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RIS3 National Assessment: Greece

Smart specialisation as a means to foster economic renewal

A report to the European Commission, Directorate General for Regional Policy, Unit I3 - Greece & Cyprus

RIS3 National Assessment Greece

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Executive summary

This report summarises the findings of a team of experts in support of the preparation smart specialisation strategies (S3) as a basis for the 2014-20 programming of the Structural Funds. The experts were asked to provide policy advice and methodological recommendations in order to ensure the following seven key points are addressed by the Greek authorities:

- an appropriate stakeholder involvement and the organisation of the entrepreneurial discovery process of testing possible new areas,
- an identification of areas of current and potential strength,
- that innovation and knowledge-based development priorities are set,
- an identification of the optimum policy mix,
- an outward looking of the strategy and the promotion of critical mass,
- the strategy produces synergies between different policies and funding sources
- appropriate governance and administrative set-ups and capacities to ensure efficient and effective implementation of the strategies in a coherent multi-level governance system.

This report is based on a series of regional meetings with stakeholders (held between end August and November 2012) and national authorities as well as a review of available literature. The expert team has produced 13 regional reports summarising the situation in each region concerning specialisation profile, regional innovation system and governance, regional innovation, cluster and digital economy policies. This overall national report is structured in a similar manner with a first chapter assessing the basis for innovation based development and smart specialisation, a second chapter reviewing Greek innovation policy and governance capacity and two thematic chapters on clusters policy and information and communication technologies and digital economy perspectives.

In line with our terms of reference, this executive summary presents evidence on potential areas of strength and critical mass and recommendations on the process for identifying specialisations and developing the national RIS3 strategy and the regional strategies. The summary identifies particular areas where Greece and its regions have or could develop a competitive advantage. We structure these key conclusions in line with the seven key pose points and then set outs a number of recommendations aimed at ensuring that Greece complies with the ex-ante conditionality for the use of future Structural Fund resources in favour of research and innovation.

Key conclusions

1. Stakeholder involvement and entrepreneurial discovery process

The expert team found a relatively weak understanding of the concept of smart specialisation. On a conceptual level, the Greek approach to a strategy for smart specialisation is focused on productive specialisation and prioritisation of industry sectors and clusters. Only stakeholders from the research community have addressed the technological perspective of S3 and link production and technology specialisations. None of the regional authorities and Intermediate Managing Authorities have adequately identified the key enabling technologies required to sustain competitiveness / modernisation of regional companies.

At the regional level, a process for "entrepreneurial discovery" to define specialisation areas has not been undertaken. This is partly due to the early stage of regional RIS3 elaboration. A bottom-up governance structure (regional innovation councils, regional

steering committees, and working groups) for defining priorities, sectors, and technologies was under development during our missions. Indeed, the meetings held with the regional stakeholders were often the first event in the region to present and discuss the S3 methodology and concept. In general, the regional meetings were not well attended by businesses (only representatives such as chambers of commerce).

At the national level, smart specialisation priorities have been proposed on the basis of sectors and technologies in which Greece has a competitive advantage due to existing production and technological know-how. Over the last five years, a series of studies and official documents have investigated and proposed production and technological specializations for Greece. These studies use different methodologies and data sets, which make them difficult to compare. Moreover, they consider specialisation from a macro-economic perspective rather than as a process of "entrepreneurial discovery" of opportunities, markets, and global market niches.

2. Areas of current and potential strength

A recent series of studies on key sectors in the Greek economy tend to converge on four broad sectors: (1) agriculture and food production, (2) information and communication technologies (ICT) for manufacturing and services, (3) health services, biomedical and pharmaceuticals, and (4) energy and chemicals.

The expert team have identified a number of potential areas of priorities in terms of sectors, technologies and clusters in each of the 13 regions and these are summarised in this main report. There are clear areas of convergence at inter-regional level. However, there is a need for further discussion and analysis on the selection of priorities through the involvement of business representatives in working groups and thematic discussions as well as analysis of value chains and clusters.

3. Innovation and knowledge based priorities

The GSRT framework for 2014-2020 proposed a selection of sectors for smart specialisation: food production and bio-agro-food, energy technologies and materials, environmental technologies and waste management, information and communication technologies. In parallel, a number of scientific fields of national interest, such as marine research and technology, socio-economic research, and human sciences were identified. The GSRT proposal includes some elements in line with smart specialisation strategy design, but it fails to address the main weaknesses of the Greek innovation system, namely the low contribution of the private sector.

The review of regional reports and suggested policies indicates a significant gap between regional innovation priorities for the period 2014-2020, focusing on modernisation of productive activities, exports and creation of innovative high added-value products, and national priorities set by the GSRT, which are more horizontal focusing on research excellence, human skills, science, and society. Most priorities set in RIS, RIS+, and PRIA projects remain valid to current economic conditions and well considered by stakeholders in the regions. Innovation priorities and goals identified in all regional reports for 2014-2020 are down to earth, close to needs of local companies, and focus mainly on company modernisation, new products, and exports.

4. Optimum policy mix

The failure of past **regional innovation policy** of Greece is mainly due to (1) creation of technology intermediary organisations than leveraging capabilities and funding from the private sector, (2) weak sustainability of innovation policy support actions; and (3) non-systemic innovation governance, characterised by low leverage of private funding, limited collaboration among innovation actors, limited synergies, networks, clusters and associations. Most innovation intermediaries (industrial change offices, university technology transfer offices, sectoral tech companies, technological development centres, etc.) ceased operation after the end of public support. The greatest innovation gap is to be found in private sector funding and public policy has failed to mobilise private investments. Despite the establishment of many intermediary organisations, cooperation between industry and research

organisations remains at a very low level and success stories on the role of intermediary organisations and the exploitation of R&D by companies few and far between.

From a regional innovation systems perspective four types of regions can be identified, for which a different tailored policy mix should be developed:

- Regions with advanced research and technology capabilities (Attica, Central Macedonia, Crete);
- Regions with strong manufacturing potential and mid-level innovation capacity (Central Greece, Western Macedonia, East Macedonia and Thrace)
- Regions relying on traditional production sectors with innovation potential in local products (Epirus, Thessaly, Peloponnese).
- Regions with strong potential in tourism (South Aegean, North Aegean, Ionian Islands) and extremely low technological (R&D based) innovation potential.

Up to 2005, the results of Greek **cluster policy** were far from satisfactory: none of the funded clusters developed a high-visibility or provided a viable model. Some of the factors that led the policies to fail included: the design followed an authoritarian top-down approach; the calls did not differ significantly from traditional business state aid measures, and stringent requirements and restrictions placed constraints on the operation and development of a cluster; most Greek companies were not ready for strategic collaboration with 'co-opetitors' and the calls were not preceded by sufficient 'ground-work' (seminars, workshops, special meetings to present good practices to candidates, etc); limited emphasis was placed on innovation and the connection with academic and research institutes and policy-makers failed to grasp the necessity of the triple-helix; the role of the cluster facilitator was underestimated and the facilitator was required to create a legal entity for purely administrative reasons; etc.

Despite good initial prospects, the regional innovation poles and zones policy conducted in the mid 2000s, delivered mediocre results and did not lead to any sustainable cluster or concentration of activity for reasons including the failure of the stakeholders, including public administration, to embrace the projects, mobilise the necessary resources and create the necessary regulatory environment for the concepts to become functional; an overly top-down-driven approach by the GSRT and several constraints that eventually hindered entrepreneurship.

However, since 2006, a successful example of cluster policy has been developed through the Corallia Cluster initiative, mandated by the Ministry of Development, to design and manage a programme that would create a favourable environment for underpinning entrepreneurship and innovation and fostering emerging technologies in exports-oriented and high-technology market segments where Greece had the capacity to attain a competitive advantage. Due to the previous failures, the decision was taken to implement initially a small-scale pilot programme in one of the most promising sectors. The main features of the new approach are: based on international good practices; deployed a clear bottom-up, customized, phased and holistic approach; put strong emphasis on innovation and exports' orientation; focused on talent & people and niche market orientation; insisted in a strong and sustainable cluster facilitator; set a long-term strategy that outperform short-term gains; determined long-term goals and integrated control gates with metrics.

ICT represents one of the main tools to boosting Greek competitiveness and improve the quality of life. However, the current performance is poor in terms of the goals of convergence and bridging the digital divide with other EU member states. The overall conditions of the ICT market players have worsened, as a result of the significant and broad cuts in the investment budgets of the public and private sector. Demand for ICT products and services has fallen, thus under-mining the potential of viable innovation efforts. The Greek regions are faced with additional challenges in promoting ICT in public administration and regional business activities, as they lack the size and the administrative structures for handling innovation-proliferation initiatives. Although

four regions (Attica, C. Macedonia, W. Greece and Crete) exhibit a relatively acceptable ICT innovation performance, there is plenty of room for bold initiatives that could change the broader technological landscape in the country. The potentially beneficial sectors for the 2014-2020 programming period are examined, setting possible ICT policy targets for each region.

5. Outward looking strategy and promotion of critical mass

The Greek innovation system is largely closed and inward looking and the measures implemented during the current programming period have done little to encourage internationalisation of either the research system (public and higher education institutes) or the business enterprise sector (export intensity and Similarly, there has been little attention to critical mass, with a few exceptions such as certain regional research centres, the regional innovation poles measures and the clusters policy. Rather than use Structural Funds to develop a limited number of centres of excellence, the Greek authorities have tended to reinforce the fragmentation of the higher-education sector by supporting non-viable regional university campuses. Moreover, the over-fragmentation of the Greek business sector has not been addressed by the current programmes which spread resources over the wider business base rather than focusing on providing specialised services for the development of export-orientated 'companies of scale' and high-value added, high growth companies.

6. Synergies between different funding sources

Due to the early stage of development of the strategies, it was generally impossible for the expert team to judge the extent to which the future RIS3 strategies and operational programmes will seek to ensure synergies between the various Structural Funds, Horizon2020, private funds and other sources of investment capital. The experience of the current period is not positive with a fragmentation of programmes and funds and little in the way of a coherent strategy, at either regional or national levels, to leverage the maximum synergies from available funds to support innovation based economic development. The Greek system is characterised by a fragmented 'project-based' approach to funding and efforts to concentrate funds, such as the Regional Innovation Poles, have not yielded the expected results due to organisational and governance failures.

7. Appropriate governance and administrative set-up

Most Greek regions had experience in bottom-up participatory innovation policy, gained from RIS, RIS+, and Regional Programmes of Innovative Actions (RPIA) funded by DG REGIO from 1995-2006. However, from 2007, RTDI policy was centralised under the management of the GSRT, which created a 'shadow' programme of RTDI measures based on the aggregation of funds from the 13 regional OPs. The current interventions are top-down and are implemented without either an appropriate consultation with the regions or an adequate interface with regional intermediaries (BIC, development agencies, etc.). Hence, continuity with the evidence base and experience of pilot actions implemented under the previous regional innovation strategies (RIS, RIS+, RPIA) has been lost.

It was evident from the regional meetings that the credibility at the regional level of national ministries and agencies responsible for RTDI policy is very low. Indeed, current and future central state initiatives are considered as a threat in the sense that they do not ensure available funds are targeted on regional priorities, rather than an opportunity. The available evidence on the implementation by the GSRT of the OP for innovation is that the poor management of the measures has meant that funds have not targeted regional comparative strengths in RTDI and has rather reinforced the existing divergence in regional innovation performance rather than fostering a convergence of performance.

A main challenge for the future implementation of smart specialisation policies and the Structural Fund operational programmes at both national and regional level is the weak to non-existent management capacity of the public authorities. The expert team

notes with concern the failure of the GSRT to effectively implement the current programmes and ensure appropriate linkages with regional intermediaries in the delivery of funding. Equally, at regional level, a fragmented system of intermediaries, dependent on project based funding in the main, means that regional businesses fail to receive the professional level of support required for innovation management, product development, etc. The newly elected regional authorities and IMA were not always involved in the previous regional innovation strategy exercises and, in the majority of cases, lack the necessary expertise to monitor and evaluate innovation measures.

Recommendations

The expert team is conscious that the Greek authorities, at both national and regional level, were still in the early phases of strategy preparation during our review mission. The recommendations are formulated with a view to assisting the on-going process of preparation for the 2014-20 period. A number of specific recommendations are made throughout the report but in summary, the main recommendations are as follows:

1. The Greek authorities should clarify urgently how they will address structural weaknesses that hinder a functioning national innovation system. In particular:
   i) Future Structural Fund investment for higher education institutes should be conditional on reform of legal and governance structures and the consolidation (merger or closure) of dispersed university and TEI faculties in line with the recommendations of the OECD.
   ii) Funding for technology transfer structures, applied research centres, etc. should be frozen until the Greek authorities provide to the Commission an international evaluation of the current intermediary structures, including the legal and regulatory framework for technology transfer.
   iii) A key future priority should be mitigate and reverse the brain drain through measures to repatriate highly skilled Greeks to work in both the research sector and in manufacturing and knowledge intensive service firms.
   iv) Enterprise and innovation support should focus on building 'companies of scale' via a client management system for a select group of firms with export-orientated growth strategies based new product (service) innovation.
   v) Given the fragmentation of the Greek SME sector, business creation should be downgraded as a priority except for support on a sub-set of high potential start-ups or early-stage firms embedded in existing or emerging clusters.
   vi) The Greek authorities should take urgent action to collect (and provide to Eurostat), up to date statistics on business demographics and R&D and innovation expenditure and activities in order to provide a basis for strategic planning, target setting and impact assessment. The non-availability of such data is entirely unacceptable and undermines evidence-based policy-making.
2. The RIS3 process should be built from 'bottom-up' starting with the production of high-quality regional S3 strategies designed with the full participation of all regional stakeholders. All regions should ensure that an entrepreneurial discovery process takes place in the region, bringing to the surface technology needs within the dominant production complex of the Region (e.g. in agriculture – local food production – gastronomy – hospitality – tourism activities in type 3 regions). We suggest a common methodology for defining optimal smart specialisation at regional and national levels. This includes two stages.
   i) At the first stage, reviewing existing studies on optimal specialisation and give priority to those sectors proposed by most studies. Most regions give priority to agriculture, production of local foods, information and communication manufacturing and services, renewable energy, and tourism. At this stage the four types of existing productive profile should be taken into account.

ii) At the second stage, further survey and mapping is needed to examine which technologies prevail within each sector. Among them, two types of technologies should be given priority: (a) technologies which feed most sectors, and (b) technologies which create bottlenecks and control value appropriation in the entire production chain.

iii) Synergies for inter-regional cooperation among regions with similar productive profile should be identified as they offer economies of scale in securing technology resources and specialist services required for smart specialisation.

3. The future Structural Fund operational programme structure should be as follows:

iv) support actions for research organisations, research institutes, university labs, research infrastructures, creation of research skills, and international research collaboration, can be more efficiently managed and delivered at national level.

v) Support actions for businesses relating to new product development, creation of innovation clusters, innovation poles, use of open innovation platforms, and innovation development consortia can be better organised regionally. In some cases, there are grounds for co-ordinated and joint inter-regional service delivery, e.g. farming and animal husbandry and agricultural production, bio-food production, green energy production and energy saving, use of ICT in the rural economy, tourism and culture.

vi) Support actions towards 'financiers', such as venture capital funds, business angel networks, seed capital funds, crowd-funding initiatives, can be more efficiently organised at national level, creating larger pools of funds and better know-how in risk assessment and IPR management. In some cases, co-investment funds and seed capital instruments could be organised at multi-regional level (e.g. a fund for northern Greece covering the regions to the east and west of Central Macedonia).

vii) Support for innovation brokers should be limited to market driven services for exporting and internationalisation. While there is a rationale for national agencies, direct support can be more effectively delivered regionally.

4. To increase the efficiency of innovation support / delivery, all innovation support actions included in RIS3 should take the form of Innovation Platforms: Innovation platforms should provide a framework (legal, organisational, resources, facilities, digital, funding, etc.) that enable a large number of actors to be involved in innovation initiatives. Each platform should provide comprehensive support to the entire innovation cycle, including financial, technological, productive, and market support. Platforms should be selected using the following criteria

viii) business models that are sustainable in the long run after public funding ends,

ix) creation of capabilities and know how in the region,

x) offering integrated solutions for technology-production-market-funding,

xi) leading to high leverage of private investments,

xii) involving a large number of beneficiaries, and

xiii) contribution to development goals of the Region.

5. Given the lack of capacity of both the national and regional public authorities, it is recommended to use a mix of contracting out of programme management and public-private-partnerships (PPP) to deliver the future programmes. The role of the GSRT and regional authorities should be concentrated on strategic coordination, on-going strategy adjustment, monitoring and evaluation of policies. PPP should be a central implementation instrument of innovation platforms, clusters and ICT/digital economy measures and the public authorities should restrict their role to setting out the terms of collaboration and providing funding

for framework conditions, while the private sector takes on management and assures long term operation of the initiative.

6. For the period 2014-20, clusters and cluster policies are being considered in the design of the national and regional strategies. Cluster policy is a multi-dimensional, multi-faceted and multi-instrument policy, informed by a mix of rationales and thus requires deep understanding of the instrument and experience in cluster dynamics before deciding to apply one. The expert team recommend for that the future implementation of cluster policy at national and regional level in Greece follows a number of principles (early private sector involvement to secure market oriented strategies in the targeted clusters; dedicated management teams with a blend of skills and competencies; the provision of support services within clusters is an important element for generating long-terms benefits for cluster participants; etc. It is recommended to implement a mixture of competitive calls to select the highest quality clusters, with a few minimum thresholds, together with some designated actions for proven and established cluster initiatives.

7. In terms of ICT and the digital economy, we recommend setting specific ICT policy targets for each region as a part of their RIS3. We stress the importance of, and the tools for, improving the ICT skills of the human capital, as well as the need for an overhaul of the public administration regarding ICT infrastructures and e-government services. Fast and super-fast broadband infrastructures represent a vital aspect of the digital agenda, and should be deployed according to a long-term plan that satisfies sustainability, balanced private sector involvement, openness, and respect to state-aid regulations. Our proposals include an extensive use of the PPP model in ICT initiatives for leveraging public funding, along with the concept of standardised regional ICT Vouchers for SMEs and selected citizen groups, in order to improve ICT demand in a sustainable manner. More specifically:

   - A priority should be given to the introduction of innovative e-government services for a wide variety of activities, directly influencing economic efficiency. Interoperability, open-data standards, open source, and cloud computing should be the technological foundations of new e-government services.
   - Education and professional training in ICT skills should be a focus of both national and regional authorities to (a) expand the demand for ICT services, (b) stimulate the production of innovative products and services, and (c) facilitate the creation of start-up companies
   - Research groups should be given incentives and e-infrastructures to enable their work to support the production of innovative marketable products and services.
   - Next-generation-access (NGA) networks have to planned, to meet the EU policy targets, using flexible funding schemes for the deployment of open-access super-fast fibre networks.
   - Each region should determine the particular sectors and the specific aspects to be supported by ICT tools to improve competitiveness.
   - The model of PPPs should be used extensively by national and Regional Authorities, to overcome the (currently unacceptable) delays, increase private sector involvement, and improve the sustainability of public ICT projects
   - ICT Vouchers should be investigated, to simplify the procedures of supporting citizens and SMEs in adopting standardized ICT tools and, thus, stimulating healthy and durable demand.

Introduction

This report summarises the findings of a team of experts in support of the preparation of the 2014-20 period of the Structural Funds. The experts were asked to provide policy advice and methodological recommendations in order to ensure the following seven key points are addressed by the Greek authorities:

- an appropriate stakeholder involvement and the organisation of the entrepreneurial discovery process of testing possible new areas;
- an identification of areas of current and potential strength;
- that innovation and knowledge-based development priorities are set;
- an identification of the optimum policy mix;
- an outward looking of the strategy and the promotion of critical mass;
- the strategy produces synergies between different policies and funding sources;
- appropriate governance and administrative set-ups and capacities to ensure efficient and effective implementation of the strategies in a coherent multi-level governance system.

In line with the terms of reference, this report:

- assesses the quality of the available evidence supporting the drafting of the strategies and the level of preparation of stakeholders to contribute to the drafting and implementation of the national and regional RIS3 strategies. Where relevant potential inter-regional complementarities and joint actions have been identified;
- makes recommendations on the most appropriate methodology to support the development of an optimal smart specialisation strategy, at national level;
- identifies the missing elements in the national or regional strategies and the actions which would be better performed at a national or regional level;
- provides recommendations as to the most effective delivery mechanisms including the possibility of public-private partnerships or contracting out of service delivery;
- reviews if the central government and the regions have a sound governance and monitoring system in place to implement, monitor and evaluate the innovation strategies and the ability to deliver the expected results.

This report is based on a series of meetings held in the autumn of 2012 in each of the Greek regions (see list of meetings in Appendix A), discussions with the national authorities and a review of the literature and statistical evidence (see Appendix B).

The study was carried out by a team composed of (authorship of sections in brackets):

- Alasdair Reid: team leader and specialisation analysis (editor and section 1)
- Nicos Komninos: governance and innovation policy (section 2)
- Jorge-A. Sanchez-P.: clusters and entrepreneurship policy (section 3)
- Panayiotis Tsanakas: ICT and digital economy (section 4)

In addition to this national report, the expert team produced 13 regional reports.

1. Innovation based development: current and potential strengths

Even before the financial crisis, Greece faced an innovation deficit: ranked lowly by the Innovation Union Scoreboard (EC, 2012a), criticised for an unfriendly entrepreneurial environment and for failing to capitalise on the potential of the digital economy. The Global Competitiveness Index (2012-13[1]) ranks Greece 96th just below countries that are objectively less developed such as Lebanon, Mongolia, Argentina and Serbia and just above Jamaica. The current financial crisis has pulled Greek performance down with particularly low GCI scores for macro-economic criteria, access to finance, etc. In short, the 'crisis' has left the proverbial glass looking more than half-empty. Yet, the expert team heard, in our meetings in the 13 Greek regions, of innovative companies that are growing through capturing new export markets and about emerging clusters that may yet help to re-ignite the Greek economy. So, perhaps, the Greek glass is half-full and a foundation for a more knowledge-intensive and higher value added economic development exists despite the current gloomy climate.

1.1 A conceptual basis for assessing Greek innovation potential

Before examining the Greek situation, the conceptual framework for the analysis can be summed up by five key points. Firstly, the expert team found that **the smart specialisation concept is not yet well understood** by Greek stakeholders at either national or regional levels. A RIS3 strategy is (EC, 2012b) an "integrated, place-based economic transformation agenda that does five important things":

- focuses policy support and investments on key priorities, challenges and needs for knowledge-based development, including ICT-related measures;
- builds on strengths, competitive advantages and potential for excellence;
- supports technological as well as practice-based innovation and aims to stimulate private sector investment;
- gets stakeholders fully involved and encourage innovation and experimentation;
- is evidence-based and includes sound monitoring and evaluation systems.

Secondly, **technological product and process (TPP) innovation is only part of the equation** of a successful innovative company or region. There is no 'linear path' from research to commercial application of a technology in the form of a product, process or service. Accordingly, there is a need to foster both TPP and non-technological innovation processes in regional business sectors and clusters, in order to boost productivity and competitiveness.

Thirdly, the seminal work of Freeman (1988) recognised that **innovation is fostered or impeded by the broader innovation system** in which a company or a cluster operates. Innovation and technology development are the result of a complex set of relationships among the actors in the regional system, which includes enterprises, universities and research institutes. Hence, the government's role is not to promote 'individual innovation events', but to 'set the framework conditions' for well-organised innovation systems and, thereby, enhance innovation opportunities and capabilities (Metcalfe, 2005). Similarly, Rodrik (2004) argues that industrial policy is not about 'picking winners', rather it is a process whereby the public and private sector arrive at a joint diagnosis about the sources of blockages to new economic activities and propose solutions to them; or more positively jointly identify the most promising 'investment opportunities' and do all in their power to realise this potential.

