in 2011 by merging and expanding pre-existing funding instruments. The Fund is expected to mobilise about €460m of public funding for supporting entrepreneurship through venture capital, start-up and seed capital, and business angels. Innovative ventures are expected to absorb 10% of the total budget. In addition, the creation of a new fund dedicated to research and innovation with a budget of 50m is planned for 2012.

The objective to direct business activities towards knowledge intensive segments of the economy, which started in the previous programming period (2000-2006), continues in the current period. A new programme supporting spin-offs from public research organisations and new firms spinning-out from established or new innovative companies started at the end of 2009 with a budget of €24m. It is estimated that new calls with a budget of €32m will be published in 2012.

[24] The problem is often stated in documents and press releases of the Ministry of Development, Competitiveness and Shipping, as well as in interviews and speeches of the Minister for Development, Competitiveness and Shipping. See e.g. the Minister's speech in "The 22nd Greek Economy Conference " of the Hellenic-American Chamber of Commerce" December 2011.

[25] DGP is expected to further decrease by 5.5% in 2011.

Innovation in services is funded by three programmes with a budget of €103m in total. "Green Tourism" started in 2010 with a budget of €13m. The other two were launched in 2011 and focus on ICT services and software applications.
Together with the green dimension of the Investment Law and "Green Tourism", two more (demand-side support) programmes, namely "Green Enterprise" and "Green Infrastructure", serve the objective of green growth.

Primacy given to the pursuit of excellence

Institutional funding for public research organisations and HEIs covers mainly the salaries of the permanent staff and the operational costs. Research projects are funded on a competitive basis through open selection procedures with emphasis on scientific excellence. Investments in the development of research infrastructures are also subject to competitive selection.
Competitive funding of research in HEIs and public research organisations represents the second largest area of support, amounting to €376m[26]. Investments in research infrastructures total €140m, of which 22% is directed to the participation in ESFRI. Research projects are funded by four programmes with a total budget of approximately €231m. The programmes support post-doc research (30m); research in TEI (€21m); large research consortia (€120m); and research projects implemented by a primary investigator (€60m).
In an effort to better organise the public research sector, reduce overlapping and increase economies of scale, the government is planning the consolidation of the public research organisations. A plan for upcoming mergers will be published for consultation in January 2012.

Partnerships at all levels

Funding for direct science–industry collaboration amounts to €238m and is thus the third largest policy area. Moreover, collaboration between science and industry is also encouraged by programmes serving other policy areas, e.g. business R&D and innovation, which adds even more emphasis to the importance of the policy area.
The main instrument for promoting cooperation is "Collaboration", a programme that supports consortia of HEIs, public research organisations, and companies in performing research in national priority areas. The programme started in 2009 with a first call of €93m. A new call followed in 2011 with €68m and another one of an equal size is planed for 2012.
In addition, funding of innovation clusters have become a promising dimension for improving the innovation climate and facilitating science-industry collaboration. The first round of funding started in 2008 with the support of the Corallia microelectronics cluster with a budget of €35m. For 2012, €30m are allocated to new measures aiming at creating more innovation intensive clusters.
Further to direct support measures, the development of an entrepreneurial and innovation friendly culture in the higher education sector is to facilitate collaboration. To this end, €101m are budgeted for the development of offices in universities and TEIs that combine career development counselling activities with the promotion of business planning competitions; as well as for the creation of entrepreneurship clubs and the development of courses on entrepreneurship. The new law for HEI recognises these offices and gives them the status of "Innovation and Liaison Offices" which are also responsible for IPRs.
In the last three years, participation in European initiatives for the design and implementation of collaborative programmes and research infrastructures also gained

[26] This includes a budget of €31m for participating in ESFRI.

importance. However, the budget is thinly distributed to several initiatives driven by bottom-up initiatives rather than by top-down prioritisation.
In addition to the €31m for ESFRI, an additional amount of €34m has been allocated for supporting the participation in the Joint Technology Initiatives (€13m), in ERA-NETs (€17.5m) and in bilateral research agreements (€3.5m). With a high number of agreements that have an average budget between €0.4m and €0.5m, the latter has remained a marginal area of support for several years. The efficiency of such fragmentation of funding is currently questioned by GSRT and a scheme containing fewer but larger agreements is considered.

Production of the right mix of skills

The policy on human resources focuses on three areas, namely the development of human resources in the public science sector, the development of human resources in the private sector, and on raising awareness of the field of science and technology. Scholarships and other types of grants that facilitate the participation of students in undergraduate and postgraduate studies amount to approximately €56m. The standard scholarship-type of support is provided regularly each year, while the Heraclitus II programme providing grants for PhDs was launched once in 2009 (€39.6m). A programme of €15m was launched in 2011 to support the hiring of highly qualified science and technology personnel in the business sector. Another €4m have been invested in interventions that increase awareness, starting in 2010.
Although the funding for the improvement of the quality of human resources has been increased compared to the previous programming period, no progress has been made in addressing the misalignment between supply and demand (see discussion in chapter 2).

Other policies affecting R&D investments

Within the domain of education policy, a new reform of the HEIs was implemented in 2011. The new Law 4009/2011 has replaced the previous reform of 2005 and has introduced radical changes towards the modernisation of higher education. These concern foremost the management (admitting non-academics to the governing boards for the first time), the academic units, and the organisation of studies. Furthermore, the funding of HEIs is under scrutiny in an effort to increase accountability, to improve management, and to strengthen the HEIs' autonomy. The reforms have been strongly opposed by a part of the academic community and by the majority of the management of HEIs, as had been the previews reform in 2005.
Other forms of reorganisation of the higher education system are also underway, with mergers taking place and schools and departments in science and technology areas of low demand being closed.

