Pockets of excellence with innovation potential

A study for the European Commission DG Research & Innovation, Unit A6 - RISE Team

Alasdair Reid, Paresa Markianidou, Agis Evrigenis
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Contents

EXECUTIVE SUMMARY

Defining Pockets of Excellence

The term pockets of excellence (PoE) has been used, previously, to refer to specific departments or units in 'teaching universities' that manage to compete with recognised research universities that have top researchers across the board". In a similar vein, but from a regional perspective, a region may not stand out in European wide-rankings in terms of economic performance but may contain one or more 'scientific' pockets of excellence. There is however a significant risk that PoEs remain 'enclaves' (linked externally to other 'pockets of excellence but with limited or non-existent local knowledge spillovers) rather than a spark for developing new innovation driven activities.

Method to identify pockets of excellence

In order to test, the extent to which regional research and innovation eco-systems are (or have a potential) to contribute to growth, the methodological framework is structured in three steps:

(1) Identify potential pockets of excellence (PoE) where research and/or innovation performance is relatively higher (or growing relatively faster) than in other less favoured regions (nationally or across EU13).

(2) Assess the extent to which the PoE (region, specific public, academic or industrial units or groupings in a PoE region) is linked to or has a potential to contribute to the regional smart specialisation priorities.

(3) Assess the potential for co-operation and synergies in specific specialisation areas amongst PoE intra- or inter-regionally or existing or potential links between PoE in one region and other 'structurally similar' regions.

Identification of 'localised' pockets of excellence

From a policy point of view what is relevant is the extent to which PoEs are already or may have the potential to drive future growth in less favoured regions. In this context, the main emphasis is likely to be on regions where a PoE may be already a factor explaining higher 'innovation performance' or where there may be potential for a PoE to contribute more to enhancing economic performance and in regions, where PoEs may be highly performing but represent an outlier in the system so that the high scientific performance of one or two organisations is not sufficient to influence overall region performance.

Linkages between scientific fields of excellence and technological /business specialisation

Some PoEs may provide insufficient potential for knowledge spillovers to the regional economy so that their contribution needs to be considered in a more indirect way (e.g. suppliers in regional economy, etc.). To be able to capture direct and indirect contributions to RIS3 a broad analytical framework is required including: 1) Technological and non-Technological skills, 2) regional synergies between research, innovation and economic policies and 3) markets.

Potential for co-operation and synergies

The potential for PoE in less favoured regions to be linked to PoE in other regions (less developed or more developed) to mutualise and complement capabilities (given the fragmentation that Bonaccorsi has pointed out) can be examined in terms of areas of specialisation and relevant regions. Three different cases can be conceptualised and empirically tested:

1. structurally similar regions with similar RIS3 priorities
2. convergence regions and structurally similar regions with past co-operations
3. convergence regions and structurally similar regions with expertise related to similar RIS3 priorities. The following leading indicators are selected: Technological skills (Patents); Regional synergies between research, innovation and economic policies (FP7 projects); hotspots of sectoral clusters (Clusters); Markets/Targets (Regional Economic base, specialisation - employment based).

The case of Crete

Crete as a PoE region in Greece and Europe & Cretan PoEs

Crete qualifies as a potential pocket of excellence region within Greece as a result of its science and technology performance and as a potential PoE region within Europe due to overall innovation performance (the composite proxy of innovation). Based on a preliminary analysis, Crete has several potential PoEs either primarily due to scientific performance such as the university of Crete or particularly due to their linkages with industry such as the telecommunications systems institute, the technological educational institute of Crete, and its centre for technological research or as a combination such as FORTH or the technical university of Crete.