[1] www.weforum.org/gcr

Fourthly, increasing investment in R&D does not directly generate economic growth. Rather, government intervention to support R&D and innovation will be effective only if the **basic micro and macro-economic conditions for innovation-based growth** are in place (Aghion, 2006). These conditions are:

- competition policy favouring market entry and exit;
- investment in higher (and indeed lifelong) education;
- reform of credit and labour markets and
- a counter-cyclical fiscal policy.

Finally, the **policies (and institutions) that favour imitation are not the same as those that favour leading-edge innovation** (Aghion et al, 2011). A country (region) that is far from the global technological frontier will maximise growth by favouring institutions that facilitate imitation but as it nears the technological frontier, the country will have to shift from imitation-enhancing institutions to innovation-enhancing institutions in order to sustain a high growth rate.

Hence, a Greek national or regional smart specialisation strategy that focuses only on funding 'individual' R&D investments is designed to fail. Rather, the focus should be on identifying how enabling technologies can be applied to leverage greater productivity, product quality, export intensity, economies of scale, etc.

1.2 Assessing the pre-conditions for innovation based growth

The **role of business entry & exit** (or "births and deaths") in fostering 'creative destruction' and in freeing up resources (human, capital, technological) is critical for a well-functioning innovation system. The World Bank 'doing business' index' ranks Greece 78th in the world in 2013 (up 11 places from 89th in 2012)[2], with areas that have improved including protecting investors, trading across borders and resolving insolvency. However, the ease of starting a business has actually declined relatively to other countries (Greece is ranked 146th in the world) and notably the cost of starting a business is four times higher than OECD average. A recent study (Calogirou et al, 2010) on business dynamics confirms that Greece is in a middle of the road position within the EU27 for start-ups, business transfers and bankruptcy procedures but broadly performance is still negative despite recent de-regulation. In this context, in March 2012, the Ministry of Development published an action plan to support entrepreneurship including actions targeted at removing obstacles to the commercial exploitation of innovation and reducing the costs of conducting research.

Figure 1 Action Plan to support entrepreneurship and improve structural competitiveness actions to support R&D

Action	Timetable	Competent Authority
Obstacle: Incentives to exploit innovations commercially		
9.1 Specific priority to be given to state-funded survey linked to the identification of the bottlenecks which hamper the commercial exploitation of innovation (by means of the Development Act, the NSRF, etc).	Q1 2012	MoEd/MoD
9.2 Incentives for the establishment of spin-offs or joint ventures/clusters of companies with research bodies (also by means of the Development Act, the NSRF, etc).	Q2 2011	MoEd/MoD
Obstacle: Tax-deductible scientific and technological research costs		
9.3 Extend the tax breaks for scientific and technology research, applicable until 31/12/2010.	Q2 2011	MoF/MoEd
9.4 Simplification of the procedure for verification of R&D expenses for the purposes of the investment law and other related incentive schemes.	Q1 2012	MoF/MoEd
9.5 Updating the table of eligible costs, incl. geological survey expenses.	Q1 2012	MoF/MoEd

[2] http://www.doingbusiness.org/data/exploreeconomies/greece/

Action	Timetable	Competent Authority
9.6 VAT exemption for the purchase of fixed assets and services required for the performance of co-financed research programmes.	Q1 2012	MoF/MoEd
9.7 Zero tax rate for the first 3 years and rate reduced by 50% for the next 5 years for spin-offs, spin-outs, start-ups and incubators.	Q1 2012	MoF/MoEd
9.8 Zero tax rate for the first three years and rate reduced by 50% for the next five years for Science and Technology Parks (STPs)	Q1 2012	MoF/MoEd
9.9 Zero tax rate for the first three years and rate reduced by 50% for the next five years for investment of capital in research and technological development projects or start-ups, spin-offs or spin-outs.	Q1 2012	MoF/MoEd

Source: http://www.mindev.gov.gr/?page_id=6506

However, the list of actions, even if fully implemented, will not significantly alter the incentive to innovate since the focus is on research commercialisation that is unlikely to bear fruit in the short-term (or even longer-run) given the limited level of scientific excellence and scale of the research system. Hence, there is a need to focus more on demand side bottlenecks that hinder the growth of companies adopting new business models, whether they are research-intensive or not.

Due to the absence of reliable business demographic data[3], it is difficult to assess whether there is a concentration of high growth companies in specific sectors or regions However, Greek SMEs account for a greater part of the business sector compared to other European countries (60% of turnover compared to 40% on average in the EU27) and are of smaller scale (notably in manufacturing where Greek SMEs are a third of the size of the average EU27 SME). Hence, the Greek economy is highly fragmented and dominated by small firms (4/5^{ths} of SMEs are sole proprietorships compared with just half on average in the EU27), even if there is some trend to consolidation over the last decade. As the empirical evidence on the relationship between size and innovation (and productivity) suggests a positive relationship (i.e., on average, larger firms tend to invest more intensively in innovation and are more productive), the Greek economy states with a disadvantage in terms of business demographics if it is to achieve a higher innovation performance.

Given the high fragmentation of the Greek business structure, there is good reason to question whether simply making it easier to create companies (after all there are already 750,000 SMEs in Greece) is a solution. On the other hand, a narrow focus on spin-offs from academic research is also likely to fail. The priority should be to focus support on a small sub-set of high potential start-ups or early-stage firms embedded in emerging clusters that are adopting new business models that will have a transformative effect on other key industrial or service sectors.

Investment in and quality of (higher) education is the second pre-condition. This report cannot explore in detail the reforms required to make the Greek education system more effective. Suffice to say that Greece is not well ranked in either performance testing of students[4], in terms of rankings of university performance[5] or in terms of the overall education system[6]. In terms of human resources for science and

[3] Analysing and comparing business demographics and entrepreneurial dynamics is difficult since Greece is the only EU27 Member State (except Malta) that fails to transmit most of the required data for the key Structural Business Statistics collated by Eurostat. See http://bit.ly/VlePxN

[4] In terms of the OECD PISA quality assessment, the average student in Greece scored 473 in reading literacy, maths and sciences, lower than the OECD average of 497. On average, girls outperformed boys by 14 points, more than the average OECD gap of 9 points. More positively, in Greece, the average difference in results, between the top 20% and bottom 20%, is 96 points, slightly lower than the OECD average of 99 points. This suggests the Greek school system provides relatively equal access to high-quality education.

[5] Only two Greek universities (Aristotle University of Thessaloniki and National and Kapodistrian University of Athens) figure in the 2012 Shanghai top 500 ranking of world universities, but both are placed in the 301-400 group of universities. However, the AUT ranks in the credible 101-150 range for engineering/technology and computer science disciplines.
See: http://www.shanghairanking.com/Country2012Main.jsp?param=Greece

[6] http://www.universitas21.com/news/details/61/u21-rankings-of-national-higher-education-systems-2012

technology, it is noteworthy (EC 2012a) that Greece performs poorly on new doctoral graduates and has a very low share of non-EU doctorate students (suggesting a relatively closed and unattractive system). In terms of research outputs, despite considerable improvement in recent decades, the research output of most Greek tertiary education institutions remains relatively low by international standards[7] and the variations in outputs and citation impact (a measure of quality) are significant (see the regional reports for more details). The OECD (2011) has made a number of recommendations for improving the education system and underlined the need notably for significant consolidation of the dispersed regional departments as well as the need to avoid blurring of the distinctions between universities and the TEI (which should be producing qualified technicians required by businesses). While some initial steps have been made (Hellenic Republic, 2012), there is a long road ahead before Greek universities can be considered as 'entrepreneurial' in terms of teaching, research or 'regional engagement' (the so-called third mission).

In this context, it is surprising that during the regional workshops, few, if any, participants (including those from the higher education sector itself) raised issues related to the need to rationalise, consolidate and specialise both teaching and scientific activity in regional higher education institutes (TEI and universities). Indeed, in some regions (e.g. in West Macedonia) explicit mention was made of the 'need' for further investment in university campuses, in parallel to concerns about graduate emigration, lack of funding for teaching materials and lay-offs of teaching and research staff. The lack of critical mass and low scientific impact of most of the universities and TEI could be offset if they were carrying out contract research or engaged in curricula development responding to the needs of regional enterprises. There have been efforts to create distinct legal 'applied research' entities (e.g. CERETH in Thessaly) to get round archaic, costly and penalising university management system and provide incentives to consolidate academic research capacities and structure them to support regional firms. However, the regional workshops discussions lead to the conclusion that university-industry co-operation is still weak and is largely project-based, driven by academic interests rather than focused on regional business needs.

Further Structural Fund investment for higher education institutes should be made conditional on significant reforms of legal and governance structures and the consolidation (merger or closure) of dispersed university and TEI faculties in line with the recommendations of the OECD (2011).

Future funding for technology transfer structures, applied research centres, etc, should be frozen until such time as the Greek authorities provide to the Commission the results of an independent (international) evaluation of the current set-up including the legal and regulatory factors influencing the effectiveness of the system.

The third condition is **well-functioning credit and labour markets**. As noted above the Greek credit market has been severely affected by the economic crisis and liquidity from the banking sector has largely dried up[8]. In the absolute sense, this has an effect on intermediate (business-to-business) and final demand in the economy and can therefore reduce the incentive to innovate. However, it is a reasonable hypothesis that Greek companies with higher rate of exports in total sales and higher technological intensity of products or services may still be able to attract private finance. Action has been taken to maintain access to finance (Hellenic Republic, 2012). However, based on a survey of 1000 Greek SMEs, Mylonas and Athanasopoulos

[7] The OECD (2011) notes that Greek scientific publications increased from less than 3 000 in 1993 to more than 10,000 in 2008. Greek scientific publications, as a share of OECD and EU publications, increased from less than 0.5% and 1.2%, respectively, in 1993 to more than 1.2% and 2.5%, respectively, in 2008.

[8] The European Central Bank's 2012 Survey on the access to finance of small and medium-sized enterprises in the euro area found that the net percentage of SMEs reporting a deterioration of bank loan availability is highest in Greece (45%), Ireland and Portugal (both at 35%).

(2012)[9] argue that Greek SMEs are characterised by "anti-economies of scale" (high-fixed costs of small companies make them more vulnerable under conditions of falling demand) and high cost of financing (due to the high interest rates but also low asset turnover in smaller companies that limits the return to capital and hence ability to borrow). The survey found that:

- Almost ¾ of SMEs carried out investments (60% being spent on equipment) in the past five years. Encouragingly, the survey found that firms are planning to **switch future investments towards increasing innovative activities (especially in manufacturing) to secure new markets and exports**. However, firms reported a reduced possibility to finance investments from earnings and equity and hence a greater need for loans and subsidies.
- there is a **difference between medium-sized and small firms** in terms of outlook and resilience to the crisis. Medium sized firms are more resilient, more positive and report a greater need for future investment (and consequently view access to finance as their key problem).
- **manufacturing firms are least affected by the crisis** and most strongly prioritise growth oriented strategies (31% compared to 22% of all other SMEs). Significantly, this result is '*attributable to exporting enterprises, which constitute a pillar for growth for the broader business sector*'.

Survey evidence underlines that the key success factors for Greek SMEs include size, strong export orientation and innovative investments. Moreover, SMEs growth prospects depend on a sound capital structure rather than profit margins.

Hence, enterprise support and innovation policy should shift their focus from business creation (except for targeted support for new technology based firms) towards building 'companies of scale' via a client management system for selected firms with growth strategies based on an export orientation and product (service) innovation.

In terms of the labour market, the **issue of a brain drain**[10] (both international emigration and intra-regionally) was raised in certain regional meetings and was an underlying theme of our discussions. A study (Labrianidis & Vogiatzis, 2012) of highly skilled migration from Greece underlines that while out-migration is not new, "*it is acquiring a massive character and is likely to further increase in the near future*". Based on a survey of just under 2000 'emigrants' (including 'repatriates'), the authors highlight that both repatriates and those who remain working abroad were driven by the same motive, namely 'better career prospects' (65.2% for repatriates compared with 76.6% for those still abroad). However, repatriates were more interested by the experience of living and working abroad and gave a higher importance to social factors for returning. Indeed, the authors found Greek scientists still abroad are more highly qualified and are more specialised in fields where relevant working positions are less frequent in Greece compared with other developed countries. However, the authors conclude that the decision to stay abroad or return is not due to success or failure abroad; but rather that the brain drain from Greece is largely attributable to a mismatch between supply and demand for professionals in the Greek labour market. Hence, skilled workers are motivated to leave the country in order to have a satisfactory job, relevant to their qualifications, abroad. At the same time, permanent positions with good salaries in another country render the decision to return extremely difficult. Moreover, the time dimension is critical as the longer people spend abroad the harder/less attractive it is to return even for 'social reasons'. In policy terms, the authors note that that the only way to stem emigration is a structural shift in the Greek economy towards higher-value added activities better integrated in global value

[9] http://bit.ly/YonGly. The survey is reportedly to be carried out each semester, which would improve the understanding of investment dynamics in the Greek economy.

[10] See for instance: http://ftalphaville.ft.com/2012/09/19/1166421/benefiting-from-greeces-brain-drain/

chains. However, as this will take time, "*an alternative path, in the short–medium run, involves the utilisation of skilled labour that remains abroad via the creation of networks and collaboration schemes*".

Innovation policy should seek to mitigate and reverse the brain drain through measures to repatriate highly skilled Greeks to work in the research sector and in manufacturing and knowledge intensive service firms. Measures to enhance networking with ex-pat Greek researchers and business people (like the Global Scot initiative of Scottish Enterprise) should be considered. Such policy measures are likely to create a win-win situation for both the 'host organisations' and society as a whole.

Considering the last pre-condition, the current macro-economic framework is clearly pro-cyclical. In principle, the Greek authorities could have chosen to maintain or, even increase support for innovation (as several of the innovation leaders did during the first half of the crisis), or at least 'front-load' the investment for R&D, business support, etc. that was planned through the current Structural Funds programmes in order to sustain the development of core competitive niche or emerging clusters in the Greek economy. However, an attempt to use public funds to 'innovate out of the crisis' will only be effective if investments are directed at 'growth firms' able to increase exports and value added. As we will argue below, the Structural Fund measures implemented during the 2007-13 period have lacked such a target approach.

Based on the preceding analysis, Figure 2 sums up the situation in terms of the pre-conditions for innovation based growth in Greece

Figure 2 Pre-conditions for innovation based growth in Greece

Pre-conditions	Greek performance
Market entry and exit by firms	• Lack of comparable data for firm demographics for Greece (should be remedied as a matter of urgency). • Greece is in a middle of the road position for barriers to entry and exit but certain areas still negatively affect 'creative destruction'.
Investment in and quality of (higher) education	• The level of enrolment for tertiary education and education investment per capita is high but doctoral studies remain a weak point. • The quality of Greek education remains below the OECD average and is a bottleneck to innovation-based development. • A fragmented university structure undermines the potential for creating 'critical mass' or specialisation that would make Greek universities competitive internationally.
Well-functioning credit and labour markets	• Some efforts to maintain investments in private sector but no significant targeting of available funds to strategic niche or export orientated firms. • Labour market in crisis and brain drain has markedly reduced human potential in the innovation system. Evidence from highly-skilled emigrants suggests that a significant proportion will not return in the absence of a corrective policy.
Counter-cyclical fiscal policy	• Overall policy is markedly pro-cyclical and has reduced significantly domestic demand, however this has not led to a shift from 'over-consumption' to increased productive investment in export led growth. • No significant front-loading of Structural Fund support for research, innovation and entrepreneurship. • More attention should be given to linking research.

The Greek national smart specialisation strategy should explicitly take account these pre-conditions and ensure that significant legal, regulatory and management (governance) reforms are pursued in order to remove bottlenecks to the effective implementation of future operational programmes and measures.

1.3 Innovation performance and the national innovation system

Does the innovation system enable 'innovators' to fulfil their potential despite the unfavourable pre-conditions? Perhaps unsurprisingly the answer is no. Komninos & Tsamis (2008) identified four main asymmetries of the Greek innovation system:

- the dominance of public sector R&D activity compared to the private sector;
- an asymmetry between innovation creation and absorption / adoption activity;
- an imbalance between a few, small innovative sectors and the rest of the economy;
- a very strong spatial concentration of innovation-related activities.

The available evidence and stakeholder consultations suggest that this characterisation remains valid and that there has not yet been a favourable evolution despite the structural reforms implemented since 2010. Indeed, Greek innovation performance is amongst the weakest in Europe. The 2013 Innovation Union Scoreboard (IUS) (EC, 2012) places Greece within the moderate innovator group with the weakest trend performance (along with Spain). Without a significant improvement in innovation activity, Greece is likely to fall into the weakest IUS group in the future. In order to understand the 'bottlenecks' in the innovation system, the following sub-sections look at investment (both public and private) for research and innovation and innovation activity and outputs and their contribution to competitiveness.

1.3.1 Investment in research and innovation

Despite a Government commitment to increasing gross expenditure on R&D (GERD) as a share of GDP, Greek GERD has stagnated at 0.6% of GDP with most of this provided by public expenditure (although even public R&D intensity is far below the OECD median). Most worryingly, the share of business expenditure on R&D (BERD) is the fourth lowest in the OECD (OECD, 2011b), notably due to a lack of large corporate R&D investors. The very low BERD intensity is one explanation for the disconnection between GDP growth and productivity growth[11] witnessed in Greece in the run up to the 2008 crisis (Tsipouri, 2012). Even taking account of industrial structure[12], the Greek business sector under-invests in R&D and continues to trails far behind the OECD average. In terms of sectoral differences, the share of services in Greek BERD is higher than in the majority of OECD countries (52.7% in 2007) as might be expected given the dominant position of services in the economy. However, despite very low manufacturing BERD, the share of high-tech sectors at 38% of manufacturing BERD, while in the lower half the OECD ranking, was higher than in some more 'advanced countries'. Hence, the data, unfortunately outdated, tend to confirm the view that a few, small innovative sub-sectors (or even companies) do manage to invest in R&D and innovate despite the less than positive 'environment'.

The lack of up to date statistics (the most recent date back to 2005) on R&D expenditure, researchers, etc. available in Greece is a particular cause for concern since it undermines evidence-based policy-making. The Greek authorities should ensure that R&D and innovation statistics are updated by end 2013 and, thereafter, ensure regular updating in line with other EU27 Member States.

Since the early 2000s, other smaller European countries, such as Estonia or Ireland, have achieved rapid growth in BERD, from low levels, allied to high economic growth (at least until the financial crisis). In both cases, the factors driving growth were partly

[11] Guellec and Van Pottelsberghe de la Potterie (2001) found that BERD is significantly positively correlated with multifactor productivity (MFP) growth The effect is larger in countries that are BERD intensive and in countries where the share of defence-related government funding is lower. In addition, there has been a growing impact of BERD on MFP over time.

[12] See the calculated adjustments made by the OECD at: http://bit.ly/14nOtM2

external: the EU's Structural Funds led to a massive boost in public investment in R&D and public support for business R&D while inward investment firms account for a significant share of innovation activity. In Ireland domestic firms also improved TFP faster as a result of the increased R&D. Hence, there is need to develop strategies to attract more high-value added and research-intensive FDI and then facilitate spill-overs and absorption of know-how into SME supplier chains in the Greek economy.

The Greek innovation system is relatively closed and FDI plays a limited role in boosting R&D investment and innovation. Given the considerable investments into higher education research facilities and the 'GSRT' centre the Greek authorities should seek to identify mechanisms and investment opportunities that could leverage private foreign funds into co-investing in Greece. There may also be opportunities in specific business clusters for more research-intensive investments.

However, the traditional measures of innovation performance do not necessarily capture the full picture of innovation activity in an economy, particularly one with an economic structure like Greece heavily dominated by more traditional sectors and the service sector (and, indeed, non-traded services) where innovation may be taking place more in non-technological forms that are not captured by business R&D statistics. The inclusion of marketing and organisational innovations creates a more complete framework, one that is better able to capture the changes that affect firm performance and contribute to the accumulation of knowledge. Indeed, the dominant form of innovation in the Greek economy, dominated by low technology, small firms, is likely to be 'hidden innovation': "*the innovation activities that are not reflected in traditional indicators such as investments in formal R&D or patents awarded*"; including the adoption and diffusion of new technologies (NESTA 2007, p4).

The Epirus region has been involved in a project to identify cases of 'hidden innovation'. This type of analysis could be usefully extended to other regions in order to support the design of policy measures for non-technological innovation. More generally, the expert team was surprised by the lack of attention to service innovation, notably for the tourism sector, even in regions where tourism dominates economic activity, but also with a view to growing the key knowledge intensive business services that could help improve manufacturing productivity and export growth.

1.3.2 Innovation outputs and activity

In terms of innovation activity, Greek business innovation is dominated by non-R&D innovation expenditures (104% of EU27 average) but as might be expected the crisis has led to a sharp decline (almost 20%) in such expenditures as well as a 14% decline in business R&D expenditure (which stand at only 14% of the EU27 average). Such data, allied to the industrial structure of the country, puts in perspective the potential for linkages with the higher education and public scientific sector (even assuming that the scientific specialisation is aligned to economic needs, which is a brave assumption as will be seen below).

Although many voices, including during the regional workshops, suggest that a 'historical' Greek weakness is an unwillingness to co-operate, the evidence from innovation surveys suggests that innovative Greek firms engage in co-operation with each other almost 20% more than the EU27 average. As noted above, the real gap in terms of linkages is in co-operation between public (higher education) and the business sectors; despite a range of efforts and policy measures developed over the last decade. However, without a higher intensity of business R&D expenditure, the scope for co-operation (either joint projects or purchasing of contract research) is extremely limited. Hence, boosting the 'supply side' by creating technology transfer offices, creating new 'research centres', etc. will prove ineffective in the absence of corresponding industrial demand and, of course, the capacity to finance R&D.

Access to finance is clearly flagged as a weakness by the EIS and was raised frequently as a concern at regional level. However, while the crisis has certainly restrained finance for all sorts of industrial investment projects, there is a lack of evidence on

whether companies with innovative ideas for new products or services are effectively constrained only by finance or whether other barriers (e.g. adequately skilled human resources to develop ideas into proposals that attract potential investors).

Even taking into account the low levels of public and private expenditure on R&D, the output performance of the Greek innovation system is poor. Nioras (2011) notes that in 2009, only 13.1% of entrepreneurs regard that their products or services are entirely new for all targeted clients, while only one in three companies declares that they use relatively new technologies (available from 1 to 5 years on the market), while the export orientation and the penetration rate of new markets increased only marginally from 5.4% during 2008 to 6.4% during 2009. Such findings underline that the limited innovation occurring in Greece is failing to make a difference in raising the value added produced in the economy, the export intensity or, critically, productivity. As McKinsey & Co (2012) underline, the positive Greek productivity growth, up until 2008, did not actually result in the gap with the rest of the EU (or other OECD countries) closing. Moreover, the persistent productivity gap is not due to the sectoral mix of the economy but rather due to productivity short-comings in each sector. McKinsey & Co (2012) rightly point to the need for a massive productivity boost that requires both significant investment in advanced production and service technologies and a shift of employment towards tradable sectors.

The current innovation activity and outputs in the Greek economy tend to reinforce the dual nature of the economy, with the positive effects of a limited number of highly innovative and productive companies not enough to offset a large non-innovative group of firms. Future Structural Fund support for productive investment should focus on manufacturing and business service companies in the tradable sectors of the economy in order to re-balance investment and reduce over-consumption trends.