3.4 Assessment of the policy mix

The effectiveness of the policy mix in addressing the main structural challenges is undermined by the profound economic crisis and the high uncertainty regarding the eventuality of bankruptcy and the future position of Greece in the Euro zone. On top of this, the government's efforts to facilitate access for companies to low cost financial instruments instead of subsidies are weakened by the low liquidity of the financial system.
Companies willing to invest in R&D and innovation have access to several instruments, as 39% of the budget is allocated to R&D and innovation in companies. Since early 2011, obstacles that hinder entrepreneurship are gradually removed, with new regulations aiming at reducing red tape for several aspects of business activities, such as licencing,

setting up of companies, etc. However, there is no evidence for the effectiveness of the reforms yet.

Due to the collapse of the Greek internal market, a large number of companies have shifted their focus to the international market. Exports have increased by 15.2%[27] between November 2010 and October 2011, following a similar increase in 2009-2010. The competitiveness of the international market is an important driver for the innovation intensity and the demand for new research based knowledge, providing that all other obstacles (e.g. cost of internationalisation, red tape, need of information, access to international suppliers' networks etc.) are removed. However, the existing policy mix gives little attention to improving the framework conditions for exports.

The reduction of research areas, in combination with a clearer focus on economic and societal challenges and the consolidation of the public research system could increase the efficiency and effectiveness of the committed resources. However, the pressure to reduce expenditures within a very tight schedule could favour changes that minimise cost without improving the efficiency and effectiveness of the system.

The alignment of supply and demand for human resources and skills would be the result of reforms in the education system and of better coordination between labour, education and research policy. The new law for the HEIs is making some progress towards the improvement of the HEIs ability to respond to the needs of the economy and society. Whether the academic community is willing to oblige remains the question, however. In addition, the reorganisation of the higher education and research systems needs to be accompanied by reforms in the way the decisions regarding the number of new students per faculty are taken[28], and a more effective allocation of public funding for PhD and post doc programmes should be established, that takes the demand side into consideration.

The introduction of a new law is a good starting point for improving the governance of the national innovation system. However, other important areas also require intervention, including training, the systematic use of tools (e.g. evaluations), improving personnel recruitment, restructuring of the government units involved in policy making, and simplifying the NSRF management structure.

The following table summarises how the policy mix affects the structural challenges identified in chapter 2, and assesses their appropriateness and performance.

Table 2: Assessment of policies addressing structural challenges

Challenges	Policy measures/actions[29]	Assessment in terms of appropriateness, efficiency and effectiveness

[27] ELSTAT

http://www.statistics.gr/portal/page/portal/ESYE/PAGE-themes?p_param=A0902&r_param=SFC02&y_param=2011_10&mytabs=0

[28] Currently, the Ministry of Education centrally decides on admissions.

[29] This includes changes in the legislation and other initiatives which are not necessarily related to funding.

Challenges	Policy measures/actions[29]	Assessment in terms of appropriateness, efficiency and effectiveness
Increasing business demand for new knowledge	• Simplification of the regulatory environment for companies and investments • 39% of the competitive funding budget is directed to R&D and innovation in companies. • Eco-innovation is encouraged through demand side programmes. • Financial instruments are to become more important tools to promote innovation • Support for investments in companies is increasingly directed towards innovative ventures	• Simplifying regulations is a move in the right direction but an insufficient measure to counterbalance the very negative economic environment, the uncertainty and the impact of tax increases. • The new regulations were applied only in mid-2011, thus their success is not yet conceivable. • The implementation of R&D and innovation programmes is hindered by the inefficiencies of the public administration. • The shift towards new financial instruments is potentially inhibited because of the banks' limited liquidity due to the crisis. • Exports are hindered by existing policy gaps.
Ensure better-focused and long term public funding on R&D	• Reduction of the number of research priority areas • Restructuring and consolidation of the public research sectors is in the process of planning	• Reducing the number of priority areas would sharpen the focus of policy. However, reliable long term planning is aggravated by the budget cuts and the uncertainty due to the crisis. • Consolidation is mainly driven by the need to cut expenses as soon as possible. The time pressure does not allow for an in-depth analysis and design of the restructuring of the public research sector.
Align supply and demand of human resources	• The new law 4009/2011 aims at improving the coordination of decisions within AEI regarding the orientation of postgraduate studies. • The HEIs' response to societal challenges could be improved on the long run by involving non-academics in their management. • Consolidation of HEIs is planned.	• The coordination of labour, education and research policy is still underdeveloped. • The academic community's strong resistance against the new law undermines its effectiveness. • The decision on the number of students per faculty remains a privilege of the Ministry of Education.
Improve the governance of the national innovation system	• A new law is under preparation. • Concentration of research programme management under GSRT • The use of international peer review in project appraisals has become the norm.	• A new law could significantly improve the governance system. However, its enforcement will have to be monitored, as the previous law was never implemented. In addition other important elements are still missing. • Improving the project appraisal system is important but does not constitute a major issue.

4 National policy and the European perspective

The deepening of the economic crisis and the severe cuts of public expenditures, which will continue at least until 2014, greatly reduce the Greek government's capability to mobilise the necessary additional funding to develop the existing public research system and to reach the targets. Therefore, its efforts should focus on reforms aiming at increasing the efficiency and effectiveness of the research system and on directing the remaining funding towards policies that stimulate demand and facilitate the access of innovative enterprises to new markets.

In the short run, a new strategic plan for research and innovation ought to be drafted and deliberated among the stakeholders. Although the available budget has already been largely allocated to specific measures, the development of a strategy is a prerequisite for the effective design of research and innovation interventions for the next programming period of Structural Funds, which is already underway. The evaluation of policies and measures that were implemented during the previous programming period should begin in 2012 and a mid-term review of measures that started within the current programming period needs to be planned for 2012 and 2013.