Crete's PoEs linkages and potential to contribute to RIS3 priorities

Crete's PoEs linkages and potential to contribute to RIS3 priorities is demonstrated as follows:

- Patents in technology fields correspond to the research activities in advanced technologies performed by Cretan RPOs (demonstrated also by peer reviewed publications and reviews) and strategically chosen in Crete's RIS3.
- Past funding allocated by SF to regional organisations reflects RIS3 priorities particularly with respect to the Cultural Tourism complex and the Environmental complex. The support to businesses as expressed by "other investment in firms" or "advanced support services for firms and groups of firms" could partially be linked to the knowledge complex but it is expected that investments and support are often provided to non or low knowledge intensive activities. Compared to the previous programming period Firm investment is no longer allocated the highest budget and it appears that more resources are being allocated to the environmental complex. The knowledge complex is partly represented by the categories on support to business by making an explicit link to innovation activities and entrepreneurship.
- Under FP7 and Horizon 2020 prevalent thematic areas in rejected proposals of Cretan affiliations correspond to RIS3 priorities. Under FP7, the primary thematic area for which Cretan affiliations were positively evaluated but finally rejected is "Information and Communication Technologies", "Environment (including Climate Change)". Under Horizon 2020 its the European Research Council which covers excellent science impacts Crete's Knowledge complex. Whether funding gaps are increasing as a consequence, particularly accounting for the fact that Greece is a country relying on EU funding for RI, requires further investigation. It is for example possible that those proposals get funding from other EU funding schemes such as COST, COSME etc. It can also be possible that by looking at the individual projects the link to RIS3 becomes less direct varying in its degree of relevance.
- Finally, according to structural business statistics on employment from Eurostat (at least for the available sectors in NACE rev.2) Crete is an economy specialised in 'Agriculture, forestry and fishing' and 'Wholesale and retail trade, transport, accommodation and food service activities'. The regional economic base is thus coherent with the RIS3 priorities, the Agrofood and Culture and Tourism complexes respectively.

Potential for co-operations and synergies between Crete and other relevant regions

In terms of the Potential for co-operations and synergies between Crete and other relevant regions we distinguish the following cases:

- Structurally similar regions with similar RIS3 priorities: The assumption is that co-operation and synergies are more likely to occur between regions with similar specialisation objectives. The basis of the analysis is hence regions' RIS3 priorities. The areas of potential co-operation are those that correspond to the priorities set by Crete. The regions with which cooperation and synergies may be sought are among those structurally similar regions with similar RIS3 priorities. The results point to several non-Greek regions in Southern European countries (Italy, Spain and Portugal).

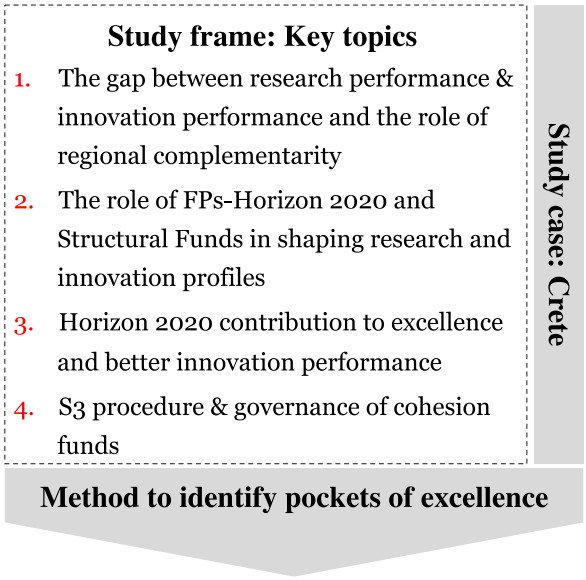
- Convergence regions and structurally similar regions with past co-operations: The assumption is that co-operation and synergies are more likely to occur in areas and among regions that have already been co-operating in the past. Existing linkages between regions partly demonstrate common objectives and facilitate further and broader co-operation. Results show Cyprus, Southwest Planning Region, Estonia, Norte, Andalucia as top 5 non Greek top collaborators.
- Convergence regions and structurally similar regions with expertise related to Crete's RIS3 priorities: The assumption is that co-operation and synergies are more likely to occur in the areas of specialisation of PoEs and other convergence regions in order to strengthen their collective presence in the European market.
    - Patent results point to potential co-operations/synergies in areas aligned with Crete's RIS3 priorities between Crete and regions in: Hungary and the Czech Republic in Biotechnology; Greek regions, the Czech Republic and Slovakia in environmental management; Portugal, Bulgaria and other Greek regions in Nanotech.
    - FP7 results obtained show a great number of regions specialising in various thematic areas. By matching FP7 thematic areas to Crete's RIS3 priorities i.e. the RIS3 complexes the results obtained point to ICT and Research for the benefit of SMEs as the thematic areas with the vastest range of other specialised regions. On the other hand, the agro-food, environmental and knowledge complexes appear to be less relevant with hence less evident potential for co-operations and synergies besides possibly Portugal in the case of environment.
    - Employment results show that areas of potential cooperation and synergies between convergence regions and Crete can be found in the sectors of 'Agriculture, forestry and fishing' and 'Wholesale and retail trade, transport, accommodation and food service activities'. There are in fact a great number of regions specialised in the latter two sectors.
    - *Finally, potential for co-operation and synergies can also be investigated through cluster based linkages. According to the European Cluster Panorama there are 16 sectoral clusters in Crete and one cross-sectoral cluster in environmental industries. The sectoral clusters are linked to RIS3 priorities particularly the environmental, agrofood and cultural tourism complexes. Potential co-operation and synergies could thus be explored with those convergence regions which either qualify as hotspots of sectoral clusters or cross sectoral clusters matching Crete's clusters.*