1.4 Scientific and industrial specialisation

1.4.1 Scientific specialisation

Understanding scientific specialisation and impact provides some hint as to the extent the Greek innovation system is more or less close to the world technological frontier in specific fields, even if the overall system is under-performing. Greece's overall percent **share of world scientific papers** from 2005-9 was 0.90% but as can be seen from Figure 3, the share was considerably higher in a number of fields.

Figure 3: Greek world share of scientific papers and relative citation impact 2005-9

Field	% papers from Greece	Impact vs. world
Computer Science	1.67	-24.00
Clinical Medicine	1.27	-9.00
Agricultural Sciences	1.27	14.00
Engineering	1.18	-5.00
Environment/Ecology	1.08	-23.00
Space Science	1.07	-22.00
Geosciences	0.93	0.00
Mathematics	0.85	2.00
Physics	0.81	15.00
Pharmacology & Toxicology	0.79	-10.00
Economics & Business	0.78	-42.00
Plant & Animal Science	0.74	-10.00
Biology & Biochemistry	0.69	-23.00
Chemistry	0.67	0.00
Materials Science	0.67	-11.00
Immunology	0.66	-33.00
Microbiology	0.61	-16.00
Neuroscience & Behaviour	0.54	-35.00
Molecular Biology & Genetics	0.52	-25.00
Psychiatry/Psychology	0.45	-31.00
Social Sciences	0.44	-10.00

Source: InCites™ Global Comparisons, Thomson Reuters. Greece's world share of science and social-science papers over a recent five-year period, expressed as a percentage of papers in each of 21 fields in the Thomson Reuters database. Greece's relative citation impact compared to the world average in each field, in percentage terms.

Between 2005 and 2009, Thomson Reuters indexed 46,821 papers that listed at least one author address in Greece. Of those papers, the highest percentage appeared in journals classified under the heading of computer science, followed by clinical medicine and agricultural sciences. As the right-hand column indicates, the citations-per-paper mark for computer-science papers featuring authors based in Greece was 24% below the world mark in the field (1.29 cites per paper for Greece, versus 1.70 cites for the world). In other fields, however, such as agricultural sciences, mathematics, and physics, Greece's impact exceeded the world mark. In two fields, the nation's impact figure happened to match the world score precisely: geosciences (4.21 cites per paper) and chemistry (5.38)[13].

Another measure of the international competitiveness of the Greek science system is **success in securing funds through competitive European funding programmes**. Data on Greek participation in the 7th Framework Programme suggests that overall Greek participants account for 2.85% of all FP participations and 2.44% of European Commission funding for projects. This is relatively credible, however, this positive picture is due to the dominant role of ICT related research in the Greek innovation system. Greek participants to the ICT theme of FP7 account for 32% of total funding (€230m) awarded to Greek organisations and participation rates were 8% higher than the EU27 average and funding share 13% higher than the EU27 higher.

Our findings confirm those of the Digital Agenda Scoreboard (DG Connect) which finds that the main Greek strengths are in the areas of ICT for health, for ageing and for inclusion but also in technology areas such as Future networks and internet, Software or embedded systems. DG Connect argues that 'Greece seems to have a strong potential to develop its companies in design, software and services where there is significant growth potential and required fixed investment is modest'[14].

Given the relative focus of Greek R&D investment on ICT, it would be hoped for that this would feed through into both new high-tech firm growth but also a greater capacity to assimilate ICT into the broader economy. However, given the above noted persistent productivity gap, it appears that this is not the case. This may be due to the concentration of FP7 ICT funding on the higher education sector, with the top five organisations all being academic research centres which in total received 44% (€101m) of the total FP7 ICT funding awarded to Greek participants. A social network analysis (see appendix E.2) identifies three main 'hubs' that are highly influential in the network: CERTH, ICCS and FORTH.

In contrast, Greek participation rates in a field like food-agricultural-biotechnology of critical importance to the Greek economy are 2% lower than the EU27 participation share and funding is 1% lower. Again in this field, the top five participants in terms of EC funding and number of participations are all academic institutes and once more attracted half of the total funding received by Greek participants (approximately €12.5m out of €25m)

In conclusion, the evidence suggests that while the overall output of Greek scientists is relatively higher in some key fields of relevance to the national economy, the quality (impact) is only significantly higher in agricultural sciences and physics. The Greek research system is has only a few top-level institutes that can 'compete' internationally but which are weakly networked nationally with either other academic units or the business sector. Indeed, Rand (2011) underline that, one factor leading to this overall

[13] See also http://metrics.ekt.gr/en/report02/index for more details and analysis. Greek Scientific Publications 1996-2010: Bibliometric analysis of Greek publications in international scientific journals.

[14] https://ec.europa.eu/digital-agenda/en/scoreboard/ict-rd-7

under-performance, is that Greek R&D system is fragmented, with small research groups not achieving critical mass. They suggest that research centres could be reorganised to achieve critical mass with a disciplinary and/or geographical focus.

A review of the impact of ICT research on the Greek economy should be commissioned in order to ascertain why the relatively strong expertise in the academic sector is not spilling-over into economy. This should focus notably on the mechanisms and obstacles to applying ICT know-how to raise productivity levels in manufacturing, tourism, agriculture and business service sectors.

Funding for research infrastructure should be made conditional on the completion of a research assessment exercise, meeting international standards by involving international peers, and the development of a national research infrastructure road map (that should be assessed by an international panel of experts). A national inventory of open access research infrastructure should be drawn up (see for instance the Hungarian model) and funding should only be provided for equipment and facilities that guarantee open access and other research management criteria.

The concept of research pooling (see Scottish experience) could be applied in order to structure inter-institutional linkages between universities and TEI by scientific field including joint doctoral schools and sharing of facilities.

1.4.2 Economic specialisation and investment opportunities

A smart specialisation strategy at both the national and regional levels should be based on studies investigating sectors and technologies in which Greece has competitive advantages due to existing production facilities and technological know-how. Over the last five years a series of studies and official documents investigated and proposed production and technological specialisations for Greece. Figure 4 summarises the findings that, despite a diversity of methods and datasets used, converge towards specialisation in four broad sectors:

8. Agriculture and food production;
9. ICT manufacturing and services;
10. Health services, biomedical and pharmaceuticals, and
11. Energy and chemicals.

At regional level, the specialisations are narrower, but overall regions converge towards similar specialisation choices.

Figure 4 Overview of studies identifying sectoral/high-tech priorities in Greece

Document	Priority sectors identified
Logotech (2007) Investigation of priority sectors for research and technology during the programming period 2007-2013. Report to GSRT, Athens. (Total scores based on production specialisation, technological specialisation, and growth rate)	• Construction (Total score: 6) • Food production (Total score: 5) • Informatics services (Total score: 5) • Health services (Total score: 5) • Electronic equipment (Total score: 4) • Telecommunications (Total score: 4) • Chemicals (Total score: 3)
Law 3894/2010, Fast track for strategic investments in Greece (Definition of strategic investment sectors)	• Manufacturing • Energy • Tourism • Transport and communications • Health services • Waste management • High technology sectors
Ministry of Economics (2011) National Reform Programme 2011-2014 for Greece	• Agriculture and food production

Document	Priority sectors identified
(Key strategic areas for the country)	• Information and communications technologies • Materials / Chemicals • Energy / Environment • Health / Biomedical
IOBE (2012) A new Growth Paradigm for the Greek Economy: Eco-systems of Activities for the Restoration of Growth and Competitiveness	• Agriculture, fishing and food processing • Mining and manufacture of basic metals and non-MM • ICT manufacturing and computer services • Waste management • Energy production & distribution • Tourism • Land freight transport, infrastructure, logistics • Pharmaceuticals
GSRT (2012) Proposal of GSRT for Defining Guidelines for the Design and Setting of Development Planning 2014-2020 (Sectors for smart specialisation based on IOBE 'A new growth paradigm for the Greek economy')	• Food production and bio-agro-food production • Energy technologies and materials • Environment and waste management • Health and pharmaceutical industry • Information and communication services in culture, tourism, maritime, and education
McKinsey & Company (2012) Greece 10 Years Ahead	Prioritised eight rising stars out of 20+ sub-sectors: • Manufacture of generic pharmaceuticals • Aquaculture • Medical tourism (mainly outpatient) • Long-term and elderly care • Regional cargo and logistic hub (trans-shipment and gateway) • Waste management • Classics hub • Greek speciality foods

Despite such studies suggesting a core group of key sectors and technologies, it is noteworthy that in the current programming period funding for both research and innovation and business investment has been provided on a largely generic basis with few, if any, thematic or targeted programmes (aside from the clusters programme).

Given the diversity of methods used, the expert team **recommend** to adopt a two-stage methodology for defining an optimal smart specialisation strategy. In the first stage, a further examination of the four broad sectors on which the past studies converged is required in order to specify as precisely as possible the niches which offer the most potential for the future. This should involve both further analysis and a phase of consultation with key stakeholders, notably from the business sector.

In a second stage, further survey and mapping analysis is needed to examine which technologies prevail within each of the priority sectors. For instance, in food production the most demanded technologies may be automation, packaging, and ICT based production management. Such a mapping would reveal the full range of technologies across the selected industry sectors. Amongst them, two types of technologies should be given priority: (1) technologies which feed most sectors, and (2) technologies that create bottlenecks and control value appropriation in the entire production chain (see: Jacobides et al. 2006; Linden et al. 2007). The GSRT proposal for the definition of optimal smart specialisation cover the first stage of this methodology and presents a selection of production sectors specialisation. However, the second stage is necessary to define smart specialisation in terms of technology fields that offer a competitive advantage rather than only industry sectors.

1.5 Regional specialisation: main findings and recommendations

The expert team reviewed the state of play and level of preparation for drafting RIS3 strategies of each of the 13 Greek regions. During our meetings with stakeholders, it was clear that there was a relatively good 'tacit' understanding of structural challenges and the emerging opportunities in each region. There is an awareness that without a significant change in the governance capacities, a shift to private-private and public-private partnerships and an end to 'coffee for everyone', the next round of Cohesion policy may fail to deliver the results required to generate sustainable (in both the financial and environmental sense of the term) growth in income and employment.

Appendix D summarise the findings in terms of the strength, weaknesses, opportunities and threats for innovation based development and regional economic and scientific specialisation patterns. Figure 5 summarises the recommendations made by the expert team for each region on the focus of their future RIS3 strategy.

Figure 5 Summary of recommendations on regional specialisation potential

Region	Recommended prioritisation
Attica	• The RIS3 strategy should be built on key sectors that play an integrating role in the regional economy: transport systems (maritime and urban), creative industries, knowledge intensive business services; (green) ICT as a key enabling technology for efficiency improvements in the private and public sectors. • Focus on how 'eco-innovation' could contribute to both boosting business potential and 'greening' the urban environment to make the city more environmentally sustainable. The negative environmental situation in Attica can be viewed as a strategic opportunity for the region to become a test-bed for new eco-innovative solutions to green the urban environment and protect and derive value from the remaining fragile natural eco-systems in the region.
Central Macedonia	• The region has a good potential to develop specialisation in more than one sector. The new programming period provides an opportunity to run and finance regionally more focused actions. However, this implies the development of stronger capacity to implement such policies and some hard choices in the short-term between various potential sub-sectors. It is advised to undertake a further study of specialisation potential, focusing notably on the needs for key enabling technologies to boost productivity and reduce the cost base of regional firms. • A focus on eco-innovation would be relevant across both manufacturing, agricultural and service (green ICT and tourism) sectors. A specific regional programme could be considered with the aim to reduce energy and material use in businesses. • The public sector could be the subject of specific innovation actions to improve efficiency through e-government, public-private partnerships for service delivery, etc
Crete	• The expert team concurs broadly with the priorities set out in the regional strategy: agro-food sector (production, packaging, food processing, Mediterranean diet), the cultural-tourist sector (hospitality, travel agencies, cultural capital, cultural activities), and the technological educational sector (research centres, universities, technology park) and its connection to the other two sectors. • However, there is a need to identify specific opportunities where research or expertise available can be used to develop new commercial opportunities through full-scale pre-competitive testing (e.g. marine or ICT applications). A priority should be given to integrating key enabling technologies and seeking out opportunities of a cross-sectoral nature (e.g. at the interface of ICT, cultural heritage and tourism; or 'blue-biotech' opportunities related to energy or food production, etc.). • Finally, a high priority should be given to reducing the extent of the dual economy, with a split between low technology agricultural and tourism activities and high technology research and education and a few spin-off firms.
East Macedonia and Thrace	• The expert team recommends that the RIS3 strategy process should seek to better identify potential linkages between a number of the main industrial groups located in the region (e.g. examining the potential for 'industrial symbiosis') and focus on identifying opportunities for investing in new higher value added niche (e.g. functional foods, specialist textiles, etc.) and on integrating specific critical technologies into the production or service delivery processes (ICT, etc.) in existing manufacturing sectors.
Epirus	• Focus future RTDI investment on research and technology extension services for the dairy industry and other agro-food firms, ICT technologies and their application in

Region	Recommended prioritisation
	improving regional health and tourism services and manufacturing production and, technology know-how related to environmental protection and sustainable exploitation of the natural biodiversity. The RIS3 process should include a more detailed analysis of technology needs and opportunities in regional firms.
Ionian Islands	• The region is heavily specialised in tourism activities. Inter-connected with the tourism sector is the bio-economy, both on natural resources and biodiversity (with a potential for reinvigorating the agricultural sector through the production of new crops and a focus on designated origin, etc. products) as well as aquatic resources (blue-biotech). Marine energy potential is still at a nascent stage (the most advanced plans are in the Aegean sea) but the future RIS3 cannot ignore efforts to reduce the islands cost basis through increased use of wind, solar and possibly tidal energy.
North Aegean	• The North Aegean region has limited business and scientific capacity but is characterised at the same time by a rich and diverse cultural and environmental diversity. While the islands' economy is heavily dependent on public sector funds, stakeholders under-lined the positive entrepreneurial culture of different islands. • There is a clear logic in building on and extending past efforts to 'brand' the islands as 'sustainable' and to implement innovative solutions to tackle insularity and protect biodiversity while exploiting the potential for new higher value added products and (tourism) services based on the natural environment. • The region has a potential comparative advantage in focusing future research and innovation actions on maximising the potential of the 'bio-economy'.
Peloponnese	• Given the regional specialisation profile, the expert team recommends to combine (1) targeted cluster programmes for agro-food, tourism and manufacturing sectors and (2) cross-sectoral support for technological upgrading by identifying key enabling technologies important to the regional business sectors. This will require further analysis and feasibility studies during the RIS3 design phase.
South Aegean	• The expert team recommends that regional specialisation should focus on cross-sectoral technology upgrading and adaptation of production processes to reduce energy use, reduce material input and waste generated; in addition to higher value added products and services in sectors connected to tourism.
Central Greece	• Two main challenges: modernise the agro-food sector and link it with other sectors along the value chain; and promote environmental and energy saving technologies. • There is also a need to better integrate and support a more balanced development of the economy through a search for cross-sectoral opportunities for applying other key enabling technologies, notably ICT. We recommend a focus on the agro-food industry as a key business sector with potential for greater synergies with the primary sector (agriculture) and service sector (tourism) as well as on the application of environmental and energy saving and ICT technologies in existing businesses
Thessaly	• The expert team notes that the past initiatives in Thessaly have focused on the agro-food sector and related industries and the value chain links to agriculture. The regional specialisation pattern is relatively diversified and other sectors such as metal production and construction materials are also important. • There is a need to enhance competitiveness of regional firms in a cross-sectoral manner through improved integration of key enabling technologies, notably ICT. Strengthening the access of regional firms to knowledge intensive business services should also be considered as a priority since this would help to foster an overall enhancement of non-technological innovation (design, marketing, etc.).
West Macedonia	• The RIS3 strategy should not focus exclusively on energy industry/technologies, even if this is clearly a core regional specialisation, but needs to adopt a more diversified approach building on existing clusters of business activity and seeking to shift such 'niche' into higher-value added activities with a strong focus on export driven growth.
West Greece	• The region of Western Greece has a number of opportunities to build on natural resource based, human capital and niche business and technology fields, some of which have been partly supported in previous programming periods. Western Greece, like a majority of other Greek regions, has a potential comparative advantage in focusing future research and innovation actions on the 'bio-economy'.

2. Governance and innovation policy

2.1 Assessment of the quality of the evidence supporting the drafting of RIS3

Reviewing the development of Greek innovation policy from the 1st Community Support Framework (CSF 1989-1993) to the current National Strategic Reference Framework (NSRF, 2007-2013) leads to the critical conclusion that it has suffers from persistently weak governance, insufficient attention to a mismatch between scientific and industrial strengths and weaknesses, and an inadequate focus on performance assessment, strategic goals and targets setting.

- The first wave of research, technology development and innovation (RTDI) policy, implemented from the mid-1980s, focused on establishing research infrastructures and technology intermediaries (e.g. government research centres, sectoral technology centres, technology transfer organisations) and the creation of supportive framework conditions (e.g. tax incentives, subsidies for R&D investments, etc).
- A more radical change took place during the 1st CSF (1989-1993) that provided an opportunity for the application of longer-term science and technology policies through the implementation of the Operational Programme for Research and Technology (EPET-I) and the community initiative STRIDE.
- During the 1994-1999 period a similar approach was pursued with an emphasis on the establishment of research infrastructures and the development of intermediary organisations and support services (e.g. technology parks, industrial property agency). However, innovation capacity and performance remained weak with Greece continuing to be ranked amongst EU member states.
- The 3rd CSF (2000-2006) continued such efforts but also introduced new measures, such as PRAXE to support spin-offs, ELEFTHO to create incubators and science and technology parks and subsequently the Regional Innovation Poles programme. However, while funding increased in comparison to the previous CSF, only 2.4% of the 3rd CSF (2000-06) was dedicated to activities related to RTDI. At regional level, less than 1.1%, on average of the regional operational programmes budget was dedicated to RTDI with an important part directed towards acquisition of embodied technology through support from the Development Laws.

In short, the intervention logic pursued through the Structural Funds adopted a linear approach, supporting precompetitive research through investment in research infrastructure with a subsequent effort to support research commercialisation through spin-offs. In contrast, the majority of support for business was focused on subsidising acquisition of embodied technology rather than fostering technological breakthroughs and innovation support market-driven product development. This has tended to he reinforce the existing trend of low investment in innovation and 'passive' adoption of embedded technology. Indeed, even if most RTDI policy measures were based on a principle of co-financing of private R&D, the public sector's attempt to leverage private sector investment has failed with BERD remaining very low.

Moreover, demand side measures, such as public procurement, have not been used to underpin innovation although Nioras (2011) reports a shift towards more emphasis on demand side measures. Rather, cost-efficiency and rationalisation tend to be the main priorities of the public procurement framework. A characteristic case is defence-related procurement. Greece has one of the highest levels of defence expenditure as a share of GDP in the EU and NATO. However, the Ministry of Defence's R&D expenditure were less than 1% of total government appropriations for R&D.

Innovation policy in the 2007-2013 period got off to a better start with three milestones being: (1) an invitation to the OECD to review the Greek innovation

system, (2) the adoption of a target to raise GERD from to 1.5% of GDP by 2015, and (3) the incorporation of an innovation component into the OP.

The GSRT report prepared as background for the OECD review of the Greek innovation system included an overview of the evolution of Greek RTDI policy, a comprehensive review of the key elements, relationships and dynamics of the national innovation system, and identified policy opportunities to enhance RTDI (GSRT 2007). Based on this report and interviews with stakeholders, the OECD recommended to:

- Foster innovation in the business sector. Innovation policy for Greek businesses should be broadened beyond a narrow focus on R&D. It should encompass organisational and marketing innovation. Likewise, it should be designed to help firms develop in-house learning capabilities, and to foster incremental innovation of products and processes combining existing knowledge in new ways. Particular measures should be taken to encourage innovation in services."
- Strengthen the links between public research and industry. The development of innovative industrial clusters, which have become an important tool of Greece's regional innovation policy in recent years, needs to be further enhanced, accompanied by state-of-the-art monitoring and evaluation mechanisms, and complemented by an improvement of some of the instruments used to promote collaborative innovation.

In this context, the National Reform Programme (NRP) set a goal for GERD to reach 1.5% of GDP by 2015 (€5,345m). To achieve this upward leap from 0.67 % of GDP in 2006, the NSRF 2007-13 allocated a significantly increased share of public expenditure to RTDI to reach €3,206m in 2015. Furthermore, the NSRF, taking into account the strengths and weaknesses of the national innovation system, included two research and innovation policy axes for improvement of R&D capacity and networks between research and industry:

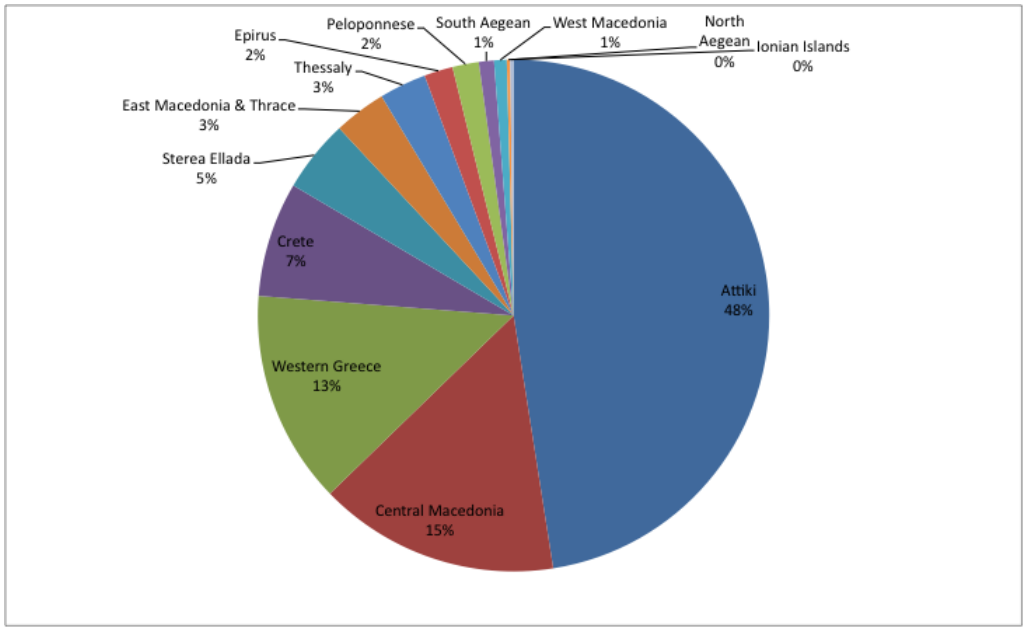
- Axis I - Knowledge and Excellence: focused on investment in knowledge, research excellence, the development of partnerships among firms and firms and R&D institutions in Greece and abroad, the creation of national sectoral R&D centres in high priority sectors for the national economy, and the creation of networks of centres of excellence and their connection with similar centres abroad.
- Axis II - Value: focused on innovation, diffusion of new technologies and entrepreneurship to produce economic and social benefits. The main targets were the exploitation and commercialisation of knowledge, the transformation of knowledge into innovative products, processes and services, the facilitation of diffusion of technology know-how to businesses and in particular SMEs, the strengthening of regional innovation clusters, the promotion of integrated strategies for innovation in regions, the creation of new knowledge-intensive enterprises and the support of seed & venture capital and business incubators.

It is now clear that the current financial crisis and the financial architecture of the NSRF resulted in missing the programme objectives for research and innovation. R&D spending is currently below the 2007 level (€1.6 billion, 1.1 public+0.5 private) and far from the target set for 2012 (€3.9 billion, 2.5 public+1.4 private).