The active involvement of the General Secretariat for Industry in innovation policy raises the issue of a better coordination with GSRT which is responsible for research and innovation policy. From a short-term perspective, coordination can be achieved without reorganisation. However, in the medium run a more radical approach should be adopted, which not only would position policy research and innovation policy making at a higher level in the government hierarchy, but also better distinguish between policy design and policy implementation.

The consolidation of research and education infrastructures is necessary in order to create economies of scale, reduce fragmentation of resources and increase effectiveness and efficiency of the available funding. Again, this is a medium rather than a short-term objective, as merging or closing research centres and institutes or university departments and TEIs should take place as a result of thorough planning, aiming at optimising the utilisation of resources and maximising performance.

Given the failure of supply side policies to stimulate business demand for research-based knowledge, the role of demand side policies in the policy mix should be strengthened. Currently, demand side policies are being implemented in the area of green investments and eco-innovation, but they need to be extended to other areas as well. However, such an approach requires a careful design as, on the one hand, demand side policies targeting end-users may fail due to the collapse of internal demand. On the other hand, the public sector has only limited capacity and capability to procure innovative products or services. Approaches such as the SBIR programmes in the USA and the UK[30] might be useful examples to be considered.

Finally, a better use of ERA could contribute to maximising synergies in areas of national priority instead of simply aiming at maximising funding. Within this context, a clear strategy should be defined in the short run, setting priorities for the development of collaborations in a small number of areas where a critical mass could be achieved.

Overall, the developments during 2010 and mainly in 2011 such as the new law for the

30 http://erawatch.jrc.ec.europa.eu/erawatch/opencms/information/country_pages/gb/supportmeasure/support_mig_0036?matchesPerPage=20&orden=LastUpdate&searchType=advanced&tab=template&index=Erawatch+Online+EN&sort=&avan_other_prios=false&searchPage=3&avan_type=support&avan_country=gb&reverse=true&displayPages=10&query=innovation+procurement&action=search

higher education system, the increase of the budget for participation in ESFRI and for European collaborations, and the allocation of a high share of funding towards science-industry collaborations address most of the ERA pillars and objectives (Table 3).

Table 3: Assessment of the national policies/measures supporting the strategic ERA objectives (derived from ERA 2020 Vision)

	ERA dimension	Main challenges at national level	Recent policy changes
1	**Labour market for researchers**	• To increase the demand for new research based knowledge from the private sector • Education system has to become more responsive to the signals of the economy and society • To reduce brain drain caused by the economic crisis	• New law for the higher education sector, which provides a framework that under certain conditions could increase the responsiveness of the system • New post doc programme supports inward and outward mobility
2	**Cross-border cooperation**	• To reduce fragmentation and spread of funding and exploit synergies in areas of national interest • To adopt strategies which increase the relevance of collaborations for economic and societal challenges instead of maximising the absorption of funding	• The budget for European collaborations has been increased
3	**World class research infrastructures**	• To reduce fragmentation and spread of funding and exploit synergies in areas of national interest • To adopt strategies which increase the relevance of collaborations for economic and societal challenges instead of maximising the absorption of funding	• Funding for research infrastructures has been increased from €36m in 2000-2006 to €144m in 2007-2015 • Preparation of the National Infrastructures Road Map (2011) and decisions (in 2011) on the participation in specific ESFRI infrastructures (€35m)
4	**Research institutions**	• To increase the responsiveness of the higher education system to the needs of the economy and society • To increase the quality of education and research • To consolidate the research and education system, aiming at increasing economies of scale, reducing fragmentation of funding, and increasing efficiency and not just minimising costs	• The new Law 4009/2011: ○ introduces radical changes that could contribute to improving the responsiveness of the HE sector ○ further improves the quality assurance system, which was first introduced in 2008 ○ links performance with additional funding

	ERA dimension	Main challenges at national level	Recent policy changes
5	**Public-private partnerships**	• HEIs and PROs to be more proactive in exploiting research results • HEIs and PROs need to develop clear the consistent policies for IPRs • To increase the relevance of the research agenda of HEIs and PROs for economic and societal challenges	• The new Law 4009/2011: ○ introduces the participation of stakeholders in the management of HEIs ○ introduces units for the management of IPRs • A call of €68m for programme "Collaboration" was published in 2011 and a new one of €68m will be published in 2012
6	**Knowledge circulation across Europe**	• To support initiatives that facilitate access to European research results and scientific publications	• The budget for European collaborations for academic research has been increased
7	**International Cooperation**	• To finalise the strategy for international collaborations • To develop collaborations in fewer areas but of national interest	• A minor bilateral agreement with the USA was initiated in 2011

Annex: Alignment of national policies with ERA pillars / objectives

1. *Ensure an adequate supply of human resources for research and an open, attractive, and competitive single European labour market for male and female researchers*

1.1 Supply of human resources for research

In total, the R&D personnel in full time equivalent[31] accounted for approximately 0.72% of the active population in 2007, which is 0.28% lower than the EU-27 average. Almost 60% of researchers in Greece are employed by the university sector. In total, the public research sector absorbs 70% of researchers while 30% are taken on by the business sector. In comparison, in EU-27 the private sector's share is 46%. The limited demand for researchers in Greece can be mainly attributed to the low demand for knowledge in the private sector, as the Greek economy overall is oriented towards less knowledge intensive business niches.