1. INTRODUCTION: SCOPE AND OBJECTIVES

Pockets of excellence (PoE) are defined as: *local or regional research or innovation eco-systems, in countries with an overall weaker R&I system, which prove capable of driving regional growth and of linking up to top-European research networks*. In order to inform the work of the Research, Innovation, and Science Policy Experts (RISE) High-level expert group (HLG), the European Commission's Directorate-General for Research and Innovation (DG R&I) awarded Technopolis Group a contract for a study on Pockets of excellence with innovation potential (invitation to negotiate, № PP-03481-2015). The preliminary findings of the study were presented at a RISE High-Level Workshop on "The impact on Smart Specialisation Strategies on Pockets of excellence and Regional growth" co-organised by the Minister of Research and Innovation in Greece and the RISE experts group, in Heraklion, Crete (7-8 October 2015).

This report has three broad objectives as summarised in Figure 1.

Figure 1: Overview of study objectives



Firstly, the study proposes a methodology to identify pockets of excellence using available data sources and existing tools (including the Regional Ecosystem Scoreboard, the Regional Competitiveness Index) and data from the Commission services on regional projects and applications submitted under the previous 7th research framework programmes (FP7) and the current Horizon 2020, on the one hand, and the European Structural and Investment Funds (ESIF), on the other.

Secondly the study explores the potential for synergies between Horizon 2020 and Structural Funds within pockets of excellence by using the case of Crete as a case study. More specifically the study:

- suggests potential areas for complementarity and cooperation between Crete and regions with similar specialisation patterns. Relevant regions are identified based on Crete's RSI3 main topics and
- identifies which proposals related to Crete's "pockets of excellence" have been positively evaluated but not funded in FP7 and Horizon 2020 Work Programme 2014-15, and will assess the link between these "pockets of excellence" and Structural Fund support allocated to Crete.

Thirdly, the study addresses a number of questions related to so-called 'pockets of excellence' to prepare the ground for a policy discussion with stakeholders:

- What is important for these "pockets of excellence" to succeed passing from research performance to innovation performance? How can complementarity between the regions with similar specialisation pattern help remove this gap?

- What has been the role of past research framework programmes (FPs) and the current Horizon 2020 and European Structural and Investment Funds (ESIF) in shaping the research and innovation profile of the pockets of excellence? Can more synergies be created to enhance the "pockets of excellence" with the use of other forms of European financial support?