The persistent deficiencies are a result of policies that in many cases focused on and supported public sector initiatives rather than private, and even where a transfer of technology from the public initiatives to firms was envisioned this was rarely achieved. Furthermore, there is an absence of proper evaluation of the measures implemented. R&D support programmes have never been properly evaluated for their effectiveness in leveraging private R&D; the evaluation was limited to absorption of available funds without focusing on results and impact to the economy and society.

In the absence of evaluation evidence on the results of the 2007-13 NSRF funded RTDI measures, the expert team were provided with data on the projects funded under the OP Competitiveness by the GSRT.

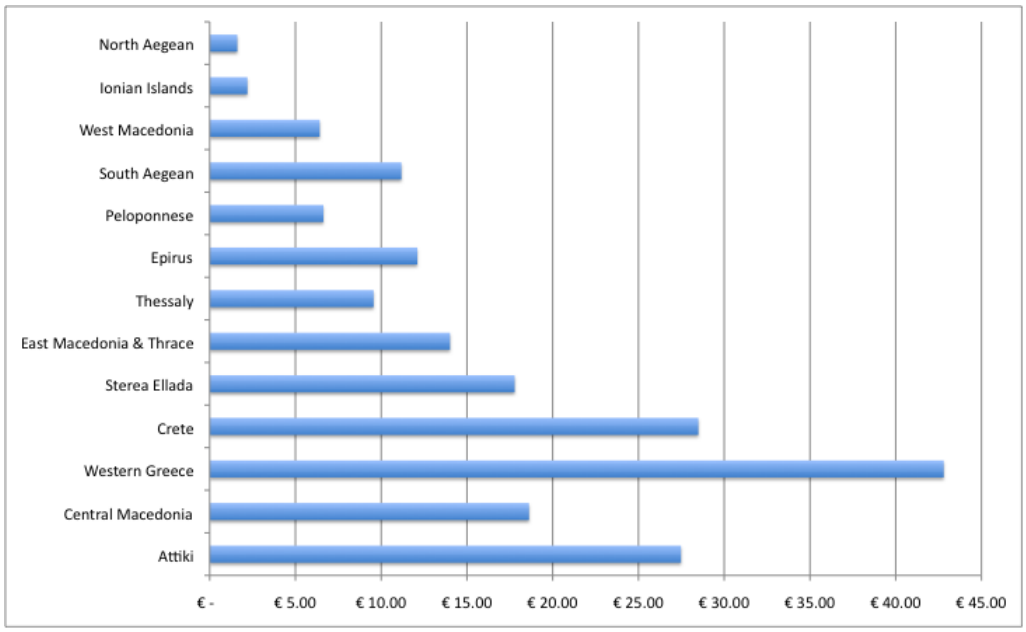
Figure 6: Share of GSRT funded RTDI project budgets by region



Source: authors based on data received from the GSRT

Given the low level, spatially and sectorally concentrated structure of Greek BERD, it would be hoped that the RTDI programmes supported via the Structural Funds would have assisted in channelling funds to key sectors and creating a more balanced 'national innovation system'. However, as can be seen from Figure 6 and Figure 7 the regional distribution of project funding by the GSRT through the RTDI measures of the national OP for Competitiveness tend to reinforce the dominance of Attica and the three 'secondary' poles in the Greek innovation system.

Figure 7 : Per capita value of GSRT funded RTDI project budgets per region

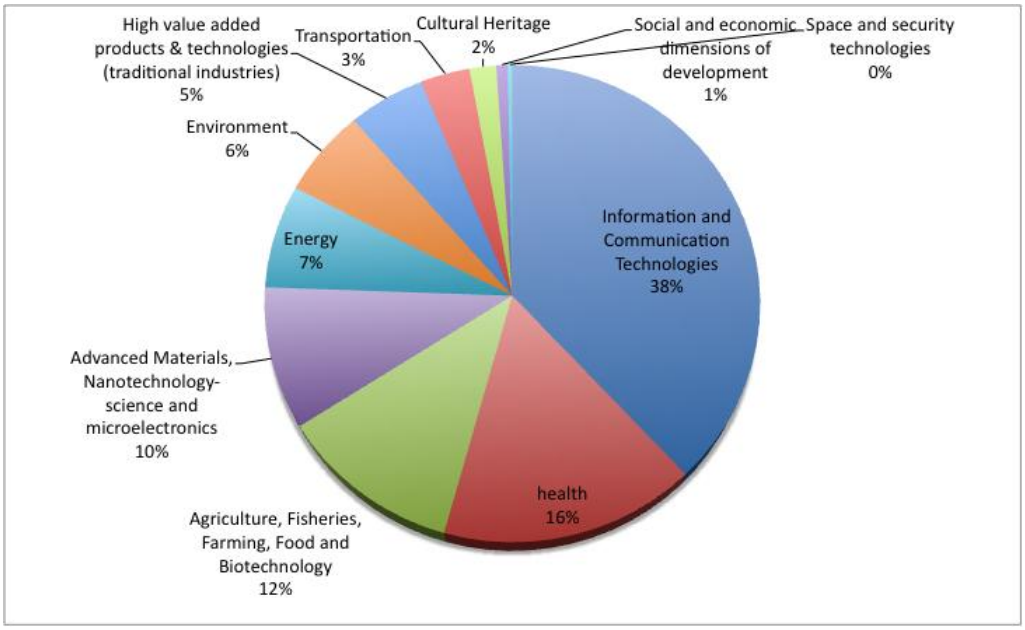


Source: authors based on data received from the GSRT

In terms of sectoral distribution, Figure 8 suggests that during the 2007 -13 period there has been a strong focus on four main technology sectors that have consumed approximately three-quarters of all RTDI project funding from the National OP

competitiveness. Business led project investments are notably in ICT technologies while research organisations account for a large share of health related R&D projects, suggesting that health technologies may be driven more by 'public sector' demand.

Figure 8: Share by 'sector' of the budgets for GSRT funded RTDI projects



Source: authors based on data received from the GSRT

It is noteworthy that despite the weight of the agro-food industry in the economy that this field has not secured a greater share of project funding. Moreover, the share of funding going to energy and environment projects that would support a shift to a low carbon economy also appear low.

2.2 Participation and preparation of relevant stakeholders to contribute to the drafting and implementation of the national and regional RIS3 strategies

The General Secretariat for Research and Technology (GSRT) plays a central role in the state-led RTDI system. During the last 30 years, the GSRT has been the main RTDI policy-maker, both in terms of policy design and implementation. In addition to overseeing RTDI policy, the GSRT supervises the majority of the publicly funded research centres (see Rand (2011) for a review of GSRT research centres), which account for about a fifth of Greek R&D activity. Moreover, the GSRT is now under the Ministry of Education, which is responsible for funding universities that account for another half of Greek R&D activity.

For the 2014-20 programming period, the GSRT has been actively involved in the design of a Greek smart specialisation strategy and proposed a framework for policy design and implementation (GSRT 2012). The key characteristics of the guidelines are:

- Policy design and governance
  - Top-down definition of priorities and policy directions
  - Non-critical review of R&I initiatives undertaken until now, which does not reveal weaknesses in innovation delivery mechanisms (i.e. incubators, ATIZ, human networks of R&D training, innovation from research institutes)
  - Design and implementation of a solid system for measuring and assessment of R&I policies for evidence-based policy design
- Smart specialisation policy

  - Selection of sectors for smart specialisation: food production and bio-agro-food, energy technologies and materials, environmental technologies and waste management, information and communication technologies
  - In parallel, selection of sectors of high national interest, such as marine research and technology, socio-economic research, and human sciences
  - Intention to further investigate the thematic priorities from the supply and demand side in consultation with stakeholders
- Research policy
  - Horizontal research policy sustaining human resources, research infrastructures, and international research excellence, and connection of research and society
- Innovation policy
  - Public-private partnerships (PPPs) for initiatives related to new product development, technology transfer, and social innovation
  - Strong incentives to the private sector to undertake R&D and innovation
  - Support of key-enabling technologies, spin-offs and new innovative companies, creation of competence centres, and risk sharing facilities
- Institutional and organisational setting:
  - Creation of multi-fund OP for research and innovation
  - Support of regional planning services with resources and skilled manpower and creation of regional policy design mirror groups
  - Coordination of regional RIS3 by the GSRT and integration of regional smart specialisation priorities into national RTDI priorities

The GSRT framework for 2014-2020 includes some elements corresponding to smart specialisation strategy design, but it fails to present a policy framework addressing the weaknesses of the Greek innovation system, namely the low contribution of the private sector. Policy design remains top-down; smart specialisation sectors are not defined by a process of entrepreneurial discovery; private sector stakeholders are not involved in policy design; research policy remains horizontal and does not provide competitive technology advantages or links to smart specialisation sectors; innovation policy relies on delivery mechanisms that were proved non-efficient to leverage significant private funding; co-ordination among regional and national strategies does not takes into account the new legal framework of 'Kallikratis' reform.

2.3 Identifying potential inter-regional complementarities and joint actions

Inter-regional complementarities exist potentially in a number of areas, including (1) policy design and governance, (2) selection of smart specialisation sectors, (3) research policy, (4) innovation policy, (5) cluster policy, and (6) ICT and broadband networks policy. A number of specific complementarities are already identified in the 13 regional S3 reports produced by the DG REGIO expert team.

In terms of inter-regional complementarities in innovation policy design, most Greek regions have experience in bottom-up innovation policy from involvement in, the ERDF co-funded, RIS, RIS+ and Regional Programmes of Innovative Actions promoted by DG REGIO from 1995-2006. However, since 2007, R&I policy has been re-centralised and implemented by the GSRT through a 'shadow' programme based on the aggregation of RTDI funds from the 13 regional OPs. Hence, continuity with the regional innovation strategies has been lost.

During 2007-2013, innovation measures have been designed and implemented in a top-down manner by the GSRT without due consultation with the regions. Innovation

policy design for the period 2014-2020 started also top–down, led by the state authorities without involving stakeholders from the economy and society. Indeed, the 13 regional meetings of the DG REGIO expert group were a first occasion to present and discuss the expected bottom-up method of the RIS3 Guide with regional stakeholders. The comments and feedback from the regional stakeholders underlined that that credibility of the national authorities is extremely low. The newly elected regional authorities consider that the GSRT has taken advantage of regional funds without ensuring that appropriate benefits have accrued in return to regional firms and researchers. In short, centralised management of RTDI funds is viewed as a risk rather than an opportunity with respect to regional innovation priorities. This places a considerable limit on the propensity for inter-regional and regional-national collaboration in policy design. There are however potential inter-regional complementarities at the level of:

- exchange of good practice on bottom-up governance: common management schemes based on 'triple helix' steering committees, thematic working groups on specific sectors or technologies and selection criteria for innovation measures, and
- the design of a common monitoring, measurement and impact assessment system to be operated by an independent and credible organisation.

A reformed GSRT might assume this role as a good practice advisor and external monitoring and evaluation assessment service.

To date most regions do not have an explicit research policy and this limits inter-regional complementarities in R&D policy. Objectives such as R&D spending as percentage of regional GDP, design of research support programmes, development and management of research infrastructures, international research collaboration are not taken explicitly on board by regional policies. These areas tend to form the basis for the national research policy. However, with a view to regional smart specialisation, a regional research agenda is necessary to sustain research capabilities and skills that offer competitive advantages to smart specialisation sectors and technologies. Inter-regional or national research programmes should be designed in targeted areas of common interest of regional technological specialisation, such as

12. farming and animal husbandry and agricultural production,
13. bio-food production,
14. green energy production and energy saving,
15. use of ICT in the rural economy, tourism and culture.

Inter-regional cooperation or national programmes delivered regionally in these fields would offer economies of scale in terms of research infrastructures, research institutes development, and technology demonstration and testing centres.

Thirdly, considering inter-regional complementarities in innovation policy, the 2007 - 13 policy suffers from problematic design and implementation. In many regions, there is mismatch between the need to modernise key productive sectors and the innovation support. Inter-regional collaboration would help to improve the design of innovation policies and optimise the selection and use of innovation delivery mechanisms. Two possible areas of inter-regional complementarities are:

- information and good practice exchange in the design of measures supporting common smart specialisation sectors, and
- exchange of know-how in delivery mechanisms such as PPPs, innovation institution setting, and deployment of open innovation platforms.

2.4 Recommendations on strategies and/or actions better performed at a national or regional level.

In a systemic perspective, innovation can be thought of as a collaborative network of four types of actors: (1) inventors, (2) transformers, (3) financiers, and (4) brokers. Inventors are R&D or creative organisations that conduct research and design new products and services. Transformers are multifunction production and marketing actors that convert inputs from inventors into new products, produce and sell them to their customers. Innovation financiers fund inventors and transformers and seek to own intellectual property rights in exchange of funding. Brokers, finally, are market makers who find and connect suppliers and customers with the network, buying or selling services and products.

Greek innovation policy has relied on support for public R&D in research institutes and university labs, support for research-company consortia, and knowledge transfer and dissemination mechanisms. The yield of this strategy, practiced for more than 20 years, has proven very poor and incapable of increasing private sector innovation. On the contrary, smart specialisation calls for efforts focusing on specialised knowledge and the emergence of a wide knowledge-driven production base. Smart specialisation strategies should support all actors to build market advantage from R&D, foster technological and non-technological learning in production, enhance market foresight and generate new business models.

Public support of smart specialisation strategies towards such innovation networks can be organised at national or regional level through a number of feasibly scenarios. We recommend that the criteria for selecting between national or regional scale initiatives should be (1) the type innovation actor supported, and (2) the efficiency of innovation delivery mechanisms. From this perspective:

- Support actions towards 'inventors' such as research organisations, research institutes, university labs, research infrastructures, creation of research skills, post-graduate support, and international research collaboration, can be more efficiently managed and delivered at national scale. The research management competence at regional level is limited and economies of scale would be lost.
- Support actions towards 'transformers' and production actors relating to new product development, creation of innovation clusters, innovation poles, use of open innovation platforms, innovation consortia can be better organised regionally, where they are closer to production units and production facilities. Assessment of results and impact would be more visible also.
- Support actions towards 'financiers', such as venture capital funds, business angel networks, seed capital funds, crowd-funding initiatives, can be more efficiently organised at national level, creating larger pools of funds and better know-how in risk assessment and IPR management.
- Support actions towards innovation brokers should be limited to market brokers for international/global promotion. Support can be better organised regionally involving existing market agents and working more closely with 'transformers', which produce innovative products and services. Funding for other types of brokers, such as technology intermediaries, university liaison offices, one-stop shops, which have proven to be inefficient and non-sustainable, should cease.

The split of innovation delivery mechanisms at national and regional levels requires two types of OPs: regional OPs focusing on open innovation for companies producing and marketing innovative products and services, and national OPs focusing on research and innovation funding. In terms of funds allocated at each level, regional OPs should receive the lion's share of Structural Funds to address the private sector innovation gap and drive companies towards smart specialisation sectors and entrepreneurial discovery of innovation opportunities.

2.5 Recommendations as to the most effective delivery mechanisms including public-private partnerships and contracting out service delivery

Innovation policy delivery mechanisms in Greece have been expected to perform an 'impossible' mission: to infuse innovation into an economy not driven by knowledge and innovation. This has resulted in available innovation funding, for both public and private beneficiaries, being used for other purposes (i.e. innovation funding used for research, technology funding for real estate, new product development for general expenses). To address this failure, we recommend the re-design of innovation delivery mechanisms with respect to three related principles: (a) creation or re-engineering of institutions for innovation, (b) development of open innovation platforms, and (c) operation of innovation delivery mechanisms as PPPs under viable business models.

2.5.1 Creation of institutions for bottom-up innovation

With a view to a smart specialisation strategy, there is a need to replace the existing top-down and state-led institutions by a set of institutions that ensure bottom-up demand and user-driven and participatory innovation governance. Examples include:

- Permanent regional innovation forums for discussion, consultation, and ideas generation in the field of innovation strategy and innovation support actions.
- Regional innovation councils involving all main stakeholders should have the mandate to propose RIS3 and corrective actions to the elected Regional Councils.
- Innovation monitoring and measurement by independent organisations or outsourcing of S3 impact assessment through periodic surveys and reports.
- The re-engineering of GSRT as strategic R&D and innovation policy think tank should also be considered. Alternatively, the GSRT could be split in two sections (a) for strategic planning of research performed in public institutes and university labs, and (b) management of national research programmes.

2.5.2 Creation of Open Innovation Platforms

All innovation support to private sector beneficiaries should be channelled through Open Innovation Platforms (OIP) that support the entire innovation chain: from funding, to product development, pre-production, and market placement. OIP should mobilise the largest possible number of beneficiaries from the business community and society. Examples of such OIP include:

- Sectoral support programmes, targeted on smart specialisation technologies, supporting companies in selected sectors and technology fields.
- Spin-off platforms, bringing together funding, research capabilities, public IPR, and production/management skills for new knowledge-intensive firms.
- Technology learning platforms and incubators for start-ups, offering combined learning of new technologies, funding, innovation support, and location premises.
- Clusters of innovation, enabling collaborative product development, production and marketing within localised production systems and value chains.
- Crowd-sourcing platforms, for user-driven innovation, product design, marketing of products and services, and crowd-funding.
- Innovation promotion and export support platforms, for product promotion and placement into global markets.

2.5.3 Sustainability of innovation delivery mechanisms

The expert team consider that PPPs provide a better basis for long-term sustainability of innovation support mechanisms, especially when they are based on viable business

models. We recommend all Open Innovation Platforms should be established as PPPs adopting business models securing their long-term sustainability.

3. Clusters and cluster policies

3.1 Assessment of Cluster Policies applied in Greece

Greek cluster policies developed from the second half of the 1990s, predominantly through research and academic initiatives and by an attempt of the State to replicate industrial policies of other more advanced countries rather than in response to the needs of businesses, sectors or regions.

The General Secretariat for Industry[15] (GSI) launched the first policy initiative based on a large-scale study 'The Future of Greek Industry"[16] that was conducted from 1994-97. The study concluded that there was a potential for establishing 19 clusters in various Greek industrial sectors, an estimate that proved over-optimistic in practice. Neither the first call launched in 1997 under the Community Initiative for SMEs nor a second call via the OP for Industry resulted in a cluster worth mentioning.

Despite this first failed attempt, the GSI pursued the effort under the OP Competitiveness[17], in 2003, through the call 'Promoting Industrial SMEs networking (clustering)'. Even though the call was well-intentioned, it adopted cumbersome and bureaucratic pre-conditions and restrictions both on the definition of a cluster and the eligibility of costs that made it unattractive. The response was very poor: only three proposals were approved and only one took off. The GSI also announced in 2003 the call "Strengthening Environmental Networks" for the promotion of entrepreneurship in environment-related sectors. Two proposals were co-funded (the call procedures were similarly bureaucratic) but only one project was completed without managing to create even a rudimentary cluster or network.

An attempt was also made in a leading Greek sector, tourism and hospitality, with the aim to build clusters on the already successful businesses of the sector. The call "Promotion of Networking in Tourism SMEs (clustering)" was opened in 2005 and received proposals from only four small clusters. By the end of the co-funding period none of them developed to be considered a good practice and the intervention was unable to either build on success or to exploit the strengths of the sector.

In short, up to 2005, the results of Greek cluster policy can be considered far from satisfactory: none of the funded clusters developed a high-visibility nor provided a national model to follow. Some of the factors that led the policies to fail were:

- the design followed an authoritarian top-down approach;
- the calls did not differ significantly from traditional business state aid measures, and stringent requirements and restrictions placed constraints on the operation and development of a cluster;
- most Greek companies were not ready for strategic collaboration with 'co-opetitors' and the calls were not preceded by sufficient 'ground-work' (seminars, workshops, special meetings to present good practices to candidates, etc);
- limited emphasis was placed on innovation and the connection with academic and research institutes and policy-makers generally failed to grasp the necessity of the triple-helix;
- the role of the cluster facilitator was underestimated and the calls requested the facilitator to become a legal entity for purely administrative reasons;

[15] http://www.ggb.gr

[16] http://www.cibam.jbs.cam.ac.uk/research/projects/futuregreekindustry

[17] http://en.3kps.antagonistikotita.gr

- the calls did not require evidence of prior cooperation between, at least some, cluster members or the pre-existence of at least an embryonic network;
- the calls prohibited the participation of large enterprises that in many cases are crucial factors for the formation of clusters;
- the calls did not consider that clusters have various integration levels which correspond to different stages of maturity and therefore require a step by step approach, with intermediate control gates and labelling levels;
- and finally the monitoring framework adopted was similar to traditional state aid calls, with no metrics related to clustering effects and results.

Overall, the policy was based on an assumption that a single call could develop flourishing networks and clusters instead of establishing a holistic framework for the deployment of cluster policies with a long term strategy. In the meantime, already since late 2003 and in view of the 2004 revision of the OP Competitiveness, policies for innovation started to somehow alter. It became evident that:

- the knowledge economy requires constant interaction of innovation actors;
- policies need to support specialisations and concentrations;
- calls need fermentation, exchange of views, technical sessions, workshops, presentations and other preparations for the initiation and maturation of collaboration of candidate participants on joint initiatives.

The first action to assist the formation and emergence of clusters, in this respect, was the Regional Innovation Poles[18], initiated by the General Secretariat of Research and Technology[19] (GSRT). The call preparation started in mid-2003 with series of meetings and discussions with technology parks, research institutes and business representatives. The discussions were complemented with the study "Regional Innovation Poles" that was delivered in 2004, recording the research, technological and productive tissue of the Greek regions and proposing an implementation plan and call bearing in mind the structural funds framework. Five regional innovation pole projects were selected in 2007, after a competitive tender aiming primarily to underpin partnerships between research institutions and businesses of the same region, to focus on one or two themes per region, to launch technological platforms where diverse stakeholders would agree on a common vision for the development of technologies that concern them and to create a critical mass that would later evolve into clusters.

At the same time a second action towards a similar scope was the Thessaloniki Innovation Zone[20] also instigated by GSRT. The aim was to develop innovation and high-tech activities in an area of Thessaloniki, where there is high concentration of universities, research laboratories, technology parks, incubators and businesses. The strategy of the Thessaloniki Innovation Zone soon focused on selected themes that would eventually lead to the creation of a critical mass of companies and clusters.

Both these actions started with high expectations but delivered mediocre results and failed to develop into a recognised cluster. The development of the poles and the zone:

- stagnated due to the failure of the stakeholders, including public administration, to embrace the projects, mobilise the necessary resources and create the necessary regulatory environment for the concepts to become functional;

[18] http://www.3kps.antagonistikotita.gr/epan/site/Beneficiaries/calls/t_docpage?doc=/docs/MainDocuments/Calls/Axonas_4/461_2005

[19] http://www.gsrt.gr

[20] http://www.thessinnozone.gr

- had an overly top-down-driven approach and constraints that hindered entrepreneurship;
- had few planning/maturing activities and did not set out clear long-term measurable objectives and roadmap;
- were also hit hard by lack of long-term commitments, cash flow issues, central and regional public services bureaucracy and poor management.

In 2004, as policy makers became concerned about the potential for Greek cluster policies, a new approach was backed by the Research and Innovation Centre Athena[21] and the most promising Greek-based high-tech industries. The original vision of the founders was to establish R&D centres of excellence that would attract investments in industrial sectors where a competitive advantage exists. The aim was to reverse the accelerating brain-drain, to reinforce entrepreneurship and to underpin the design and fabrication of products based on "Innovation Made in Greece" for the world markets, in a similar fashion to what Taiwan, Korea and Israel have achieved.