As a result of the low demand of the private sector, the majority of PhD graduates pursue academic careers. The current crisis is expected to exacerbate the employment situation for researchers, as companies cut their research budgets while pushing their research teams for increased productivity.[32] In the public research sector a recruitment freeze is in place until at least 2014 due to the strict consolidation programme. Until then, personnel will only be hired on a project base, which in turn might lead to significant delays in the launching and implementation of research programmes and impede the continuity of funding.[33]

The options for the surplus of doctoral graduates are to take up non-research jobs, to emigrate, or to remain in the countries where they obtained their research degree. Except for some pre-crisis figures giving an indication of the extent of brain drain, data on international mobility of researchers is scarce, which makes it difficult to estimate the current emigration of researchers. According to Moguérou and Di Pietrogiacomo (2008), 605 scholars in the US were of Greek origin in 2005/2006. In relative terms, Greece is ranked 10th among the EU Member States, as the US scholars with Greek origin represented approximately 2.5% of the researchers in the HE and government sector. Short-term outward mobility is high, especially for study purposes. Thus, the ratio of Greek students obtaining their PhD degrees in another Member State compared to the PhD candidates in the country is the second highest in the EU[34] (Moguérou and Di Pietrogiacomo, 2008). According to the same study, in 2005, 8% of the Greek PhD students pursued their degree in the US. Three years later, this share was decreased by half to 4% (MORE, 2010a). MORE also found that in 2010, 73% (the third highest share among EU-27 countries) of the researchers in Greek universities worked in a country other than the country where they obtained their highest educational degree (PhD or

[31] As mentioned above, the latest available data on researchers provided by Eurostat for Greece is in FTE for 2007. The latest data on head counts is for 2005.

[32] An increase in FTE with a stagnation or even decrease of the head count is observed.

[33] Calls for the three programmes addressing academic research were published once since 2007 and no further calls are expected.

[34] Ireland has the highest ratio with 25.7% of students obtaining a PhD degree abroad.

post doctorate). This might be explained in part by the fact that until recently there was a lack of well-organised PhD programmes in Greece, which made studying abroad for a degree a more attractive option.

Obstacles for inward mobility still exist, however, as foreign degrees have to be formally recognised by the National Academic Recognition and Information Centre (NARIC) in order to be regarded as equivalent to Greek degrees. This certification is obligatory in order to sign up for a postgraduate course or to be employed in a permanent position as a researcher in the Greek higher education and research system. Conversely, individuals that have already held similar professional positions in another country are excluded from this requirement. Cutting the red tape continues as some other impediments for inward mobility of third-country researchers have been eliminated by the adoption of the Council regulation 1408/71 and of the Council directive 2005/71 regarding scientific Visa into national legislation.

One of the major challenges, however, remains the brain drain. As mentioned above, no concrete data on the actual numbers of researchers leaving the country exist, but there is evidence that with the deepening of the economic crisis and the cuts in public expenditures pressures increase. According to Malkoutzis (2011), within the first five months of 2011 more than 35,000 Greeks (22,000 of them under the age of 30) registered their educational and qualification details with the EU's Europass job mobility service. According to the Eurobarometer (2011), 37% of young Greeks stated that they were willing to work long-term in another European country, thus ranking Greece third compared to other Member States (European average was 25%).

In the current economic climate inverting the brain drain trend goes beyond the research policy domain and will increasingly depend on the success of the economic and fiscal policy. Therefore, research policy measures can only have a marginal effect.

The only instrument for enhancing transnational mobility is a programme supporting post-doc research of foreign and national researchers hosted by Greek universities, and of national researchers hosted by foreign universities. The programme has a budget of €30m for the period 2011-2015.

1.2 Ensure that researchers across the EU benefit from open recruitment, adequate training, attractive career prospects and working conditions, and remove barriers to cross-border mobility

In terms of remuneration, the research sector in Greece is less attractive compared to other west European countries. Before the crisis the average gross yearly salaries in universities and public research centres were €32,045 and €39,452, respectively[35] (CARSA, 2007). Due to the fiscal crisis in Greece, the salaries in the public research sector were first reduced on average by 17.5%[36] in 2010 and again in 2011, but no specific data on the second round of cuts is available yet. With the implementation of the new remuneration policy for the public sector further reductions are expected for 2012. The government centrally defines the salary levels in universities and government research organisations. Wages differ only according to levels of seniority and between universities and government research organisations. Researchers in universities can receive additional pay for providing services (including research) to university clients or within the framework of national or European research projects. The new law for HEIs enables them to use their own resources to offer additional financial incentives to academic staff for exceptional research or educational performance.

[35] The amounts have been adapted to take the cost of living in Greece into account.

[36] Data of Ministry of Finance

On top of remuneration, the attractiveness of a research environment is also influenced by the practices affecting the conduct of research. This issue is addressed in the European Charter of Researchers that was issued by DG Research in 2005. In Greece, only two out of the 16 public research organisations and seven out of the 23 universities and 15 technological education institutes have signed the Charter. So far, no research organisation in Greece has been acknowledged by the European Commission for having made significant progress in implementing the Charter and Code.

Researchers and academics with permanent positions have civil servant status and, therefore, only Greek or EU citizens are eligible. EU citizens can be hired if they are proficient in the Greek language, which in itself is a significant barrier. Researchers who are citizens of non-EU countries are only hired under short-term contracts for the completion of specific research projects.

Hiring in HEIs and research centres follows a call for expression of interest that is advertised in the national press and on the websites of the organisations. Recently, an increasing number of organisations have started to advertise their vacancies in European media and in the EURAXESS Jobs portal. Applicants are selected based on their formal qualifications (defined by national law and the internal regulation of the organisation) and an interview, which is usually performed on site. Foreign degrees have to be formally recognised by NARIC in order to be regarded as equivalent to Greek university degrees, which is a lengthy bureaucratic procedure. However, individuals that have already held similar professional positions in another country are excluded from this requirement.

Research grants are not transferable and if a researcher holding a grant leaves, the grant remains at the host organisation or it is cancelled depending on the specific provisions of the grant.

1.3 Improve young people's scientific education and increase interest in research careers

The number of science, maths and engineering graduates fluctuates from year to year but the general trend is slightly positive. In 2008, the number of tertiary graduates in these fields per 1000 citizens aged 20-29 was 11.2, which is much lower than the EU-27 average of 14.5. The average growth rate for Greece for the period 2005-2008 was 8%, which is higher than that of total graduates (6.8%).

Recent studies (Lianos, 2007, and Lambrinidis, 2011) provide evidence that the number of highly educated individuals exceeds overall demand, indicating a misalignment between supply and demand for university graduates.

The new law 4009/2011 increases the autonomy of HEIs and contributes to the improvement of institutions' responsiveness to societal requirements by inviting the participation of stakeholders in the management of the institutions. In addition, HEIs can develop shorter curricula and courses tailored to specific professional or societal needs which lead to a training certificate.

Since 2009, efforts have been made to nourish a spirit of entrepreneurship in the courses by restructuring the Liaison Offices (DASTA) in HEIs and by including a unit for the promotion of innovation and entrepreneurship. The unit is responsible for the organisation of seminars on innovation and entrepreneurship, business contests, entrepreneurship clubs, etc. The Ministry of Education has regarded the operation of Liaison Offices successful[37] and thus the new law 4009/2011 recognises the Liaison Offices as an organisational unit of the HEIs. In addition, courses on entrepreneurship have been introduced in the curricula of engineering, business and economic studies.

[37] This perception is not backed by evaluation studies.

1.4 Promote equal treatment for women and men in research

The share of female PhD graduates in 2004 was 34% and increased to 40% in 2006 and 2007.[38] Women's Participation in research professions in all sectors is 6% above the EU-27 average. In 2005, the latest year for which data on Greece is available, 36% of researchers were women, compared to 30% in EU-27. Greece also compares favourably in the business sector, where 28% of the researchers are women, while the figure for EU-27 is 19%. However, the higher up the research hierarchy, the lower is the percentage of women. In the academic sector, even though 32% of the academic staff in 2007 were women, the number of female full professors only amounted to 17%.
The salary differential between men and women researchers is around 14.3% (CARSA, 2007). This is among the lowest in EU-27 and associated countries, with only Malta, Denmark, Iceland, and Norway featuring lower disparities.
The government has taken no special measures to increase the share of female researchers. HEIs and public research organisations recruit strictly on the basis of academic and research quality criteria.
Greek labour legislation provides strong protection for women working in the public sector. There is no evidence that maternity leave has a negative effect on women researchers' careers in the public sector. On the contrary, employees in the private sector are less well protected and often maternity leave does affect research opportunities. According to a study implemented in 2007 (Quantos, 2007), 46% of Greek female researchers in the business sector believe that maternity is the main obstacle to a successful research career. However, 12% of companies that are active in research have adopted policies to increase the participation of women. Furthermore, approximately 70% of women researchers claimed that their companies ensure equal opportunities for men and women, while 19% believed that there is gender discrimination in their companies.

2. Facilitate cross-border cooperation, enhance merit-based competition and increase European coordination and integration of research funding

Greece participates in several joint programming and bilateral agreements, although budgets are low. There is no coherent strategy in terms of collaboration with specific countries and participation in specific research areas. Instead, the priorities are defined rather ad-hoc on the base of existing links and collaborations of researchers who have access to policy makers.

Bi- and multilateral agreements with other ERA countries

Bilateral research agreements are a well-established practice for Greece, although their budgets are relatively small and the participants are mainly academics. For the whole period 2007-2015 the budget for the ERA countries amounts only to €2.4m. Currently, five agreements on R&D co-operation are effective. The first bilateral agreements in the programming period 2007-2015 started in 2009 with France (€0.6m), Hungary (€0.3m), and Turkey (€0.45m). In 2010, two more countries were added, namely Serbia (€0.3m) and Romania (€0.3). In 2011, collaborations started with the Czech Republic (€0.25m) and Slovakia (€0.25m).
The research areas selected for funding in those active bi-lateral agreements include ICT, biotechnology, fisheries and agriculture, health, renewable energy and energy saving, information technology, astronomy, nanotechnology, medical sciences, and

[38] National Statistical Service of Greece

environment. The collaboration with Romania also includes research on cultural heritage.

Recently, the strategy for bilateral agreements has been reconsidered in an effort to concentrate on areas of national interest. The intention is to reduce the number of agreements but to drastically increase the budget of the remaining collaborations to around €10m-€20m per programme instead.

Other instruments of cooperation and coordination between national R&D programmes

Greece's involvement in ERA-NETs is relatively high in terms of number of participations, although it is limited when it comes to participation in joint calls and to financial contributions. In total, Greek teams have participated in 52 actions, 25 of which are still ongoing (NETWATCH, 2011). Greece has participated in 57% of FP7's ERA-NETs and in 1.8% of ERA-NETs Plus (one project). During the first cycle of ERA-NETs, GSRT was one of very few participants and now 24 organisations are taking part. Despite the relative high number of participations (52), given the size of the country and of its research system, participation in joint calls and public funding is very low with only 15 calls and an average budget of below €400,000. The main barrier for participation is the small overall government budget for R&D. The budget for future calls until 2015 amounts to €15m.

Greece also participates in some initiatives undertaken under Article 185. The country is among the first members of the "European and Developing Countries Clinical Trials Partnership" (EDCTP). Moreover, research teams participated in two out of the three calls of Ambient Assisted Leaving with €2.5m and €3m, respectively, of public funding. The participation in the 4th call is under consideration as Greek industry has expressed a strong interest. The country also participates in EUROSTARS with a small budget of €1.78m.