Early in 2005, after a broad consultation with a significant number of stakeholders, the vision found support from both the public and private sector. The failures/lessons learnt from previous attempts were recognised after a study of worldwide best practices, a SWOT analysis and the elucidation of the specificities of the Greek research and industrial fabric that was delivered early in 2006 (phase-0). The vision, strategy and implementation track took form in the Hellenic Technology Clusters Initiative (HTCI) that was established in 2006, and renamed soon after to Corallia[22], as an independent unit of the Research and Innovation Centre Athena.

The Ministry of Development mandated Corallia in 2006[23] to design and manage a programme that would create a favourable environment for underpinning entrepreneurship and innovation and fostering emerging technologies in exports-oriented and high-technology market segments where Greece had the capacity to build a sustainable innovation ecosystem and could attain a worldwide competitive advantage and yield world-class results.

Due to the previous failures, the policy makers decided to implement initially a small-scale pilot programme in one of the most promising sectors. In the period 2006-2008, the pilot cluster programme (phase-1) implemented within the OP Competitiveness, yielded very positive results through the establishment and expansion of the nano/microelectronics based systems and applications cluster (mi-Cluster) and the milestones achieved by its cluster members such as double-digit growth rates in turnover (+59%), exports (+109%), employment (+92%) and patent applications (+137%). In the course of the pilot programme, Corallia inaugurated in 2007 the Athens InnoCenter[24] (Marousi, Attica), a thematic building that concentrated the mi-Cluster members, creating a reference point for the microelectronics industry and optimising the geographic focus of the cluster.

In 2008, Corallia started the implementation of one of the most important interventions for the development of clusters in Greece, the "Phase-2 Microelectronics" programme, within the OP Competitiveness and Entrepreneurship[25], including a dedicated measure[26] covering activities from the call for proposals to the monitoring of granted projects. The results were noteworthy: in the period 2009-2011 the cluster companies exhibited an estimated growth rate of

[21] https://www.athena-innovation.gr

[22] http://www.corallia.org

[23] Law 3460, Article 15. Gazette 105, 03/30/2006

[24] http://www.corallia.org/el/Athens-innocenter

[25] http://www.antagonistikotita.gr/english

[26] http://www.corallia.org/en/research-a-development-projects/stateaid.html

turnover +145%, employment +70%, exports +108% and investments by private investors +369%; patent applications grew by 76% (a total of more than 60 applications); while joint industry-academia diploma and doctoral thesis grew by 160% (80 in total). Within this intervention, in 2011, Corallia established one more Innovation Centre, the Patras InnoHub[27] (Kastritsi, Western Greece) to concentrate the mi-Cluster members in Western Greece.

The main features of the new approach can be summarised as follows:

- based on international good practices;
- deployed a clear bottom-up, customized, phased and holistic approach;
- put strong emphasis on innovation and exports' orientation;
- focused on talent & people and niche market orientation;
- insisted in a strong and sustainable cluster facilitator;
- set a long-term strategy that outperform short-term gains;
- determined long-term goals and integrated control gates with metrics;
- deployed a plan-do-check-act management method for the control and continuous improvement;
- accepted no more than zero-tolerance to nepotism, corruption, discrimination;
- designed the program with eligibility of actions based on needs of sectors instead of limitations of funding frameworks;
- invested in good publicity reaching out worldwide.

By 2008, Corallia had been widely recognised in Greece for its impact and had started its globalisation journey, with early recognition at European and global level. This rapid and significant success rejuvenated the interest of policy makers and created a favourable climate for cluster policies.

The heads of the Ministry of Development and the Managing Authority of the OP Competitiveness and Entrepreneurship, the GSRT and the GSI looked again into the implementation of cluster policies following the new paradigm, organised fermentation events, meetings with stakeholders, participated in international events for clusters and special missions abroad to visit successful clusters. This led to

- a two-step call by GSI in May 2011[28]: The call, entitled "Clusters", even though improved in design from previous GSI calls, still had some stringent requirements and restrictions. Most importantly, however, was the fact that even though the first step call gathered considerable interest and was evaluated swiftly, GSI never announced the second step of the call. Indeed, the GSI never informed the proposers of the reasons for discontinuing the process, damaging the trust that had begun to be built around the government strategy on cluster policies;
- a June 2011 update of the Incentives Investment Law (3908/2011)[29] incorporated a special chapter for clusters, is another rather imperfect example of cluster policies. Mature clusters did not apply and the call received only one proposal (no official announcement has been made). The chapter on clusters is currently open for a new consultation to receive feedback from stakeholders for improvement;

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[27] http://www.corallia.org/el/patras-innohub

[28] http://www.ggb.gr/%CE%94%CF%81%CE%B1%CF%83%CF%84%CE%B7%CF%81%CE%B9%CF%8C%CF%84%CE%B7%CF%84%CE%B5%CF%82/%CE%A0%CF%81%CE%BF%CE%BA%CE%B7%CF%81%CF%8D%CE%BE%CE%B5%CE%B9%CF%82/tabid/88/vw/1/ItemID/116/language/el-GR/Default.aspx

[29] http://www.ependyseis.gr/sub/nomos3908/n3908.htm

- a two-step call by GSRT in September 2011[30]: the call, entitled "Establishing Innovative Clusters - A Greek Product, One Market: The Planet", had a good design, received 21 proposals in the first round announced in September 2011, of which the nine highest ranked proposals were asked to submit a final proposal to in September 2012. While some improvements could be made to the design of this call, the most important deficiency has been the extremely long time lag for evaluating proposals (more than 18 months) which creates a concern about the capacity to follow up with the implementation of the programme.

It is noteworthy that all the aforementioned actions have been designed and implemented at national level. At regional level, apart from the preparatory actions and experience gained by the Greek Regions through the RIS, RIS+ and RPIA projects and the Regional Innovation Poles no cluster policies have been launched by 2012.

3.2 Assessment of Plans for National and Regional Cluster Policies in Greece

For the period 2014-20, clusters and cluster policies are being considered in the design of the national and regional strategies[31] as follows:

- **National level**: the General Secretariat for Research and Technology in the workshop organised on 28 August 2012, a meeting held on 05 October 2012, in their presentations at regional meetings in September through November and in their preliminary strategy for 2014-20, stated that: a) smart specialisation is in the core of their strategy, constituting one of its three main axes, b) the following sectors that resulted from various studies (see section 1.4.2) will be considered for regional smart specialisation: Food and Agro-Bio Food, Energy Technologies and Materials, Environmental Technologies and Waste Management, Health and Pharmaceuticals, Information Communication Technologies, c) clusters are considered as one of the tools for strategy implementation and specifically for the "promotion of networking between businesses and research institutions".
- **Region of Attica**: In both the 1 October 2012 meeting, and in the Attica preliminary 2014-20 strategy, the region stated that it targets "the creation of trans-sectoral, trans-institutional and trans-business networks (clusters), with the aim to improve exports orientation and the integration, production and promotion of innovation", in all steps of the Attica 2014-20 strategy, as well as "to attract new industrial and business infrastructure (business parks), with an emphasis on collaborative activities (clustering) and innovation".
- **Region of Central Macedonia**: At the meeting on 12 September 2012, the IMA of Central Macedonia stated their intention to implement cluster policies; seven clusters are proposed based on various mappings completed recently. The Central Macedonia preliminary 2014-20 strategy also provides one reference to clusters in the SWOT analyses; it considers "a technology cluster" as an opportunity.
- **Region of West Greece**: During the 29 August 2012 meeting, the IMA of West Greece stated their intention to implement cluster policy measures for sectors with a competitive advantage, including food and beverages, fisheries, agricultural products, tourism in the axis Katakolo-Ancient Olympia and high-tech sectors like microelectronics, energy/photovoltaic, chemical industry, pharmaceuticals, transport and logistics. The West Greece preliminary 2014-20 strategy also

[30] http://www.gsrt.gr/central.aspx?sId=110I458I1163I646I453967&olID=750&neID=589&neTa=1_618&ncID=0&neHC=0&tbid=0&lrID=2&oldUIID=aI750I0I119I428I1089I0I1&actionID=load&JScript=1

[31] The observations are based on the experts team's meetings and on the proposals of the GSRT and the response of the 13 regions to the call of the Ministry of Development, Competitiveness, Infrastructure, Transport and Networks for the design and preparation of the development plan for 2014-20; thus they are not based on any consolidated national RIS3 nor the RIS3-related strategies of other secretariats like the General Secretariat for Industry or the RIS3 of the 13 Greek Regions. Wherever the text refers to a preliminary strategy for 2014-20, it means the above proposals.

provides hints to the implementation of cluster policies "on existing sectors with competitive advantage after consultation with cluster members".

- **Region of Crete**: At the meeting held on 17 October 2012, the Regional Authorities of Crete stated their willingness to implement cluster policies for the sectors in which a competitive advantage exists. Indeed, in the forthcoming period, the preliminary 2014-20 regional strategy places an emphasis (priorities 1 & 3) on economic activities connected with the agricultural-food complex (production, packaging, food processing, Mediterranean diet), the cultural-tourist complex (hospitality, travel agencies, cultural capital, cultural activities), and the technological educational complex (research centres, universities, technology park) and its connection to the other two. The interventions proposed are related to the lack of regional competitiveness, the limited propensity for innovation and entrepreneurship, the restricted commercialisation of research into marketable products and services, the lack of venture capital funds, the small scale of firms and the low number of knowledge intensive firms. Clusters are not mentioned, per se, but referred to in more generic terms, like, value chains, sectoral and spatial specialisations and integrated production complexes.
- **Region of Central Greece**: The region does not have previous experience of implementing cluster policies, nor does the preliminary 2014-20 strategy make any reference to clusters as a tool for regional development. The 2014-20 strategy document does refer, however, to the need for specialisation and actions it will take towards the development of specific sectors and, in particular: the "existence of large processing units in the Region", "the remarkable natural and cultural reserve for the development of all forms of tourism", "the large plains with of high productivity", "the strategic location of marine areas", "the significant number of young farmers that are familiar with the technology and new farming methods", "the modern and competitive facilities in aquaculture and fishery", "the existence products with designation of origin", "the further development of mining as an opportunity", "the existence of large companies with specialised R&D departments", etc.
- **Region of East Macedonia and Thrace**: At the meeting held on 4 October 2012, the Region of East Macedonia-Thrace stated their willingness to implement cluster policies for the sectors in which a competitive advantage exists. The preliminary 2014-20 regional strategy provides only one reference to clusters in the SWOT analyses; it considers "a technology cluster" as an opportunity and as a threat the lack of a "modern perception and attitude about business clusters".
- **Region of West Macedonia**: In both 3 October 2012 meeting, and in the preliminary 2014-20 regional strategy, the region stated their willingness to deploy the Energopolis plan to implement integrated interventions in selected clusters and geographical areas.
- **Region of Peloponnese**: The Peloponnese Region has no previous experience of cluster policies, nor has it identified in its preliminary 2014-20 regional strategy clusters as a tool for regional development. However, the regional strategy does refer to specialisation and actions it will take towards the development of key sectors.
- **Region of Epirus**: The preliminary 2014-20 regional strategy places a greater emphasis on specific sectors. The development of clusters was identified as opportunities in the SWOT analysis and at the meeting on 16 October 2012, the IMA of Epirus indicated they would seek to implement a cluster policy for sectors with an identifiable competitive advantage.
- **Region of Thessaly**: The preliminary 2014-20 regional strategy identifies clusters as an opportunity in the SWOT analysis for 2014-20 without giving further statements.

- **Region of South Aegean**: At the meeting held on 26 November 2012 and as mentioned in the SWOT analysis of the preliminary 2014-20 regional strategy, the Region of South Aegean has no previous experience on cluster policies, no cluster "culture" and no mature clusters operating in the region.
- **Region of North Aegean**: At the meeting organised on 6 September 2012, the Intermediate Managing Authority of North Aegean indicated they were willing to implement cluster policies and programmes for the sectors where a competitive advantage exists, but that this would require further study.
- **Region of Ionian Islands**: The Ionian Islands region has no previous experience in cluster policies. However in the preliminary 2014-20 regional strategy adopted on 30th September 2012 by the Regional Council, the region makes a clear statement on the specialisation of the region and the specific actions it will take towards the development of these sectors. In particular, competitiveness priorities will be centred around qualitative improvement of tourist business potential, linked to strengthening agriculture and manufacturing with an emphasis on local and organic products and regional "baskets" and promoting innovative business which link tourism with culture.

3.3 Recommendations on Cluster Policy, Strategies and Actions

Cluster policy is a multi-dimensional, multi-faceted and multi-instrument policy, informed by a mix of rationales and thus requires deep understanding of the instrument and experience in cluster dynamics. Cluster development means different things in different places. Differences in cluster initiatives are a product of not only different objectives, instrument choice and implementation styles, but also context specific institutional configurations and different types of government intervention (Uyarra & Ramlogan, 2012).

Clusters themselves can be related to various conceptual and theoretical meanings. However, most definitions include: 1) a degree of specialisation in a particular industry, 2) co-location of the specialised industry, universities, research centres, governmental institutions, associations and other economic actors in the sector, 3) the presence of a developed value chain of industry and actors and 4) a critical mass in the cluster. Clusters vary also in size, breadth and state of development (Porter, 1998) and evolve in a sort of life cycle consisting of embryonic, growth, maturity and decay stages (Rosenfeld, 2002).

It is worth mentioning that the economic importance of clusters entails mainly from the advantages arising from geographical proximity that have been associated with: 1) specialised, high productivity employees with lower search and training costs, 2) suppliers with local access to specialised materials and components, finance, marketing and business services that benefit from reduced transport costs and 3) technological information and knowledge spillovers, all giving rise to innovation and productivity benefits. Other kinds of advantages associated with clusters derive from more favourable market conditions, namely the presence of demanding customers, greater rivalry and complementarities in products and technologies (Uyarra & Ramlogan, 2012).

As the above discussion suggests, the promotion of clusters can mean very different things in different contexts. Sometimes they may not even be labelled as such, but as local production systems, competitiveness poles, centres of expertise, industrial and technology districts (Nauwelaers & Wintjes (2008). Traditional policy measures are sometimes relabelled as clusters (Sölvell et al, 2003) and sometimes network policies and cluster policies are used interchangeably.

Cluster policies may be designed to pursue objectives of industrial and SME policy or research and innovation policy. Programmes may also differ according to the national institutional configuration, the level of government involved, and the nature of government intervention (Enright 2000). They can also vary in terms of the types of sectors, firms, and territories targeted, the identification and selection of the targeted

clusters, the mix of instruments used and the institutional context and actors' constellation of cluster programmes.

Nevertheless, a number of consistent threads and key observations emerge across evaluation reports of cluster initiatives worldwide (Uyarra & Ramlogan, 2012) and are **recommended** for any potential implementation at national and regional level in Greece:

- in terms of governance, early private sector involvement is important to secure market oriented strategies in the targeted clusters;
- clusters require dedicated management teams with a blend of skills and competencies to reconcile the interest of the private and public sector participants;
- the provision of support services within clusters is an important element for generating long-terms benefits for cluster participants;
- public sector cluster investments have been successful in leveraging private funding but this seems to be contingent on the nature of the cluster. High technology clusters appear to be better placed than more traditional industry clusters in attracting private sector funding;
- cluster policies need to improve their clarity and focus in their choice of objectives and rationales;
- cluster policies need to be deployed in phases, allow for evaluation in the process and move into deeper interventions for labelled clusters;
- cluster policies should use flexible and adapted interventions that are realistic rather than a rigid cluster model;

In terms of the **cluster selection mechanisms**, targets of cluster policy may be designated (non-competitive) or selected through open competition (competitive). Competition to select the highest quality or most suitable projects has been implemented in Swedish and Germany's cluster programmes. In other cases funds have been allocated according to specific criteria like in the Finish cluster programme. In practice, selection processes are often based on a combination of statistical methods and negotiated approaches. It is **recommended** to implement a mixture of competitive calls to select the highest quality with a few minimum thresholds on critical cluster statistics together with some designated actions to proven and established cluster initiatives.

Cluster policy inevitably involves a form of **'targeting' and selectivity**, favouring certain sectors and geographical areas. In support of the tough decision to be made,

Figure 9 combines statistical data on the concentration of employment by sector (see Appendix C) with information gathered from the regional meetings and the preliminary 2014-20 regional strategies. It thus **hints** at the sectors that may have critical mass and other attributes needed for the development of clusters.

Figure 9 : Cluster development potential in Greek regions

Region Sector	Attica	Central Macedonia	Central Greece	East Macedonia and Thrace	West Macedonia	Peloponnesus	West Greece	Epirus	Thessaly	South Aegean	North Aegean	Crete	Ionian Islands
Agricultural products, forestry		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Farming and animal husbandry, aquaculture		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Stone quarries, construction materials		✓	✓	✓	✓	✓				✓			
Energy, renewables, mining, production, distribution	✓	✓		✓	✓	✓	✓	✓					

Green Tech, Water, Sewage, Waste Management		✓						✓				✓	
Food and beverages	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Chemical products, plastics, advanced materials	✓	✓	✓	✓									
Value-added products (metal, wood, leather, paper, textile, etc)	✓	✓	✓	✓	✓								
Information communication technologies	✓	✓		✓			✓					✓	
Microelectronics	✓						✓						
Satellite technologies, aerospace, security	✓												
Creative Industries, Media, Entertainment	✓												
Biotech, Pharmaceuticals, Medical Devices	✓		✓										
Tourism and hospitality						✓	✓	✓		✓	✓	✓	✓
Transportation and logistics, maritime	✓	✓	✓	✓		✓	✓			✓	✓	✓	✓
Financial and insurance services	✓												
Health services	✓	✓											

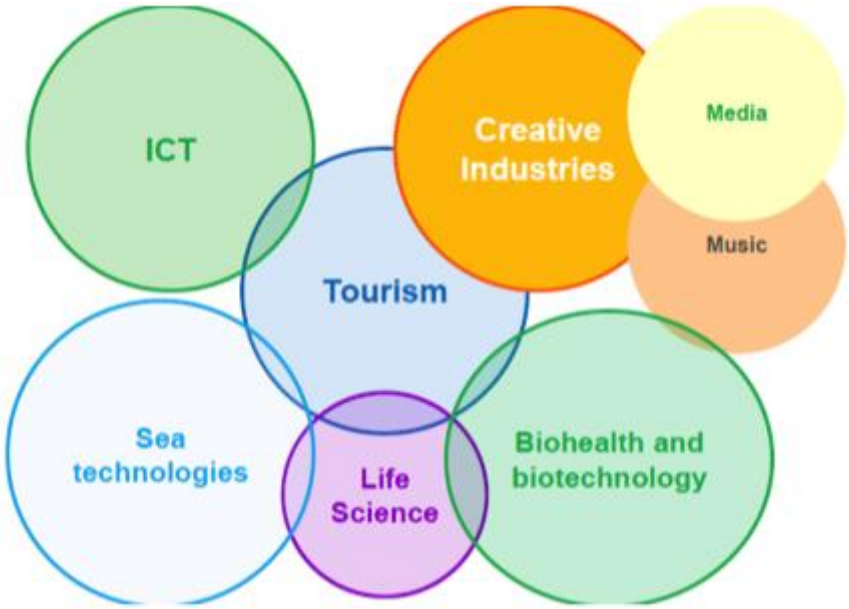
As this analysis is based on available data up to 2009, it is **recommended** that the national and regional agencies **update with more recent data** (sectoral data on employment trends, number of enterprises, growth in turnover, exports, patents, etc.) wherever possible to provide a firm foundation for the RIS3 strategy.

Furthermore, it is **recommended** that **more qualitative focus studies** are carried out in the activity domains where regions **show relative specialisation to identify niches**. The study "Smart specialisation in Europe: European specialisation data by region" by the Centre for Strategy and Competitiveness, of the Stockholm School of Economics is a good starting point for the identification of those niches.

It is **recommended** that the analysis also involves **expert work on value chain identification** for linkages between clusters/industries/sectors within and across regions. A particular focus should be given to strengthening the cooperation of existing/emerging sectors/clusters to connect to local, national and global value chains.

At the regional meetings held on August to November 2012 and as referred to in the preliminary 2014-20 regional strategies (see), the Greek Regions have **no previous experience on cluster policies**, no cluster "culture" and in most cases no mature clusters operating in their regions while central agencies have some experience but failed to implement in most cases effective cluster policies in Greece. It is **recommended** to draw on the experience of competitive technology industrial cluster approaches to facilitate the rapid spread of good practice (e.g. Corallia Clusters Initiative or policies of other regions with similar profile like the cluster policy of the Balearic Islands, a specialised, connected and sophisticated regional innovation system).

Figure 10: Technologies and clusters supporting tourism in the Balearic Islands



Source: Smart Specialisation Strategy in the Balearic Islands

In relation to the level of **government responsible** it is **recommended** to consider for the implementation of the cluster policies a joint work between the national and the regional level. Particularly in countries with a decentralised or federal system, cluster programmes are fundamentally a regional policy initiative. In other cases, responsibility is shared between the national and the regional levels in relation to the selection of funding of the programmes, for instance in the case of the French Pôles de compétitivité. In Canada, even though sub-national governments have implemented strategies to support clusters, the main programme with an explicit cluster strategy is delivered at the national level by the National Research Council. The programmes in Germany are also examples of joint work between the federal and the regional level, with the former playing the role of facilitator and the latter actively managing the programmes. Authorities at the regional and local level tend to be more aware of the problems of the locality and are allegedly better placed to adapt policies to specific regional circumstances. They may however lack the holistic view, the competences, or the capacity to act on the right policy levers that cluster development requires.

Whether cluster policies become a principal tool for national and regional development, it is **recommended** to consider the **creation of a cluster secretariat at national level**.

Cluster policies may use a variety of instruments, in fact, they are a form of "umbrella policy" that can include many instruments. Studies on cluster policy tend to describe a menu, or toolbox of instruments for cluster development commonly used in clusters that can be adapted according to the specific needs. So typically they would include a combination of instruments such as R&D funding, competence centres, support to training activities, networking, identity building, venture capital funds, etc. Nauwelaers and Wintjes (2008) distinguish between three types of cluster instruments, aimed at influencing cluster's environment, facilitating synergies and supporting projects. Similarly, OECD (2007) differentiates between instruments directed at actors' engagement, provision of collective services and promotion of collaborative research. Andersson et al (2004) differentiate between instruments aimed at improving internal cluster dynamics or at improving the external cluster environment. It is **recommended** to define the mix of instruments in cluster policies according to the objectives and stages of development of the targeted cluster. For instance, collaborative R&D are more common in cluster programmes targeting innovation and commercialisation, and include instruments such as

commercialisation support, financing for spin-off firms, etc. Targets and instruments would also need to evolve over the cluster life cycle in order to adapt to new and evolving cluster needs.

In view of the above the following measures are also related to cluster policies.

It is **recommended** to consider, in the strategy, incentives for the development of **transnational and trans-regional clusters**.

It is **recommended** to **facilitate cross-clustering and the identification of innovation opportunities at the interface between different sectors** (e.g. ICT and agriculture).

It is **recommended** to create **thematic one-stop-shops** on an existing structure or by merging existing organisations into a new structure with the appropriate improvements and sustainability plans based on lessons learnt and known deficiencies of current implementations.

It is also **recommended** to further develop the **industrial zones, the science parks, the incubators and business innovation centres** to offer professional added-value services to tenants and provide incentives for the establishment of incubators in combination with other policies like clusters that will allow the hosting and growth of selected sectors.

Furthermore, neither regional **business angel networks nor regional venture capital funds** have been formed in most Regions nor are they considered in their strategies. It is **recommended** to support the creation of regional business angel networks and give incentives to venture capital funds with professional standards and co-investment funds to invest in regional business opportunities.