Greece takes part in 23 Joint Technology Platforms Initiatives. For the first time Greece participated in the 2011 calls of the platforms ARTEMIS (€7m), ENIAC (€6m). The Medicine Initiative, the Clean Sky Initiative, as well as the forthcoming initiative "Antimicrobial Resistance" have also drawn great interest but no budget has been committed to yet. Finally, Greece participates in the Joint Programming Initiative "Alzheimer's and other neurodegenerative diseases", however no budget has been allocated so far, either.

Opening up of national R&D programmes

Opening up of national research and innovation programmes is among the priorities of research and innovation policy (GSRT, 2007). However, few steps have been taken yet towards this aim. Although a variation of rules applies, participation of non-nationals without funding is possible, with the exception of subcontracting, in which case non-nationals are paid at market prices for the provided services. Another exception is the new programme for postdoctoral research, in which non-nationals can participate providing that they undertake their research in a Greek university or public research centre.

The main barrier for supporting non-nationals is that public funding of the national research system is low overall and, therefore, funding of non-nationals will further decrease the resources channelled to the national system. Under the current budget constraints opening up national R&D programmes will be even more difficult.

3. Develop world-class research infrastructures (including e-infrastructures) and ensure access to them

The development of a national research infrastructure is a typical example of the lack of long term planning and coordination of public research policy (GSRT, 2010), resulting in fragmented, bottom-up initiatives by research groups instead of thorough strategic organisation.

Most of the existing large research infrastructures were developed in the area of earth and space sciences and are maintained by the Athens National Observatory in collaboration with other public research centres and universities across the country. The most important one is NESTOR, Europe's first collaborative effort on a deep sea high energy neutrino telescope, which keeps attracting transnational cooperation. The National Seismic Network is a national infrastructure with 46 stations across the country and a network of telescopes, including the Aristarchos telescope which is the largest observatory in the Balkan and Eastern Mediterranean area. The Oceanographic Research Vessel is a national research infrastructure in the area of Earth exploration and the environment. In the field of laser technology, the Ultravaiolet Laser Facility ULF-FORTH has been in operation as a European laser research infrastructure since the mid-1990s as part of the public research centre FORTH. Finally, GRNET is a significant national infrastructure that provides an academic and research network as well as an information technology infrastructure for all universities and public research centres.

Between 2000 and 2006, €36m were directed towards all kinds of research infrastructures, amounting to 1% of GBAORD for that period. For the period 2007-2015, it is estimated that the funding provided by the National Strategic Reference Framework for research infrastructures will be increased fourfold to €144m. The budget that has been already committed to specific projects amounts to €125m, of which €32m are allocated to infrastructures and projects related to ESFRI.[39]

The participation in the European Research Infrastructures became an opportunity for public policy to develop infrastructures in areas of synergies with other Member States. Thus, the National Infrastructures Road Map was used actually for developing infrastructures in compliance with participation in ESFRI. In 2007, GSRT commissioned a study in the attempt to propose a National Infrastructures Road Map, followed by feasibility studies in December 2008. In 2011, the National Infrastructures Road Map was finalised.

Greece is member of the EIROforum and participates in nine ESFRI infrastructures with several calls published in 2011 (XFEL €4m; DARIAH, BBMRI and EATRIS €5.7m; CESSDA €0.87m; EMSO €3.7m; EURO-ARGO €0.8m; INFRAFRONTIER €3.9m; PRACE €3.5m; LIFEWATCH €3.7m; HIPER €2m and ELI €3.4m).

Participation in the KM3NET has also been considered provided that it will be hosted nationally by NESTOR. In this case the Greek contribution will amount to €5m.

4. Strengthen research institutions, including notably universities

Autonomy of HEIs

The new law (4009/2011) for HEI was supported by the two leading parties and approved by Parliament in August 2011. It contains significant changes in regard to the organisation, the governance and the budget of HEIs.

Traditionally, the Ministry of Education has been only marginally involved in the shaping of research agendas and activities in Universities. Academic staff at all levels is free to

[39] Estimated by the authors based on data provided by Unit A1, Special Management Service of the OP "Competitiveness and Entrepreneurship" and analysis of the database of calls of the NSRF 2007-2013 http://www.espa.gr/en/Pages/Proclamations.aspx.

define research priorities autonomously. In practice, this freedom is further ensured by the lack of research strategies at the institutional level and the fact that public funding is not allocated towards specific research. The new law retains and increases the autonomy, but it is based on long-term planning.

With regard to public funding, the new law maintains the logic of the previous reform (2007). Accordingly, the allocation of funding of HEIs is based of a four-year development plan which is to be prepared by each HEI and to be negotiated with the Hellenic Quality Assurance and Accreditation Agency (HQA) on behalf of the Ministry of Education. Decisions are taken on the basis of quantitative targets and criteria and the allocation of additional funding is centred on quality targets to be agreed with HQAA.

The new law increases the autonomy of HEIs in terms of human resource management. The faculties (or schools), being the principal academic units in the HEI structure, can define the specification of the scientific area for each position and are free to hire and promote academic staff within the budget limits foreseen in the four-year development plan. Despite their autonomy in hiring personnel, HEIs cannot appropriate the salaries and social benefits for the academic and non-academic staff as they are set down by the government. However, the new law introduces some flexibility for the HEIs to grant bonuses out of their own resources for exceptional research or educational performance or in order to attract new staff or academics from abroad.[40]

The new law is strongly opposed by part of the academic community, the Synod of Rectors, arguing that the involvement of non-academics in the management of HEIs and the appointment of faculty Deans[41] undermines the HEIs' independence and hinders management efficiency. On the contrary, the Ministry of Education holds that the new arrangements increase the opening-up of the HEIs to society's needs, that they improve accountability, reduce independence from the Ministry, and benefit the coherence of management as there is a clear distinction between the management of academic and non academic issues and a better coordination among the management levels.