4. ICT networks and Policy

This section reviews the overall ICT market conditions as well as the opportunities to apply ICT to boost economic competitiveness and improve the quality of life. The potentially beneficial sectors for the 2014-2020 programming period are examined, setting possible ICT policy targets for each of them, with an emphasis on developing the required national research e-infrastructures. We also analyse the importance of, and the tools for improving the ICT skills of the human capital, as well as the need for an overhaul of the public administration regarding ICT infrastructures and e-government services. Fast and super-fast broadband infrastructures represent a vital aspect of the digital agenda, and should be deployed according to a long-term plan that satisfies sustainability, balanced private sector involvement, openness, and respect to state-aid regulations. The proposals also include an analysis of the PPP model in ICT initiatives, along with the concept of standardized regional ICT Vouchers for SMEs and selected citizen groups.

4.1 ICT in past and current programming periods

Most of the ICT related Actions were carried out via the InfoSoc and the "Digital Convergence" OPs. The most notable ICT initiatives that have been implemented in the recent years were concerned with the implementation of metropolitan access optical networks (MAN) and municipal wireless hot-spots, e-government services, tourism-related applications, the development of content for the disabled and for SMEs, digitising and diffusion of cultural archives, health management systems, natural disaster management systems, and the networking of the higher education institutions and the school units to the national research and education network and the Internet. There have also been voucher-based actions, supporting the adoption of portable PCs, Internet/IT skills and services for selected students and citizen groups, with interesting results. The impact of these projects, however, was not maximal, mainly because[32]:

- they were fragmented in a large number of beneficiary organisations
- the lack of ICT Planning executives at the general and regional government administrations
- the lack of a single coordination mechanism for the strategic ICT initiatives
- the imposed procedural restrictions were/are causing significant delays in handling the required implementation phases of each project
- the staff of the involved Management Authorities was inadequate to manage such a big number of projects

4.2 ICT Market Status

The Greek ICT market is under unprecedented stress, as the enterprises are facing (a) lower demand due to the economic recession, (b) reduced public projects due to deep budget cuts across-the-board, and (c) huge outstanding debt obligations. The existing excess capacity has caused fierce competition, leading to the significant reduction of profit margins and continuing layoffs. In this context, public and private investment in ICT has been kept at minimal levels, insufficient to support the transformation of the production paradigm toward a modern knowledge society. Telecoms (fixed line and

[32] «Κείμενο θέσεων για τις βασικές στρατηγικές επιλογές και κατευθύνσεις για την ενίσχυση της πρόσβασης, χρήσης και ποιότητας των τεχνολογιών πληροφορικής και επικοινωνιών στο πλαίσιο της νέας προγραμματικής περιόδου 2014-2020» Managing Authority of the OP "Digital Convergence", Feb. 2013.

wireless) are rather the only sector in which investment has been at relatively acceptable levels, especially between 2004-2008.

4.3 ICT Education and Training

Besides the existing unemployment rates among the ICT professionals, the enterprises face a shortage in specialized staff in new technologies like agile software development, mobile applications development, medical informatics, network design, and database-driven web applications. The regional educational institutions should be encouraged and supported to update their curriculum and e-infrastructures, and enhance their internship programmes with ICT companies.

The regional educational systems should be urgently supported in a way to (a) empower all educational actors; to foster the linking up and connecting of learning communities and the building up of new partnerships[33], and (b) enhance the ability of higher education institutions and research centres to carry out applied research for innovative products and services.

Special emphasis should be placed in continuing training programs supporting professionals in modern ICT disciplines of high demand. Effective incentives and cost sharing arrangements should be established to enhance public and private investment in the continuing training of the workforce, and increase workers' [34] participation in lifelong learning.

A possible initiative for the prompt enhancement of the application development skills of a large number of young ICT professionals may be carried out by a specialized ICT Skill enhancement Voucher program. The beneficiaries (young graduates from IT departments) will be partly subsidised to obtain the skills and the respective certifications from internationally recognized institutions (like Microsoft, Oracle, Cisco, SAP etc).

4.4 ICT Research and Innovation

The major part of research and innovation in ICT is currently carried out by the state Universities, Technological Educational Institutes, and Research Centres, mostly funded by EU-sponsored projects. The respective contribution of the private sector is limited, as the economic conditions have deteriorated and the focus shifted to short-term goals.

Although the original publications of the Greek researchers are remarkable[35], there is insufficient exploitation of the respective research work in the form of patents and/or start-up companies, thus limiting their impact in broader economic terms (new jobs, competitiveness).

An important prerequisite of any successful research and innovation activity is the availability of modern research infrastructures. E-Infrastructures, in particular, represent a crucial aspect of modern ICT ecosystem, able to provide a competitive advantage for the groups competing for advanced results in several R&I fronts. E-infrastructures may include data, computing and software systems, communication networks and systems to promote openness and digital trust.

Currently, the only truly-universal research infrastructure is the academic network GRNET, providing advanced interconnections for all the Greek research and education institutes with the pan-European research network GEANT. Some other e-

[33] http://ec.europa.eu/education/transversal-programme/doc968_en.htm

[34] An Agenda for new skills and jobs: A European contribution towards full employment, 23.11.2010 COM(2010) 682 final

[35] "Ελληνικές Επιστημονικές Δημοσιεύσεις 1996-2010", ΕΚΤ, http://reports.metrics.ekt.gr/

infrastructures (like PRACE-GR[36], for providing high-performance computing services, in conjunction with the EU PRACE[37] Initiative) have been scheduled, in the current programming period.

The GSRT is laying out a national plan for developing the most appropriate research infrastructures[38] to meet the demands of the national RTD communities. We expect that this initiative will result in the identification of the most appropriate research infrastructures to be supported in the 2014-2020 programming period. These investments should be linked with the respective EU-level infrastructures, to leverage the impact and cooperation potential.

The relevant authorities should:

- adopt a meaningful and realistic R&I strategy for ICT in each region, involving both the public and the private sector
- develop a sustainable e-Infrastructures road-map, to enhance the links with the EU counterparts, and support the needs of all the research communities, on an equal opportunity basis.
- ensure that any support is given under strict conditions related to either state-of-the-art research e-infrastructures or concrete innovations of marketable value.

All the initiatives should be executed in a business-friendly environment, where innovative start-ups are thriving, alongside with established ICT enterprises and public research/education organisations.

4.5 Broadband infrastructure and Internet usage

In the fixed-line broadband market, the licensed operators have mostly invested in ADSL infrastructure during the last decade. In some cases of distant areas, the operators received extra financial assistance from CSF programmes. Thus, the availability of ADSL has approached the EU standard, while the prices (especially for double-play subscriptions) have become more competitive. In rural areas, however, coverage is still at only 60% of the population[39], while the national average stands at 91.2%.

The GSM operators have recently completed the deployment of 3G networks, covering more than 99% of the population; they are now starting to invest in new-generation LTE infrastructures.

According to recent data[40], more than 50% of the households own an ADSL broadband connection to the Internet, while 84% have a home PC.

The availability of affordable broadband connections for all the households is a major "Digital Agenda" target, to be reached by 2013. Moreover, the EU strategic policy [41] demands that by 2020 all the member states should achieve:

- superfast broadband (at least 100 Mbps) for at-least the 50% of the households

Since Greece lacks any cable TV infrastructure, it is almost imperative that the above targets will require:

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[36] http://www.hellashpc.gr

[37] http://www.prace-ri.eu

[38] "Πρόσκληση εκδήλωσης ενδιαφέροντος για την κατάρτιση του οδικού χάρτη ερευνητικών υποδομών", GSRT, Jan. 2013 http://www.gsrt.gr/News/Files/New653/RIS_Roadmap_SupportDoc_2013.pdf

[39] http://ec.europa.eu/information_society/digital-agenda/scoreboard/index_en.htm

[40] "Η χρήση του Διαδικτύου από τους Έλληνες", Παρατηρητήριο για την ΚτΠ, Μάιος 2011. http://www.observatory.gr/files/meletes/A100526_%CE%A0%CF%81%CE%BF%CF%86%CE%AF%CE%BB%20%CF%87%CF%81%CE%B7%CF%83%CF%84%CF%8E%CE%BD%20internet%202010.pdf

[41] http://ec.europa.eu/digital-agenda/en/our-targets/pillar-iv-fast-and-ultra-fast-internet-access

- increased investment in both fixed-line and wireless facilities
- new massive fibre optics deployment (FttH) for a significant part of the country.

A major part of these investments is not expected to be carried out by normal market activities, due to the high CAPEX associated with next-generation access (NGA) networks. A state-aid mechanism should be set up, in order to gain the profound benefits of fast broadband as soon as possible. This mechanism should adhere to the directives of network neutrality and prevent the creation of any monopolies in the broadband markets. In this context, the Authorities can exploit the recently issued "state aid" rules for broadband investments[42], aiming to simplify the whole procedure and facilitate fast deployment.

The relevant Authorities should complement all the national- and EU-level actions (like CEF[43]), to further extend broadband coverage and take-up in all the Regions. More specifically, they should help making local Industrial Zones/Parks as "FttH-ready", i.e. bringing fibre to each hosted enterprise. The same can be done for selected neighbourhoods, by connecting the respective households with a passive "open-access" FttH local network.

It order to have an efficient and sustainable fast-broadband market, the Authorities should:

- make best use of previous public investments (like municipal MANs and urban broadband development projects)
- restrain from any action that may cause market distortion
- attract the maximum possible level of private investment, along with the given state funding, probably by using the public-private partnerships model.

It is also crucial that the demand-side of fast broadband should also be addressed, by providing some incentives to pre-specified groups of citizens and enterprises to subscribe to the new "advanced" services. Low-income citizens, young students, school units, and new SMEs may be allowed to get subsidized connections to the new superfast broadband services, thus stimulating the demand for advanced digital services.

Additional activities like setting-up of a big number of open-access hot-spots in public places, in ports, schools, sports/recreation areas, churches, etc. will also be supportive for increasing the use of modern e-services.

In the mobile Internet front, it would be very helpful to have 4G (e.g. LTE) network investments accelerated. The Regions should investigate incentives that will facilitate the fastest possible deployment of this infrastructure, e.g. by simplifying the licensing procedures or by granting public buildings for LTE-enabled base stations.

4.6 Tackling the digital divide

In addition to the typical divergence of Greece compared to the rest member states, we witness four additional types of critical "digital divides"[44], between:

- the rural/under-populated areas and the rest of the country
- the younger and the older generations
- those with higher and those with lower education

[42] http://europa.eu/rapid/press-release_IP-12-1424_en.htm

[43] https://ec.europa.eu/digital-agenda/en/connecting-europe-facility

[44] "Η χρήση του Διαδικτύου από τους Έλληνες", Παρατηρητήριο για την ΚτΠ, Μάιος 2011. http://www.observatory.gr/files/meletes/A100526_%CE%A0%CF%81%CE%BF%CF%86%CE%AF%CE%BB%20%CF%87%CF%81%CE%B7%CF%83%CF%84%CF%8E%CE%BD%20internet%202010.pdf

- male and female

The citizens belonging to any of those lagging groups should be supported to acquire the basic ICT skills that will allow them to take active part in the emerging knowledge society. Improved ICT skills by these groups can result in a sustainable increase in the demand for ICT products and services, resulting in higher productivity and better quality of life.

In this regard, the regional and national authorities would promote a robust and aggressive voucher-based ICT skill improvement plan, with the following characteristics:

- the end-user beneficiaries would be specified by fair and objective criteria, after an evidence-based cost/benefit study
- each individual beneficiary would be able to freely choose a licensed training institution for acquiring the pre-specified skill sets.
- funding should be linked with third-party certification of the skills gained by the beneficiary

4.7 Boosting Competitiveness by ICT

Most Greek ICT enterprises are focused on software development, system integration, maintenance, and software support for the public and business sectors. However, the competitiveness shortfall of the Greek economy is partly due to the restricted use of modern ICT tools in the relevant production phases[45]. Moreover, the severe economic recession has further delayed the needed ICT modernisation in SMEs, which represent the majority of the national economic activity.

The 2014-2020 Structural Fund resources should be used as a priority to stimulate the adoption of ICT-tools in the broader economy, aiming at fast productivity gains, and job creation/preservation. Interventions may either take a generic form (e.g. deploying ERPs, CRMs over the Cloud), or be sector-specific (e.g. power and water conservation systems in greenhouses). Enterprises from the following sectors could be targeted in order to improve their business activities and raising their competitiveness:

Primary sector: the sector represents a significant portion of the regional economic activity, with remarkable growth potential if combined with modern ICT tools. Agriculture, forestry, fishing, aquaculture and mining enterprises are in urgent need to accommodate quality control, administration, monitoring, marketing, and logistics tools. ICT tools could support implementation of the European quality policy for food[46] and conformance of agricultural products and foodstuffs to specific certification schemes[47]. ICT-tools could support forestry measures and can strengthen forest protection and management activities[48]. Organically produced products or foodstuffs which are produced in a traditional manner, can benefit from internet-based marketplace participation, to widen their distribution channels and optimise branding, procurement, packaging etc. Farmers and livestock unit owners could also be supported to optimise their production activity, by employing modern control and monitoring tools, especially in reducing the water consumption and cutting the cost of energy and saving greenhouse gas emissions by using renewable methods, like geothermal sources or bioenergy.

Transportation: the cost and delay of transportation for citizens and enterprises is substantial. Modern smart transportation approaches (also referred to as Intelligent

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45 See for instance, the analysis of productivity gap sources in McKinsey & Co (2012).

46 http://europa.eu/legislation_summaries/agriculture/food/ag0002_en.htm

47 http://ec.europa.eu/agriculture/quality/certification/index_en.htm

48 http://ec.europa.eu/agriculture/fore/characteristics/index_en.htm#book4

Transport Systems (Tsekeri et al, 2013), based on ICT smart-city initiatives, should be selectively deployed, to minimise the cost of travelling (e.g. improving fleet management or optimizing public transportation schedules), reduce the consumption of fossil fuels, improve the delivery of certain business processes, and raising the reliability of the public transportation services. ICT offers great tools in freight transport for paperless information flows accompanying the physical shipment of goods. Core services include schedule, rooting, tracking and tracing (especially dangerous goods and animal transports), fleet management, intelligent truck parking, multimodal transportation and remote freight information [49].

Energy & Environment: the cost and the consequences of energy consumption, and the environmental protection represent serious challenges for all the Regions. ICT tools should be used in a systematic way to help reduce waste and improve efficiency, at both residential and industrial settings. Moreover, smart-grid, smart-metering, and distributed generation applications can be supported by modern ICT tools, resulting in reduced costs and more efficient use of the energy resources.

Health: health services are beyond reach for several citizens, because of the rising costs and the limited capacity of the traditional public health system. This problem can be partially solved by using new cost-efficient telemedicine or home-care services for elderly or chronic patients. The Regions should provide support to the private sector, to deploy affordable telemedicine or home-care platforms, for selected groups of citizens. These services would be organised as public-private partnerships (PPPs), in cooperation with local state hospitals and health centres, under a sustainable model.

Manufacturing: this sector, suffering from reduced demand and low-cost imports, needs to be supported by ICT, in applying better automation, control and monitoring. Cost minimisation by electronic procurements and quality assurance can help restrain job losses and bring about new investment. Recycling can be an important source of raw materials, so ICT tools could support Reverse Logistics activities: Handling and management of equipment, products, materials accompanied by a series of processes as collection, inspection, separation, and so on, leading to e.g. remanufacturing, reselling or recycling. Recycling waste products between companies in industrial recycling networks (Industrial Symbiosis) can bring environmental and competitive benefits. ICT tools could facilitate recycling networks as they provide a platform for declaration of waste products, needs and schedule management. [50] [51]

Tourism and culture: most of the Regions of Greece host numerous of world-class archaeological sites, and tourist attractions, capable of attracting huge numbers of foreign visitors. SMEs should be motivated to exploit modern technology and synergies (e.g. augmented-reality applications), to maximize the outreach of the tourist destinations in the new digital media, minimise management and advertising costs, thus extending the tourist season, and creating more and better jobs. Low-cost and high-quality broadband services can be especially useful in attracting prestigious conference organisations.

Food & Beverages: SMEs in this sector can also improve their sales and profit margins by better branding and advertising, using new-generation ERP and CRM tools, along with modern e-commerce and procurement platforms. The required certification of special high-profile eco-products can also be best executed by proper ICT tools, resulting in significant cost reductions.

Education Services: the education system of the Regions should be supported in a way to (a) improve the ICT skills level of the citizens and (b) enhance the ability of higher education institutions and research centres to carry out applied research for

[49] http://ec.europa.eu/transport/themes/its/road/application_areas/freight_and_logistics_en.htm

[50] http://ec.europe.eu, Clear identity needed for industrial recycling networks

[51] http://www.eitplus.pl/en/industrial_symbiosis_for_europe%E2%80%99s_regi/2962/

innovative products and services. Special emphasis should be placed in the provision of high-end e-infrastructure services to the public schools, the University Departments and the Research Centres.

A proposed sectoral prioritisation for ICT actions per region is given in Figure 11

Figure 11: Priority sectors for ICT support to businesses per region

Region / Sector	Attica	Central Macedonia	Central Greece	East Macedonia, Thrace	West Macedonia	Peloponnesus	Western Greece	Epirus	Thessaly	South Aegean	North Aegean	Crete	Ionian Islands
Primary Sector		X	X	X	X	X	X	X	X	X	X	X	X
Transportation	X	X	X				X				X	X	X
Energy & Environment	X				X	X				X	X		X
Health services	X	X	X	X	X		X	X	X			X	
Manufacturing	X	X					X		X				
Food and beverages	X	X	X	X	X	X	X	X	X		X	X	
Tourism and Culture	X	X		X	X	X		X	X	X	X	X	X
Education services	X	X	X	X	X	X	X	X	X	X	X	X	X
Information communication technologies	X	X					X					X	

4.8 Public Administration

The scarcity of efficient ICT tools in public administration represents a major obstacle in implementing the required reforms of the whole society. The number and the usage of e-services of the public administration are limited. The lack of reliable registries is an additional factor that inhibits the use of any new public e-service by the citizens and the enterprises. It is critical that the Greek authorities revisit the plan for introducing modern, reliable, and interoperable e-services, for a wide spectrum of the public administration jurisdictions. Adoption of SOA architecture and development of a Government Service Bus for the e-services would be advisable[52] [53].

More effort should be devoted to the improvement of the reliability of the registries, applying techniques of data cleansing, data verification, identity resolution and cross-checks. Data quality is a critical factor for any reliable e-service delivery.

The public sector should seek to engage with the private sector in the development and the provisioning of new ICT infrastructures and e-services, preferably based on a common Enterprise Architecture (Leonidas et al, 2010). By imposing standards-based interoperable "open source" application development, the public sector can obtain high-quality services at reasonable cost and avoid lock-in. Priority areas for deploying new ICT infrastructures and services include:

[52] Design Principles for Swiss eGovernment Version 1.0, Willy Müller, Beat Schmid, Christoph Schroth, Till Janner, Florian Schnabel Federal Strategy Unit for IT (FSUIT)

[53] http://www.oracle.com/us/corporate/press/214691

- e-prescriptions and electronic health records
- public ambulance and e-police management systems
- social care handling systems
- integrated hospital information systems
- public employment services (fight undeclared work)
- road safety improvement services (reduce the fatality ratio)
- e-justice (reduce bureaucracy, and improve transparency and efficiency)
- e-cadastre services
- public e-procurement system
- e-invoice handling systems
- tax collection support systems (fight tax evasion)
- public budget management systems (improve transparency and accountability)
- interoperable customs management systems
- e-signature public infrastructure
- public network and g-cloud services
- public e-signature infrastructure
- smart IDs for the citizens

Most of the above e-services should be accessed by the citizens and the enterprises, using generic portals, based on the one-stop-shop concept. The embedded interoperability should ease the use of them by less literate users or by disabled people.

The public administration could apply flexible type of contracts such as Framework Agreements [54] supported by skilled technical management teams. Time and Means contracts and functional measurement approaches for software development projects would be more appropriate in some cases[55]. Many of the public e-services can be built and operated by the private sector, using the PPP model, thus allowing improved sustainability, lower cost, and faster implementation.

4.9 Regional ICT Vouchers

It is recommended that the region authorities consider measures to enhance business competitiveness by using advanced ICT tools and services. The regions could issue targeted calls focused on specific economic sectors in line with their RIS3. The calls could cover standard activities of regional enterprises, like ERPs, B2B, B2C, B2G, production automation, CRMs, collaboration tools, marketing tools, research capacity enhancement, infrastructure virtualisation etc. Eligible enterprise would be awarded a predefined amount of funding (ICT Voucher) that could be used to acquire relevant ICT services (hardware, software and relevant services) within a pre-specified time period. ICT Vouchers should involve private matching funding, the level of which will be determined by the respective sectoral call. The regions should create a robust administrative mechanism, supported by an information system, to cover the following activities:

[54] http://ec.europe.eu/classic-dir-framework_en.pdf

[55] http://ec.europa.eu/taxation_customs/resources/documents/common/tenders_grants/tenders/IT_General_Conditions.pdf

- Identify the business sectors with comparative advantages, and the target operations within each enterprise, to be covered by each call for ICT Vouchers.
- Determine the rules applicable for the ICT Vouchers (maximum subsidy, percentage of co-financing, duration, verification mechanism etc.)
- Prepare and issue the calls to award the ICT Vouchers to the eligible enterprises
- Monitor the proper implementation of each ICT Voucher
    - Award public funding, after the verified implementation of each ICT Voucher
    - Evaluation and fine-tuning of the overall Action

4.10 Public-Private Partnerships (PPPs)

Regional and National e-Services or e-Infrastructures can be deployed by involving the private sector in a way that guarantees a significant leverage of public funding, using the well-defined model of Public-Private-Partnerships (PPPs). This implementation model can also help improve both the completion time and the sustainability, because of the flexibility introduced by the private sector. Moreover, it can enhance transparency, by applying objective criteria in selecting the concessionaires.

Each Authority should carry out thorough and evidence-based studies to identify the services and the respective infrastructures that can be built and operated by using PPPs. Several e-government services can be designed in a way to involve the private sector in both the implementation and provision phases, ensuring that both sectors share the risk and benefits of launching successful e-services. Moreover, the private partner (e.g. in the form of a Special Purpose Vehicle) will have additional incentives to further improve and enhance the characteristics of the offered services, by making additional investments and secure the sustainability of the whole project activity.

Special regional e-infrastructures (e.g. Smart city services) can also be built much faster and cheaper by using PPPs. The Regional authorities should establish a comprehensive mechanism for choosing and specifying those e-infrastructures that mostly benefit the local economy and are best aligned with the respective RIS3 strategy. The EU Regional funds can be used as the basis for attracting additional private investments, with a long-term view, deploying the most advanced ICT technologies in the most suitable operations management schemes.

In order to maximize the benefits of PPPs, each Authority should establish a specialized unit, assigned with the tasks of handling all the phases of conceiving, studying, designing, disseminating, monitoring, and evaluating PPP-based e-Infrastructure projects. The selection criteria (e.g. new jobs, competitiveness improvement, additional exports, and quality of life improvement) would be stated in advance, according to the respective RIS3 strategy. This Unit should be also responsible for monitoring the progress and viability of the deployed PPP projects (e.g. define objective criteria to measure the efficiency of the established PPPs and assist the decision-making for maintaining, extending or terminating existing projects).

Figure 12: An ICT PPP: e-Prescription and Electronic Patient Records (EPR)

As Nikolic & Maikisch (2006) note a PPP can be used to create a national e-prescription and EPR services. The tender for selecting the PPP concessionaire should include all the functional requirements of the services to be offered, including the quantitative specification of each transaction between the system and its users (doctors, health institutions, patients, pharmacies, social insurance funds, Ministries, banks etc.). Moreover, the tender may include the duration of the PPP and the detailed service level agreements (SLAs) for the execution of each transaction, along with the bank guarantees and the applicable penalties for each possible SLA violation.

The selection criteria are normally quantitative (e.g. the fee for each transaction), allowing the fast PPP contract completion. The selected concessionaire will then have to create a special-purpose vehicle, make the required ICT investments and prepare the delivery of the specified

public services as fast as possible, using the flexibility of the private sector. The interests of both parties (public and private) are thus matching, since the fast, smooth, secure, and widespread service provision are mutually beneficial, contrary to what often happens in the traditional ICT procurement models. Public funding is therefore more efficient since it is strictly associated with the real service delivery and leveraged by private investment.

4.11 Public Sector Prerequisite Actions

The successful implementation of the ambitious ICT-related tasks depends on the proper handling of some fundamental reforms, associated with the legacy of public administration. More particularly, it is strongly suggested that the Greek authorities overhaul the legal framework that relates with:

- streamlining of conflict resolution procedures, also supporting alternative dispute resolution and adopt systems for out of court resolution, as the "ODR platform" [56]
- creating a truly business-friendly environment, removing all the unnecessary permits and regulations, and simplifying the procedures of the required ones
- legalising and facilitating modern digital means of doing business, like e-invoices and e-patent/IPR handling
- simplifying the procedures of setting up and running public-private partnerships (PPP), to cover a wide variety of ICT services and e-infrastructures.

4.12 RIS3 Strategy ICT-related requirements

- There is currently no detailed regional ICT strategy per sector. In many cases, there may be a balanced allocation, in order to achieve better economies of scale.
- There is no master plan for e-government services. Most of them (cadastre, e-prescription, e-invoicing, etc) are administered by national authorities and, therefore, should be better addressed by a balanced allocation. The regional authorities could administer other e-services such as local taxation, regional permits. E-government services for audit and monitoring and ICT projects supporting regional planning could be directed by the Regions. All e-government services should adhere to well-defined interoperability standards, and be based on dependable cloud computing platforms[57].
- The national and regional authorities should establish and maintain an inventory of ICT infrastructure.
- There is no reference to viable plans for the deployment of new, and the extension of existing Next Generation Access networks.
- Both the national and regional authorities should take steps to ensure the active involvement of the private sector in ICT measures, so as to both leverage community funding and improve sustainability, especially for the delivery of products and e-services.

[56] http://www.europarl.europa.eu/sides/getDoc.do?pubRef=-//EP//TEXT+COMPARL+PE-487.752+01+NOT+XML+V0//EN

[57] http://ec.europa.eu/information_society/activities/cloudcomputing/docs/com/com_cloud.pdf

Appendix A Schedule of meetings

Region	Meeting date
West Greece	29 August 2012
North Aegean	6 September 2012
Central Macedonia	12 September 2012
Attica	1 October 2012
Thessaly	2 October 2012
West Macedonia	3 October 2012
East Macedonia and Thrace	4 October 2012
Peloponnese	9 October 2012
Ionian Islands	15 October 2012
Epirus	16 October 2012
Crete	17 October 2012
Central Greece	19 October 2012
South Aegean	26 November 2012

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Appendix C: sector size, specialisation and focus of Greek regions

The table below summarises the sectors in each Greek region with the highest combined scores in size[58], specialisation[59] and focus[60], according to the European Cluster Observatory[61] Star Rating System. The data indicates the sectors with a critical mass of employment in the Greek Regions and thus at opportunities for cluster development.

Region / Sector	Attica	Central Macedonia	Mainland Greece	East Macedonia and Thrace	West Macedonia	Peloponnesus	West Greece	Epirus	Thessaly	South Aegean	North Aegean	Crete	Ionian Islands
Aerospace													
Agricultural products		2★	2★	2★	★	3★	2★	1★	2★		1★	2★	1★
Apparel	1★	2★											
Automotive													
Biotech													
Building fixtures, equipment and services													
Business services													
Chemical products													
Construction	2★	1★	1★	1★	1★	1★	1★	1★	1★	1★	1★	1★	1★
Construction materials				1★									
Distribution	1★												
Education and knowledge creation													
Entertainment													
Farming and animal husbandry		3★	2★	3★	2★	3★	2★	2★	3★		2★	2★	2★
Financial services	2★												
Footwear	1★												

[58] The 'size' measure shows whether a cluster is in the top 10% of all clusters in Europe within the same cluster category in terms of the number of employees. If employment reaches a sufficient share of total European employment, it is more likely that meaningful economic effects of clusters will be present. Those in the top 10% receive one star.

[59] The 'specialisation' measure compares the proportion of employment in a cluster category in a region over the total employment in the same region, to the proportion of total European employment in that cluster category over total European employment. If a region is more specialised in a specific cluster category than the overall economy across all regions, this is likely to be an indication that the economic effects of the regional cluster have been strong enough to attract related economic activity from other regions to this location, and that spill-overs and linkages will be stronger. If a cluster category in a region has a specialisation quotient of 2 or more it receives a star. If a cluster category in a region has a specialisation quotient of 2 or more it receives a star.

[60] The 'focus' measure shows the extent to which the regional economy is focused upon the industries comprising the cluster category. This measure relates employment in the cluster to total employment in the region. If a cluster accounts for a larger share of a region's overall employment, it is more likely that spill-over effects and linkages will actually occur instead of being drowned in the economic interaction of other parts of the regional economy. The top 10% of clusters which account for the largest proportion of their region's total employment receive a star.

[61] http://www.clusterobservatory.eu/index.html

Region / Sector	Attica	Central Macedonia	Mainland Greece	East Macedonia and Thrace	West Macedonia	Peloponnesus	West Greece	Epirus	Thessaly	South Aegean	North Aegean	Crete	Ionian Islands
Furniture													
Heavy Machinery													
Instruments													
Information Technology													
Jewellery and precious metals	2★												
Leather products					3★								
Lighting and electrical equipment													
Maritime	1★		1★	1★		1★	1★			1★	1★		1★
Media and publishing	1★												
Medical devices													
Metal manufacturing													
Oil and gas	1★				1★	1★							
Paper products	1★												
Pharmaceuticals	2★												
Plastics													
Power generation and transmission													
Processed food		1★	1★		1★	1★		1★	1★		1★		
Production technology													
Sporting, recreational and children's goods													
Stone quarries													
Telecom	1★												
Textiles													
Tobacco		2★	★	2★		2★	2★		2★			1★	
Tourism and hospitality										2★	1★	2★	2★
Transportation and logistics	2★									1★	1★		1★

Appendix D Summary of regional specialisation patterns and SWOT analysis

D.1 Overview of the strengths, weaknesses, opportunities and threats for regional research and innovation potential

Region	Strengths	Weaknesses	Opportunities	Threats
Attica	• Improved quality of urban infrastructure post 2004 Olympics further enhanced by on-going major infrastructure project such as extension of Athens Metro, etc. • Significant concentration of national higher education and public research institutes. • Host to majority of business headquarters and private R&D facilities. • Well-connected (by air and sea) international metropolis acting as a hub between Europe and Middle East, etc. • Specialised notably in (maritime) transport sector; other focal points include tourism and business services.	• Manufacturing sector 'hollowed' out and weak development of hi-tech manufacturing. • Low rates of employment in knowledge intensive services contrasting with over-blown share of 'consumption' related service sectors in economy • Limited interaction between public/higher education research and business sectors. • Heavily polluted urban environment and congested (road) transport networks.	• Good potential for switch to renewable energy resources (photovoltaic, etc) and reduce energy consumption in housing and industrial sectors. • Unexploited potential to develop alternative transport modes (car sharing, greener public transport, cycling, etc). • Future requirements for improved waste management, etc. provide opportunity for job creation in recycling, re-use and 'urban mining'. • Potential for further expansion of creative industries sector.	• On-going urban sprawl and ageing stock of buildings and urban infrastructure. • Reduced levels of Structural Fund support in coming period and lack of regional agencies able to manage innovation and knowledge type measures. • Increasing taxation and costs of operating in Greece may lead to further off-shoring.
Central Macedonia	• Presence of certain sub-sectors industries with increased international competitiveness. • Significant mass of regionally based public and higher education research and technology organisations • Relatively unique, in Greece, private sector initiatives to develop 'innovation infrastructure' (incubators, clusters) • Pilot region at EU level with long-run history of planning and organising innovation policies, since 1994 Regional Technology Plan • Good degree of networking of regional institutions	• Research activity is concentrated in university laboratories, and it is fragmented among numerous small units without any specific clear industrial goal or connection • Innovation potential is highly concentrated spatially with a metropolitan, peri-urban and rural divide. • Limited self-financing capacity of regional SMEs for innovation activities • Fragmentation of innovation support activities and lack of co-ordination at regional and local levels	• Growing pressure to export may help to drive business innovation and an increased openness of the production system • Potential to promote Thessaloniki as an 'Open city': Metropolitan character, connections with the Greek and Balkan hinterland and the Black Sea region, • Good potential for health and health service related innovation • Opportunities to develop a more vibrant creative industries sector building on base of specialised services, cultural, etc. resources • Potential to diversify tourism offer towards higher-value added and 365 days a year attractions	• Further erosion of employment in sectors based on low-wage competition • Bureaucratic nature public initiatives to support innovation and entrepreneurship. • Unclear and changing institutional framework (taxation, management of research results, etc.) • Significant reduction of financial capacity because of the economic crisis. • Brain drain
West Greece	• Above average level of public/HEI investment in R&D • Significant concentration of researchers and scientists at the HEIs	• Low levels of business investment in product development and technological innovation. • Limited capacity to absorb	• Under-developed tourism potential • Cluster development still nascent • Shifting towards higher value added and speciality products in core	• Possible brain drain of HRST due to crisis • Region has few distinctive sectors or fields of specialisations compared to

Region	Strengths	Weaknesses	Opportunities	Threats
	and research centres • Significant transport and business infrastructure (industrial areas) and 'gateway' location conducive to attracting higher-value industries	technological advances and new knowledge in regional enterprises • Mismatch between the scientific and research orientation of the HEI and the economic specialisation of the region	regional industries	rest of Greece. • Already low business investment in innovation and life-long learning weakened by the financial crisis.
Crete	• R&D infrastructure well developed • Strong role of government and higher education in R&D • Good scientific quality in renowned R&D institutions • Strong knowledge creation capacity • Development of ICT practices	• Overall low level of R&D investments • Quasi inexistence of business investment in R&D • Economy focussed on small low-tech companies • Low level of patenting • Low level of high tech venture capital investments • Low level of science-business collaboration • Low level of education and life-long learning practices	• Increased participation in EU Framework Programmes for areas of scientific excellence • Increase absorptive capacity in region, especially in the two leading sectors of tourism and agriculture • Reorientate production towards higher value-added segments and introduce innovation in services • Address the needs of the local economy's most advanced segments • Increase economies of scale for firms and farms by increasing size and networking	• Economic specialisation in low-tech sectors (agriculture, tourism, trade) • Mismatch economic/scientific specialisation: low absorption capacities • Competition from low-costs economies • Brain drain
CentralMainland Greece	• Proximity of Greek capital city • Strong manufacturing sector • Presence of a university • Natural and renewable energy resources	• Dependence on Attica region • Strong sub-regional disparities • Specialisation in low tech activities • Low level of investments in R&D • Low level of regional research institutions • Low level of ICT diffusion • Low level of life-long learning • Lack of innovation culture within firms	• Modernisation of the agro-food sector and linkages with other sectors along the value chain • Promotion of environmental and energy saving technologies • Improved support to upgrading SMEs technological capacity • Explore synergies with other regions in terms of innovation infrastructure and technology transfer • Increased focus on tourism promotion	• Environmental depravation • Competition from low-cost economies • Further decline of agricultural sector
East Macedonia and Thrace	• Improving regional infrastructure (network of newly build roads linking the area with the rest of Greece, SEE and other EU countries) • Geographic location, at the crossroad of Europe and Asia, proximity of Thessaloniki • Presence of a regional university and TEI	• Low productivity and weak economic structure • Traditional economy based on labour-intensive activities in low-tech sectors (agriculture) • Very small average size of enterprises, leading to an inability to adapt to new developments in management, technology, market trends • Low level of overall investments in R&D, and in particular by businesses • Low level of ICT diffusion • Low level of education of the population and life-long learning	• Better match between scientific and economic specialisation • High renewable energy potential • Demand for ecologically produced agricultural products rising world – wide • Promoting synergies for the transfer of knowledge from higher education to the business community • Improved support to upgrading of SMEs technological capacity	• Brain – drain of highly qualified people towards the Athens, Thessaloniki and abroad • Competition from low-cost economies in traditional sectors • Decline of traditional manufacturing sectors • Degradation of the environment with energy highways posing risks for agro-tourism

Region	Strengths	Weaknesses	Opportunities	Threats
		practices • Low level of science-business collaboration • Lack of innovation culture within firms		
Thessaly	• Good quantity and quality of scientific production • Improving education level of the population • Presence of regional academic research capacities • Central geographic position • Mixed economic structure with niche in primary and manufacturing sector and tourism services	• Low R&D investment intensity notably by business sector • Traditional economic structure dominated by small low-tech companies • Low level of ICT diffusion and use • Low level of life-long learning practices • Low level of science-business collaboration • Lack of innovation culture within firms	• Opportunities for increased interaction between science-industry at regional level to develop new business niche through public-private partnerships (e.g. health, bio-energy, etc.) • Under-exploited agro-food and bio-economy potential • Potential for higher-value added tourism in both mountain, eco- and traditional coastal tourism	• Economic specialisation in low-tech sectors • Environmental degradation from unsustainable agricultural practices and manufacturing waste • Competition from low-cost economies • Brain drain
Epirus	• Good quantity and quality of scientific production • High level of HRST • Presence of regional academic research capacities with specialisation relevant to regional economy • Past experience in the development of regional innovation policies (RIS, RPIA, RISI, etc.). • Significantly better transport infrastructures for inter-regional connections • Rich and relatively well-protected natural and aquatic resources	• Quasi non-existent business R&D investments • Traditional structure of the economy, dominated by small low-tech companies • Remote, under-developed area • Low level of ICT diffusion • Low level of education of the population and life-long learning practices • Low level of science-business collaboration • Weak entrepreneurial and innovation culture in business sector	• Enhancement of the competitiveness of agriculture and tourism and increased focus on quality (e.g. green products) based on scientific specialisation • Increase coordination of national and regional policies to support ICT diffusion • Improvement and upgrading of infrastructure in the industrial areas and of support infrastructures • Improve support to upgrading of SMEs technological capacity • Potential for expanding renewable energy generation	• Economic specialisation in low-tech sectors (agriculture, tourism) • Competition from low-cost economies • Brain drain
Peloponnese	• Proximity to and good transport links to Athens • Advanced infrastructure networks • Natural resources (incl. for energy production) • Strong manufacturing base • Increasing level of human resources for science and technology	• Overall low R&D intensity and inexistent business R&D investments • Traditional structure of the economy based on small low-tech companies • Low level of ICT diffusion • Low level of education of the population and limited investment in life-long learning • Low level of science-business collaboration • Lack of innovation culture within firms	• Enhancement of the competitiveness of agriculture and tourism and increased focus on quality (e.g. green products) • Support to ICT diffusion • Improved support to upgrading of SMEs technological capacity	• Economic specialisation in low-tech sectors (agriculture) • Competition from low-cost economies

Region	Strengths	Weaknesses	Opportunities	Threats
		• Lack of entrepreneurship		
North Aegean	• Rich and relatively unspoilt biodiversity • Entrepreneurial culture (notably on Chios) • Natural advantages for tourism • Quality food and drink products with designated origin protection • University as both a means of attracting skilled students and graduates and of developing and diffusing technologies into regional firms • Regional government agencies (RF, IMA, planning department have establish good co-operation)	• Insularity leads to higher relative costs for businesses operating from the islands • Fragmented business structures with small size of firms and lack of a critical mass • Lack of quality business support services • Ageing population and continuing external migration and difficulty to retain graduates on islands • University remains largely disconnected from regional enterprises, even if there are ad hoc cases of co-operation.	• Under-exploited tourism potential notably from Turkey and other nearby non-EU countries • Under-utilised potential of clustering of regional firms (Mastic producers model has not been replicated by other sectors) • Rich potential for new products and services based on specific characteristics and culture of each of the islands • Relatively good level of digital network connection and improving usage of Internet potential.	• External migration leading to a brain drain; • Potential conflict between further development of tourism and island biodiversity • Regional development planning may continue to fail to take account of business needs and focus on infrastructure • Lack of experience in designing and implementing innovation type measures • Risk of continued lack of 'joined-up' regional development policy (across programmes and funds) and of mainstreaming of successful actions
West Macedonia	• Natural endowments • Level of education of the population rapidly growing • Presence (even if recent) of regional academic research capacities • Key player in the energy production sector	• Quasi inexistent R&D investments by businesses • Very low level of overall R&D investment • Traditional structure of the economy • Low level of ICT diffusion and use • Low level of life-long learning practices • No data on patenting activities • Low level of science-business collaboration • Lack of innovation culture within firms	• Better incentives for business investments in R&D activities • Increased coordination of national and regional policies to support ICT diffusion • Smart specialisation in the energy area • Improved support to upgrading of SMEs technological capacity • Attraction of foreign direct investments	• Economic specialisation in low-tech sectors (agriculture, tourism) • Pollution and environmental damages associated to mining activities and energy production • Brain drain
Ionian Islands	• Economic specialisation in specific manufacturing activities in addition to tourism activities • High-quality of life and biodiversity • Existing university with limited capacity but several laboratories carrying out research in informatics and historical and cultural heritage	• Low level of R&D and quasi inexistent business R&D investment • Economy based on small low-tech companies • Insular region with related cost, etc. disadvantages • Low level of ICT diffusion • Low level of education of the population and life-long learning practices • No apparent scientific specialisation in fields relevant for regional economy • Lack of innovation culture within firms	• Capture greater share of high-value added tourism (e.g. eco-/agro-tourism, expand capacity of cruise ships), etc • Enhance innovation in services, notably through better ICT diffusion • Improved support to upgrading of SMEs technological capacity • Potential for increasing renewable energy sources (off-shore wind, etc.) • Re-development of agro-food sector and exploitation of bio-diversity for natural products, including blue biotech potential	• Economic specialisation in low-tech sectors • Fragmented tourism offer, with inter-island competition • Competition from low-cost economies

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Region	Strengths	Weaknesses	Opportunities	Threats
South Aegean	• Relatively wealthy region • Natural and cultural environment • Rapidly expanding ICT diffusion • Presence of regional research capacities with one multi-campus university • Renowned tourism hotspot • Better level of patenting than Greek average • Several areas of regional economic specialisation	• Isolated area geographically fragmented • Lack of energy resources • Lack of R&D investments, in particular by businesses • Low level of education of the population and life-long learning practices • Low level of science-business collaboration • Lack of innovation culture within firms • Traditional structure of the economy focussed on low-tech sectors	• Better use of scientific outputs in businesses, in particular from natural sciences • Better science-industry collaboration and knowledge transfer • More focus on eco-innovation projects, eco-tourism • Improved support to upgrading of SMEs technological capacity	• Damages to the environment • Competition from low-cost economies

D.2 Overview of regional specialisation patterns

Region	Economic specialisation	Scientific specialisation	Potential innovation investment focus	Sectoral or technological priorities mentioned in draft regional strategies
Attica	• Services hub: – Trade, – Financial services, – Transport, – ICT, – Health and social services, – Real estate, – Recreation, – Research and business services • Medium to low technology manufacturing: – Food industry, – Metal products, – Chemicals and basic pharmaceuticals, – Textiles and shipbuilding • Main specialisation is in maritime transport, transportation and logistics	• Agricultural sciences • Medical and health sciences • Engineering • Natural sciences • Social sciences	• Few key sectors that have an integrating role for the regional economy: – Transport systems (including maritime and urban), – Knowledge intensive business services including architectural and engineering activities, technical consultancy and financial services – (Green) ICT as a source of new firms and to encourage efficiency improvements in the private and public sectors. • Should focus on how 'eco-innovation' could contribute to both boosting business potential and 'greening' the urban environment to make the metropolitan area more environmentally sustainable. • Optimism with respect to the development of the ICT and creative industries sectors with possibility to link 'media' sectors to the strong potential in education and latent design capacity	Attica 2020+ strategy: intends to focus on various sectors and 'emerging clusters': • 'Recovery' step: focus on the five largest sectors (tourism, retail, energy, construction and agriculture); while the food and beverage industry is seen as a critical sector with strong inter-sectoral linkages and export potential. • 'Renewal-change' step: build on and attract investments in "emerging" markets, e.g. in marine tourism; generic pharmaceutical products, fish farming, medical tourism, spa tourism, care for the elderly and the chronically ill, the creation of regional transit nodes, management of solid and liquid waste, focusing on specific food categories, creating international "hubs" for classical studies, etc. • 'Growth orientation' phase: targeted investment to reduce the carbon footprint, enhance agricultural residues to produce energy or feed, environmental management processing infrastructure, introduce innovations in the production process, development of robotic systems and stimulate patenting, etc. Criteria used for indicative selection of emerging industries: availability of resources required and/or raw materials, availability of specific expertise, existing infrastructure and geographical proximity to markets.