Mission of HEIs

All universities and TEIs share the same general missions, although there are some differences in their proclaimed focus areas. According to the new law the mission of both universities and TEIs goes beyond the three traditional missions, as teaching and research should contribute not only to the wealth and economic development ("third mission") but to the development of culture and students' personality and to meeting societal challenges.

In universities the emphasis is on mastering scientific knowledge and methods and on the provision of an integrated education, while TEIs focus on applications and on professional qualifications.

Monitoring and evaluation

Quality control for both research and educational activities was introduced in 2008 for all HEIs. Every faculty undergoes its own internal quality assessment, which is followed by an external evaluation. The evaluation procedures pertaining to higher education institutions are coordinated and supported at national level by an independent authority, which is now called Hellenic Quality Assurance and Accreditation Agency (HQA)[42]. The new law has increased the scope and authority of HQA in terms of

[40] Article 22 of the Law 4009/2011

[41] Previously Deans and the Directors of departments were elected by the members of the faculties and departments, respectively.

[42] Under the previous status the authority was named "Hellenic Quality Assurance Agency for Higher Education" (HQAA).

establishing and implementing a framework for the quality assessment of the HEIs' work and achievements; monitoring the implementation of the assessment exercises by HEIs; assessing the progress and advising on the allocation of additional funding based on the quality achievements. HEIs are free to develop their own evaluation approach, as long as it is compatible with the quality assessment framework. Thus, each HEIs has its own Unit for Quality Assurance that is responsible for the implementation and improvement of the internal quality assessment and of the quality assurance plan of the institution. Under the new framework, the funding of HEIs is linked to performance based on indicators and the results of the evaluation exercises. The indicators are defined at an ad-hoc basis as a result of negotiations between the HQA and each institution.

5. Facilitate partnerships and productive interactions between research institutions and the private sector

Policies facilitating partnerships and interactions

Knowledge circulation within the Greek research system is hindered by the weak links and interactions among the main actors, especially between the research community and the business sector (Maroulis, 2009 and GSRT, 2010).

It has always been the main priority of public research policy to improve the collaboration between the research and the business sector. To this effect, government has undertaken efforts to develop the necessary infrastructures and to provide funding at a competitive base for collaborative research and innovation projects. However, the impact of these policies so far has been poor because of the underlying structural problems that go far beyond the research policy domain.

During the previous programming period (2000-2006), GSRT has supported the creation of Technology Transfer Offices (TTOs) in universities and research centres. However, TTOs have failed to deliver the expected results and today only few of them are active in technology transfer.

In the current programming period, GSRT will be allocating approximately €238m (the third highest budget for a policy area in the policy mix) to research and innovation programmes that directly focus on the promotion of collaboration and circulation of knowledge between HEIs, public research organisations and industry. The largest part of the budget (€229m) will be given to research consortia of companies, HEIs and of other types of public research organisations via the programme "Collaboration". A smaller programme of approximately €8m provides innovation vouchers to SMEs for buying technology transfer services from HEIs and public research organisations. In addition to the programmes directly aiming at enhancing collaboration, several other programmes serving other RTDI policy objectives also indirectly contribute to this goal.

IPRs and technology transfer

Patent and intellectual property rights (IPR) laws and the relevant institutions have been in place since 1987. The law for the commercial exploitation of IPRs by universities and research centres provides incentives to both research organisations and researchers to exploit research results as it decrees that the researcher owns 60% of the IPR and the research organisation 40%. In theory, government owned results are freely available. However, there are no mechanisms in place to facilitate access and dissemination.

HEIs and public research centres do not follow a common approach regarding technology transfer and management of IPRs. IPR patents are usually driven by researchers and academics. Sometimes patenting is commissioned by private individuals, as the institutions neither have the capacity to monitor the process, nor the budget for patenting.

The new law 4009/2011 for HEIs foresees the establishment of a unit in each institution that will be responsible for IPR issues. These units could also take on other responsibilities of a Technology Transfer Office.

Inter-sectoral mobility

There are significant structural barriers for the long term mobility from the academic to the business sector. Researchers working in the public research are deterred from changing their career paths because there is only little demand from the business sector. Among the university researchers, approximately 16% have been employed in the private sector before, while 30% of them left university in order to work in the private sector but returned to the university (MORE, 2010b).

Short term mobility or sharing positions between the public and private sector is easier. A considerable number of academics are on the Management Board of private firms or carry out consultancy work for them. Often they work as Managing Directors or Chairmen of the Board in firms with public participation. The new law 4009/2011 allows full time employees in the private sector to be employed part time in HEIs with 35% of the salary of a full time academic of the same level. Academics can also participate in spin-off companies.

Furthermore, researchers in research centres are allowed to work part time for a short period on a reduced salary, while retaining their status, in case they want to provide services in the private sector. Similar provisions exist for academics.

Involvement of the private sector in the governance of HEIs and PROs

The new law 4009/2011 radically changes the management of the HEIs by introducing a new management body. The Council is responsible for the management of the institution, while the authority of the Rector and of the Senate is restricted to the management of academic affairs.

The Council consists of elected members of the academic community, one student, internal non-academic staff (60% in total), and of external members (40%) of recognised contribution to sciences, literature, arts, economy, or politics. The Council is responsible for setting the strategy of the institution, creating the action plan and negotiating the programming agreement with the Ministry of Education. The Council is also responsible for the administration of the institution and the election of the Rector, for universities, or the President, for TEIs.