Region	Economic specialisation	Scientific specialisation	Potential innovation investment focus	Sectoral or technological priorities mentioned in draft regional strategies
Central Macedonia	Relatively specialised in: • Manufacture of other food products; • Other retail sale of new goods in specialised stores; • Maintenance and repair of motor vehicles; • Manufacture of tobacco products. Number of new knowledge-intensive sectors like bio-agriculture, bio-medicine, and ICT but still attract relatively limited investment.	University of Thessaloniki: • natural sciences; • medical and health sciences; • engineering and technology; • and to a small extent agricultural sciences and social sciences. TEI Thessaloniki: • natural sciences; • engineering and technology; • followed by medical and health sciences and agricultural sciences.	Three challenges/opportunities (Avranas & Nioras (2011)): • agro-biotechnology; • ICT; • health. Seven areas for knowledge intensive growth (Georgiou et al (2012)): • agriculture/nutrition; • re-industrialisation by boosting remaining manufacturing based on more knowledge-intensive industrial activity; • summer and winter tourism, • ICT cluster; • transport and logistics; • education; • health. Strong focus on eco-innovation would be relevant across both manufacturing, agricultural and service (green ICT and tourism) sectors. Improve efficiency of strong public sector base in the region through e-government, public-private partnerships for service delivery, etc.	• *Clusters of innovation:* Six potentially viable manufacturing clusters are proposed for further investigation: – (1) food, – (2) clothing and fashion, – (3) chemical and energy, – (4) building materials and household equipment, – (5) metallurgy, metal products, machinery and equipment, – (6) electronics, electrical appliances and ICT. • *Targeted technology platforms:* Proposed technological platforms include – (a) broadband networks, – (b) energy, – (c) materials, – (d) food technology, and – (e) logistics.
West Greece	• Transport hub • Primary sector: significant source of employment and commercial activity, but uncompetitive. • Manufacturing activity mainly concentrated in the sectors of food and drink, clothing, the wood-cork industry, metal products and construction.	University and Technical Education Institute of Patras: • Natural sciences • Engineering and technology	• Scientific specialisation in line with industrial specialisation: Regional strengths and weaknesses appear to be broadly identified and understood. • Identify emerging clusters, exploring the potential for greater inter-sectoral co-operation (e.g. speciality food and drink products related to tourism networks, etc.) or cross-cutting technologies that could be applicable to more traditional business services.	• Regional innovation strategy not described The Regional Operational Programme (2012-2014) targets mainly existing (traditional) production sectors: • Restructuring of productive sectors towards higher value-added services incorporating the developments in technological progress and innovation, • Development high level of synergies between the three production sectors, Whereas programmes in the recent past (Regional

Region	Economic specialisation	Scientific specialisation	Potential innovation investment focus	Sectoral or technological priorities mentioned in draft regional strategies
	Relatively specialised in: • Sale, maintenance and repair of motorcycles and related parts and accessories, • Sea and coastal water transport; • Growing of crops and mixed farming.			Innovation Pole, Integrated Strategic Plan for Innovation) were targeting emerging technology-intensive sectors.
Crete	• Trade and Tourism represents 38% of the regional added value, financial services 15.8%, industry and construction 13.8%. • Primary sector: smallholdings focused mainly on olive and wine production. • Main regional manufacturing activities: processing and packaging of agricultural products, food and beverages, non-metallic mineral products, metallic products, plastics and chemicals • Highly specialised in the renting of automobiles; growing of crops, market gardening, horticulture; and hotels	UOC: • natural sciences • medical and health sciences TUC: • natural sciences • engineering and technology FORTH: • natural sciences • medical and health sciences • engineering and technology	• Establishment of the knowledge infrastructure disregarded the region's existing economic specialisation and potential. • Synergies between the scientific and economic potential have been developed only in agriculture and food. • By contrast, no strong links have been developed in areas where scientific excellence has been developed, i.e. biotechnology, ICT, laser, astrophysics, materials technology and life sciences, if one excepts the strong cooperation with the local public health sector. • While a sectoral focus on agro-food, tourism, etc. can be justified, a main priority should be given to integrating key enabling technologies and seeking out opportunities of a cross-sectoral nature (e.g. at the interface of ICT, cultural heritage and tourism; or 'blue-biotech' opportunities related to energy or food production, etc.). • Need for a significant programme of innovation management support and technology investment in more traditional sectors, which have a good export potential.	Initial proposals for the 2014-20 programming period, emphasis placed on: • The agro-food sector (production, packaging, food processing, Mediterranean diet), • The cultural-tourism sector (hospitality, travel agencies, cultural capital, cultural activities), • And the technological educational sector (research centres, universities, technology park) and its connection to the other two sectors These strategic priorities are broadly in line with the national and European policy guidelines, are outward looking and have a strong focus on restructuring and diversification of in the main regional business sectors.
Central Greece	Relatively specialised in: • Manufacture of vegetables	• Very low level of regional R&D activity, no real	• Need to better integrate and support a more balanced development of the economy through a search for cross-sectoral opportunities for	• Priorities for the forthcoming 2014-2020 period for research, innovation, digital convergence and

Region	Economic specialisation	Scientific specialisation	Potential innovation investment focus	Sectoral or technological priorities mentioned in draft regional strategies
	and animal oils and fats, • Manufacture of tubes, mining of non-ferrous metal ores • Manufacture of cement, lime and plaster	scientific specialisation	applying key enabling technologies, notably energy saving and ICT. • Create opportunities for diversification and discovery of niche markets in manufacturing, local agricultural products, and the valorisation of natural resources (bauxite, thermal springs, mountainous regions). • Need to focus on the agro-food industry as a key business sector with potential for greater synergies with the primary sector (agriculture) and service sector (tourism) as well as on the application of environmental and energy saving and ICT technologies in existing businesses • Efforts should aim at improving the access of regional firms to know-how and expertise located in neighbouring regions, while reinforcing or developing a small number of regionally based R&D and technology teams aligned with regional technological needs	SME support not clearly set yet. Operational Programme of Thessaly, Central Greece, Epirus 2007-2013: • Not really sector specific: • One aim is to achieve higher competitiveness through the re-organisation of the production base and the upgrading of sectors and branches towards higher added value, quality and environmental sensibility,
East Macedonia and Thrace	• High share of primary (agriculture) sector in the economy and important service sector • Essentially low-tech manufacturing sector but some technology intensive industries in chemicals and the manufacture of machinery and equipment located in the region Most specialised in: • Cutting, shaping and finishing of ornamental and building stone; • Manufacture of accumulators, primary	DUOTH: • Medical and health sciences • Natural sciences • Engineering and technology • Social sciences • Agricultural sciences TEI Kavala: • Natural sciences • Engineering and technology	• Scientific specialisation does not match well with the industrial specialisation • Emerging potential sectors include energy and to some extent niche ICT activities. • Should seek to better identify potential linkages between a number of the main industrial groups located in the region (e.g. examining the potential for 'industrial symbiosis') and focus on identifying opportunities for investing in new higher value added niche (e.g. functional foods, specialist textiles, etc.) and on integrating specific critical technologies into the production or service delivery processes (ICT, etc.) in existing manufacturing sectors. • Suggestion (MIRIAD) of a diversification of the primary production towards greater specialisation combined with the introduction of	Regional Development 2014-2020 report (draft provisional version): • Turn agricultural production into new dynamic products • Utilisation of geothermal energy in agricultural production • Strengthening of high-tech clusters • Promotion and integration of innovation in agricultural production, in products and in production processes • Enhancing access, use and quality of information and communication technologies • Enhancing the competitiveness of SMEs, the agricultural sector and fisheries and aquaculture

Region	Economic specialisation	Scientific specialisation	Potential innovation investment focus	Sectoral or technological priorities mentioned in draft regional strategies
	cells and primary batteries; • Manufacture of tobacco products, • Animal farming; • Growing of crops.		agro/biotechnologies and synergies with other sectors like life-sciences and environmental technologies towards the combined promotion of pharmaceuticals, specialised foodstuff, health and different types of tourism as a clustered composite product/service.	
Thessaly	• Tertiary sector: essentially tourism, retail and wholesale trade and transportation services. • Manufacturing sector: medium to low technology sectors, such as food and beverages, textiles and wearing apparel, manufacture of furniture, manufacture of wood and of products of wood, manufacture of basic metals and manufacture of fabricated metal products. Relatively specialised in: • Manufacture of structural metal products, cement, lime and plaster: • Maintenance and repair of office, accounting and computing machinery	UTH: • Medical and heath sciences; • Natural sciences. TEI Larissa: • Natural sciences; • Engineering and technology; • Agricultural sciences.	• The two HEI do have some degree of specialisations in technologies relevant for the regional business structure as well as emerging fields of specialisation. • Past initiatives in Thessaly have focused on the agro-food sector and related industries and the value chain links to agriculture. • The regional specialisation pattern is relatively diversified and other sectors such as metal production and construction materials are also important and should be considered. • Need to enhance competitiveness of regional firms in a cross-sectoral manner through improved integration of key enabling technologies, notably ICT. • Strengthening the access of regional firms to knowledge intensive business services should also be considered as a priority since this would help to foster an overall enhancement of non-technological innovation (design, marketing, etc.).	Strategy developed by the Region of Thessaly: • Limited set of targeted priorities which however do not correspond to the regional productive structure and needs; • Moreover, they do not seem to have the consent of the regional stakeholders.
Epirus	• Main regional services activities: transport, financial intermediation, tourism, health, education and trade • Highest share of employees in 'growing of	UOI: • Natural sciences • Medical and heath sciences • Some activity in engineering and	• Regional scientific specialisation is more in line with regional needs than in some other Greek regions, with a number of specialised centres (notably in agro-food technology). • Home to a number of food and natural resource based businesses and growth potential of alternative tourism (eco-tourism, etc.) is	Proposal of the Region of Epirus for the Priorities of the National Development Strategy 2014-2020: • Strengthening research, technological development and innovation: – Primary sector (farming, aquaculture); secondary sector (processing, packaging, partnerships, promotion); tertiary sector

Region	Economic specialisation	Scientific specialisation	Potential innovation investment focus	Sectoral or technological priorities mentioned in draft regional strategies
	crops, market gardening, horticulture' But main fields of relative specialisation: • Site preparation; • Bars; • Animal farming; • Manufacture of dairy products and mixed farming. Renewable energy sector, particularly wind and hydro-power, growing in importance	technology TEI Epirus: • Natural sciences • Agricultural sciences	recognised. • Should focus future innovation investment in developing 2-3 core competencies relevant to the regional economy: – R&D extension services for the dairy industry and other agro-food firms, – ICT technologies and their application in improving regional health and tourism services and manufacturing production and, – Technology know-how related to environmental protection and sustainable exploitation of the natural biodiversity. • Technology needs of production sectors should be defined, as well as the routes that will make these technologies available to companies.	(tourism, culture); environment (management and protection) – Development of qualitative and export-oriented agricultural production and aquaculture – Development of specific forms of tourism
Peloponnese	Relative industrial specialisation in: • Crop production, market gardening, horticulture; • Tobacco products, refined petroleum products; • Mixed farming; and mining and agglomeration of lignite; • Processing and preserving of fruit and vegetables.	UOP: • Natural sciences • Engineering and technology TEI Kalamata: • Natural sciences	• Scientific focus in natural sciences coherent with regional economic specialisation. • Suggestion to combine – (1) Targeted cluster programmes for agro-food, tourism and manufacturing sectors and – (2) Cross-sectoral support for technological upgrading by identifying key enabling technologies important to the regional business sectors. • Need of capability building for design and development of new products in major regional productive sectors, namely agriculture, food and drink industry, and tourism.	Current OP 2007-2013: • Actions will be focused mainly on characteristics and needs of the productive fabric of the region: mainly very small size, lack of integration of new technologies, administrative and manufacturing flaws and direct or indirect connection with: – (1) Agriculture, – (2) Construction and – (3) Tourism sectors. • Innovation policy orientations of the Regional Authority: – Broadband connectivity, – Euro-Mediterranean institute of marine wind energy, – Green economy and waste management, – Creation of special economic zones.

Region	Economic specialisation	Scientific specialisation	Potential innovation investment focus	Sectoral or technological priorities mentioned in draft regional strategies
North Aegean	Relatively specialised in: • Bars; • Sea and coastal water transport; • Manufacture of builders' carpentry and joinery; • Provision of services to the community as a whole.	University of the Aegean: • Natural sciences • Engineering and technology • Social sciences	• Scientific specialisation does not match the industrial specialisation, which mainly focuses on services. • There is a clear logic in building on and extending past efforts to 'brand' the islands as 'sustainable' and to implement innovative solutions to tackle insularity and protect biodiversity while exploiting the potential for new higher value added products and (tourism) services based on the natural environment. • Potential comparative advantage in focusing future research and innovation actions co-financed on maximising the potential of the 'bio-economy'.	• Current ROP: no real focus on innovation and knowledge-based development priorities and only marginal levels of funding allocated directly to digital convergence and entrepreneurship. • Insufficient attention is paid to supporting entrepreneurship and the innovation capabilities of SMEs.
West Macedonia	• Important electric energy production centres • Manufacturing base in traditional sectors, including marble, saffron, fruits, local wines, furs and specialised arts and crafts. Significantly specialised in: • Mining and agglomeration of lignite, • Dressing and dyeing of fur; manufacture of articles of fur; • Production and distribution of electricity; • Mining and agglomeration of hard coal. Biggest regional employer is the growing of crops, market gardening and horticulture.	UOWM and TEI West Macedonia: • Natural sciences • Engineering and technology Scientific specialisation is limited and focused essentially on energy technologies.	• Scientific specialisation in line with a main player in the regional economy, the public power company, and with the push to develop renewable energy • Despite this focus, the region has not managed to create a competitive advantage and is trapped in a vicious circle where efforts towards differentiation and development in the energy sector have reinforced the dominance of the public sector. • The RIS3 strategy should not focus exclusively on energy industry/technologies, but needs to adopt a more diversified approach building on existing clusters of business activity and seeking to shift such 'niche' into higher-value added activities with a strong focus on export driven growth.	Operational Programme of West Macedonia 2007-2013: • 1) the creation of conditions for the differentiation of the rather dependent on the energy sector production base, and adaptation of local standards and • 2) the improvement of existing services to citizens with a parallel exploitation of ICT.

Region	Economic specialisation	Scientific specialisation	Potential innovation investment focus	Sectoral or technological priorities mentioned in draft regional strategies
Ionian Islands	• Tourism oriented economy Most specialised in: • Manufacture of tanks, reservoirs and metal containers; • Manufacture of central heating radiators and boilers; • Maintenance and repair of motor vehicles; • Sea and coastal water transport; • Renting (repair) of personal and household goods.	• Given the low level of scientific activity of the Ionian University and the Technical Education Institute of the Ionian Islands, it is impossible to identify a scientific specialisation	• Heavily specialised in tourism activities. • Inter-connected with the tourism sector is the bio-economy, both on terrestrial natural resources and biodiversity (with a potential for reinvigorating the agricultural sector through the production of new crops and a focus on designated origin, etc. products) as well as aquatic resources (blue-biotech). • Marine energy potential: at a nascent stage but efforts to reduce the islands cost basis through increased use of wind, solar and possibly tidal energy. • Innovation policy should focus on the major production complex of the Region, the "agro-food + gastronomy + hospitality + tourism" complex and identify technologies that can enhance regional competitive advantages. • Stakeholders from the private sector and academia have already elaborated ideas for new business opportunities in the field of bio-agriculture, food production with anti-oxidant properties, food preservation by essential oils, use of yeast-fungi in wine production, anti-oxidant olive oil. These initiatives should be further analysed and documented. • Information technologies targeted on tourism and the environment is also a promising area and can provide opportunities for regional growth.	Operational Programme of Ionian Islands 2007-13: • Support of business by promoting specific forms of tourism, the qualitative upgrade of services, and the adoption of quality standards • Support of businesses to introduce new technologies, encourage the absorption of innovative practices and ideas • Support to the modernisation of existing activities in tourism, services including trade, and processing. • Promotion of innovative projects and practices stemming from the Regional Innovative Actions Programme implemented during 2000-2006. • Promotion of new integrated pilot projects on strengthening regional identity and sustainable development.
South Aegean	• Tourism most important regional sector followed by trade, transportation services and real estate activities. Relative industrial specialisation in: • Building,	University of the Aegean: • Natural sciences • Engineering and technology • Social sciences	• The limited scientific specialisation of the region does not match the industrial specialisation. Region specialised in rather low tech sectors. • Regional specialisation should focus on cross-sectoral technology upgrading and adaptation of production processes to reduce energy use, reduce material input and waste generated; in addition to building higher value added products	• The innovation policy proposed is focused on the productive fabric and the use of ICTs. • Focus on tourism as main export productive sector, but also look for diversification and enlargement of the regions' productive base.

Region	Economic specialisation	Scientific specialisation	Potential innovation investment focus	Sectoral or technological priorities mentioned in draft regional strategies
	• Retails sale of new goods in specialised stores, • Repair of personal and household goods • Activities of travel agencies and tour operators, tourist assistance activities. • Fishing, • Quarrying of stone, • Hotels and restaurants. These sectors also account for a high share of employment and an important share of the regional added value.		and services in sectors connected to tourism • Clearly other forms of tourism than summer tourism, taking place all year round, should be considered. Technologies to focus should include: – (1) ICT and digital media, – (2) Creative services for marketing and promotion, – (3) Organic food production and foods for healthy living, – (4) Green energy, and – (5) Smart city technologies.	

Appendix E Greek participation in FP7

E.1 Overview of participation and funding per sub-programme

EU funding to Greece under FP7

		FP7 (up to date - 18/10/2012)		FP7 (up to date - 18/10/2012)	
Country code	Country name	No. Participations	% of total FP participations	EC financial contributions	% of total EC contributions
EL	Greece	2590	2.85%	719,506,043	2.44%

Breakdown of Greek FP7 participations, by type of organisation

		FP7					
Country code	Country name	Public body (excluding research and education) (PUB)	Private for profit (excluding education) (PRC)	Higher or secondary education (HES)	Research Organisations (REC)	Other	Total
EL	Greece	59	708	834	945	44	2590
Share of Total		**2%**	**27%**	**32%**	**36%**	**2%**	**100%**

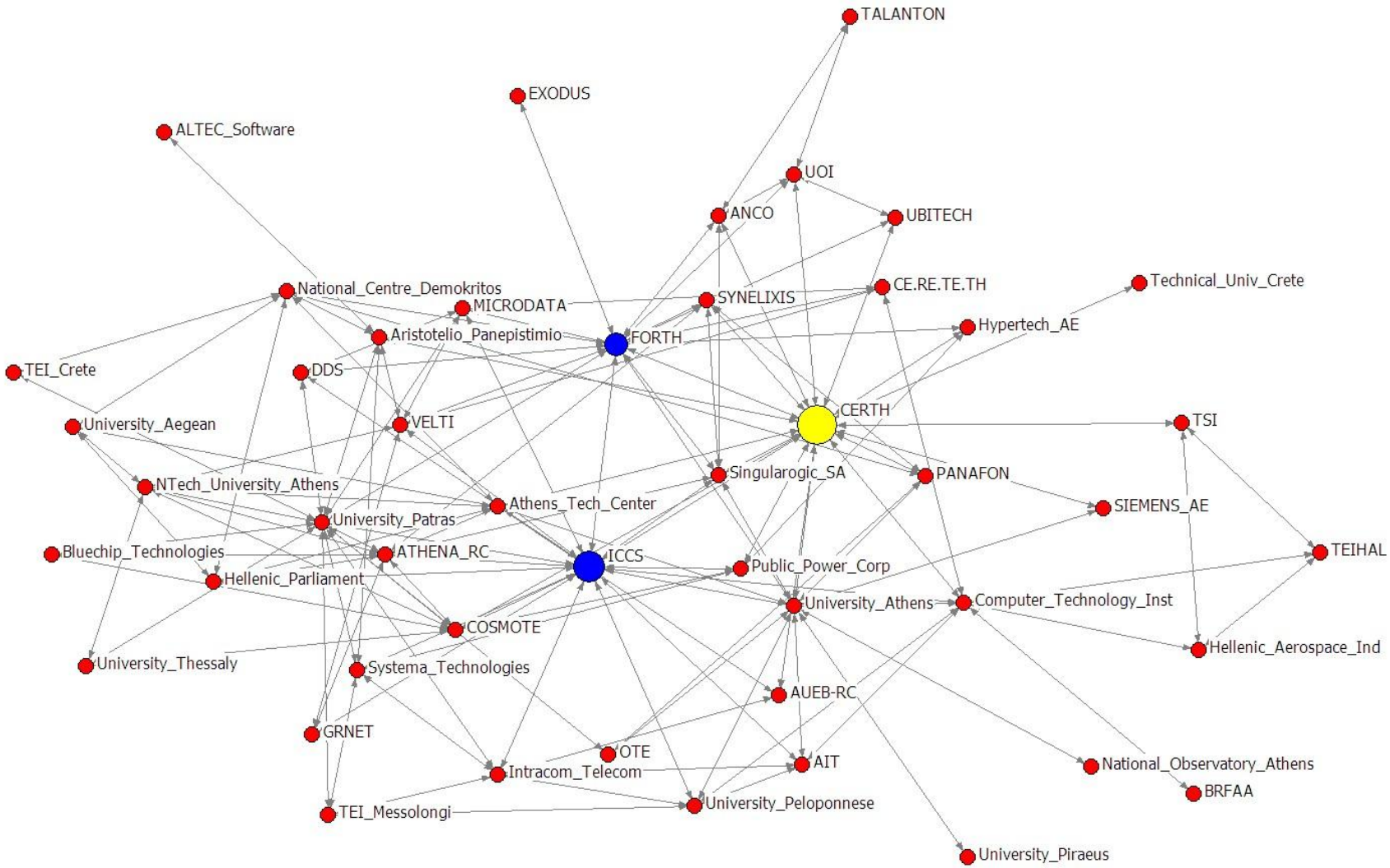
Greece FP7 participations and EC funding by type of instrument

FP7	Participations	EC funding	Participation share	EC funding share
Collaborative Projects (CP)	1510	484,457,545	58%	67%
Networks of Excellence (NOE)	38	9,228,811	1%	1%
Coordination and Support Action (CSA)	469	97,821,101	18%	14%
Marie Curie Actions (MCA)	307	60,581,668	12%	8%
Research for the Benefit of Specific Groups (BSG)	237	26,441,690	9%	4%
Support for Frontier Research (ERC)	29	40,975,229	1%	6%
Total	**2590**	**719,506,043**	**100%**	**100%**

Greece FP7 participations and EC funding, by priority area (up to 18/10/2012)	Greece				EU27				Differences share participations	Differences share EC funding
Priority Area	Participations	EC funding	Participation share	EC funding share	Participations	EC funding	Participation share	EC funding share	Greece vs EU27	Greece vs EU27
Health	107	34,696,725	4%	5%	8,439	3,453,215,226	9%	12%	-5%	-7%
Food, Agriculture, and Biotechnology	134	24,813,702	5%	3%	6,160	1,416,595,686	7%	5%	-2%	-1%
Information and Communication Technologies	657	230,774,548	25%	32%	15,842	5,518,957,247	17%	19%	**8%**	**13%**
Nanosciences/technologies, Materials and new Production Technologies	164	47,408,374	6%	7%	7,155	2,220,548,311	8%	8%	-2%	-1%
Energy	84	31,749,658	3%	4%	2,892	1,087,575,419	3%	4%	0%	1%
Environment (including Climate Change)	149	32,746,337	6%	5%	5,584	1,296,650,720	6%	4%	0%	0%
Transport (including Aeronautics)	209	43,255,678	8%	6%	6,659	1,774,310,530	7%	6%	1%	0%
Socio-economic sciences and Humanities	28	6,521,816	1%	1%	1,848	366,875,766	2%	1%	-1%	0%
Space	40	8,012,247	2%	1%	1,726	477,040,674	2%	2%	0%	-1%
Security	88	25,817,936	3%	4%	2,314	764,145,675	3%	3%	1%	1%
General Activities (Annex IV)	5	526,855	0%	0%	171	264,287,984	0%	1%	0%	-1%
European Research Council	30	41,125,229	1%	6%	3,275	4,598,780,536	4%	16%	-2%	-10%
Marie-Curie Actions	355	62,449,767	14%	9%	13,561	3,142,258,419	15%	11%	-1%	-2%
Research Infrastructures	144	33,281,340	6%	5%	4,564	1,330,485,056	5%	5%	1%	0%
Research for the benefit of SMEs	248	27,463,467	10%	4%	5,993	801,738,704	7%	3%	3%	1%
Regions of Knowledge	24	2,101,236	1%	0%	733	83,860,585	1%	0%	0%	0%
Research Potential	40	56,707,401	2%	8%	266	266,349,674	0%	1%	1%	7%
Science in Society	36	4,292,434	1%	1%	1,329	183,375,440	1%	1%	0%	0%
Coherent development of research policies	2	220,130	0%	0%	105	24,799,348	0%	0%	0%	0%
Activities of International Cooperation	36	4,701,385	1%	1%	885	115,860,738	1%	0%	0%	0%
Fusion Energy	3	108,428	0%	0%	64	4,998,981	0%	0%	0%	0%
Nuclear Fission and Radiation Protection	7	731,349	0%	0%	1,332	240,022,420	1%	1%	-1%	-1%
Unknown							0%	0%	0%	0%
Total	**2590**	**719,506,043**	**100%**	**100%**	**90,897**	**29,432,733,139**	**100%**	**100%**		

Source: Data from E-corda, analysis by Technopolis Group

E.2 Social Network Analysis of FP7 ICT Greek participants



Source: Data from E-corda, analysis by Technopolis Group