6. Enhance knowledge circulation across Europe and beyond

Due to the small size of the Greek research system, access to international knowledge has been regarded as very important by public research organisations and companies with an international orientation. Similarly, public policy saw international collaboration as an opportunity for taping into additional sources of funding and to increase the local research capacity.

The main mechanism promoted by public policy for cross border cooperation is the participation in EU Framework Programmes. The demand from Greek researchers is very high. In FP7, Greece ranks 7th in terms of number of applicants and of requested EC contribution[43]. Finally, 1769 Greek teams (12.22%) are participating in 1205 FP7 contracts, ranking Greece 9th in terms of number of participations and of budget share.

In order to support public research organisations to participate in the FPs, the government provides additional funding for the participating public organisations.

The total budget for bilateral agreements with ERA countries (€3.5m), Joint Technology Initiatives (€13m), ERA-NETs (€17.5m) and Joint Programming Initiatives ((€13m)

[43] Source: European Commission (2011). Data was been updated on 16/03/2011.

amounts to €34m. From the above budget, €18m have been allocated through calls launched in the period 2009-2011. A further €15.8m will be distributed by calls in the course of 2012.
Participation in international scientific and research infrastructures is another way of promoting access to international knowledge that is attracting the attention of policy makers. Greece is one of the 12 founding members of CERN and contributes €13m per year. In 2005, Greece joined the ESA contributing €11m per year.
Access to research outputs in terms of publications is promoted by the National Documentation Centre, which is developing interoperable content e-infrastructures on science and technology that facilitate openly accessible e-research, namely, a series of peer reviewed e-journals (www.openaccess.gr) and the National Archive of PhD Theses. The latter is also channelled into the European portal for PhD Theses, DART Europe. Further, the National Documentation Centre/NHRF operates the www.openarchives.gr, a full-text search engine into Greek repositories and other infrastructures that are built on the basis of interoperable standards, thus affording scientific research from a one-stop shop.

7. Strengthen international cooperation in science and technology and the role and attractiveness of European research in the world

Research collaboration with third countries is organised through bilateral agreements. In the previous programming period (2000-2006) an extended programme of research programmes based on existing bilateral agreements with USA, Japan, Korea, China, India and the Southern Mediterranean countries was implemented. In the current programming period only a small research programme with a budget of €0.3m, based on the bilateral agreement between Greece and the US, started in November 2011 in the area of materials.
During 2010 and 2011, efforts were made towards the development of a strategy for international collaborations. Due to changes in the Ministry of Education, the preparation of the strategy has been delayed. Among the objective of the new strategy is to reduce fragmentation of funding and develop a critical mass in areas of national interest. Thus, among the options that are considered is the reduction of the number of bilateral agreements and the increase of their budget to €10m-€20m per programme.
There is no specific framework that regulates bilateral agreements with third countries. The rules are defined ad-hoc in the bilateral agreements as it is the case with bilateral agreements with EU member states.

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List of Abbreviations

BERD	Business Expenditures for Research and Development
CERN	European Organisation for Nuclear Research
ERA	European Research Area
COST	European Cooperation in Science and Technology
ERA-NET	European Research Area Network
ERP Fund	European Recovery Programme Fund
ESA	European Space Agency
ESFRI	European Strategy Forum on Research Infrastructures
FP	European Framework Programme for Research and Technology Development
EU	European Union
EU-27	European Union including 27 Member States
FDI	Foreign Direct Investments
FP	Framework Programme
FP7	7th Framework Programme
GBAORD	Government Budget Appropriations or Outlays on R&D
GDP	Gross Domestic Product
GERD	Gross Domestic Expenditure on R&D

GOVERD	Government Intramural Expenditure on R&D
GUF	General University Funds
HEI	Higher education institutions
HERD	Higher Education Expenditure on R&D
HES	Higher education sector
HQA	Hellenic Quality Assurance and Accreditation Agency
IP	Intellectual Property
NARIC	National Academic Recognition and Information Centre
NCRT	National Council for Research and Technology
NSRF	National Strategic Reference Framework
OECD	Organisation for Economic Co-operation and Development
PRO	Public Research Organisations
PSCTA	Permanent Special Committee on Technology Assessment
R&D	Research and development
RI	Research Infrastructures
RTDI	Research Technological Development and Innovation
SDP	Strategic Development Plan for Research Technology and Innovation
SF	Structural Funds
SME	Small and Medium Sized Enterprise
S&T	Science and technology
VC	Venture Capital

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Abstract

The main objective of the ERAWATCH Annual Country Reports is to characterise and assess the performance of national research systems and related policies in a structured manner that is comparable across countries. EW Country Reports 2011 identify the structural challenges faced by national innovation systems. They further analyse and assess the ability of the policy mix in place to consistently and efficiently tackle these challenges. The annex of the reports gives an overview of the latest national policy efforts towards the enhancement of European Research Area and further assess their efficiency to achieve the targets.

These reports were originally produced in November - December 2011, focusing on policy developments over the previous twelve months. The reports were produced by the ERAWATCH Network under contract to JRC-IPTS. The analytical framework and the structure of the reports have been developed by the Institute for Prospective Technological Studies of the Joint Research Centre (JRC-IPTS) and Directorate General for Research and Innovation with contributions from ERAWATCH Network Asbl.

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As the Commission's in-house science service, the Joint Research Centre's mission is to provide EU policies with independent, evidence-based scientific and technical support throughout the whole policy cycle.

Working in close cooperation with policy Directorates-General, the JRC addresses key societal challenges while stimulating innovation through developing new standards, methods and tools, and sharing and transferring its know-how to the Member States and international community.

Key policy areas include: environment and climate change; energy and transport; agriculture and food security; health and consumer protection; information society and digital agenda; safety and security including nuclear; all supported through a cross-cutting and multi-disciplinary approach.

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