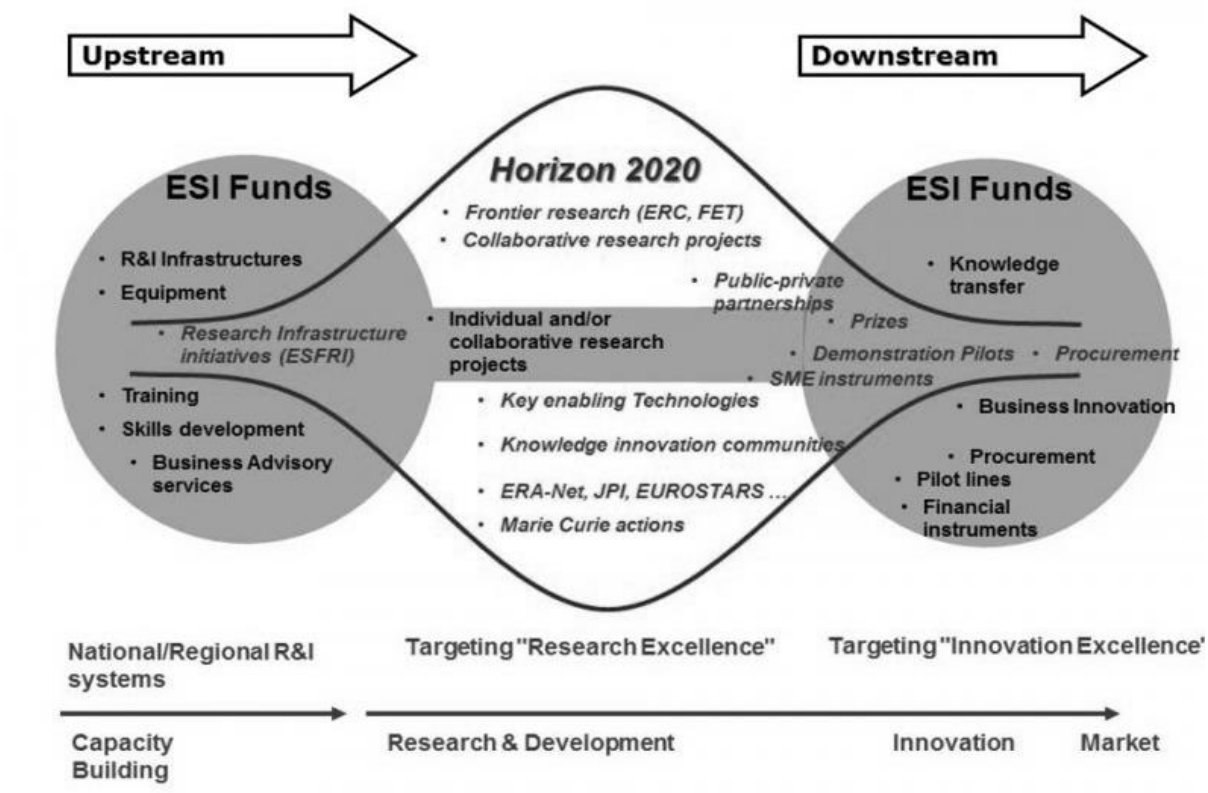
- How are existing Horizon 2020 programmes dedicated to spreading excellence and widening participation contributing to excellence and better innovation performance?

- What is the impact of the S3 procedure on governance of cohesion funds? Will it help improve governance, or rather cause further complexity for the system?

2. THE POLICY CONTEXT: UP STAIRWAYS TO POCKETS OF EXCELLENCE

ESI Funds (ESIF) have been investing in research and innovation in less-favoured regions[1] over two decades with little discernible impact in terms of convergence in innovation performance (Regional Innovation Scoreboard 2014). In the decade since 2004, the accession of southern and Central and Eastern European Member States has reinvigorated the debate on the extent to which investment by ESIF on research and innovation help less favoured regions to climb a "**stairway to excellence**".

Figure 2: Stairway to excellence concept 2014-20



Source: http://s3platform.jrc.ec.europa.eu

[1] Generally defined as regions with less than 75% of the average EU GDP per capita

The hypothesis is that ESIF funding 'upstream' helps build 'capacity' that improves access of regional research performers to competitive funding (e.g. national programmes, Horizon 2020) and helps 'open' regional innovation systems to international networks. Overtime, the 'scientific excellence' built up in the 'upstream' phase of ESIF funding may translate into enhanced regional innovation performance, through knowledge transfer (licensing technologies to regional firms, skilled people, etc.), creation of new technology based firms or by generating attracting research/innovation intensive (foreign direct) investment.

However, it is important to underline that pockets of 'scientific excellence' in one or more higher education or research institutes located in a region does not itself guarantee a direct impact on regional competitiveness. In some cases, the 'pockets' may be very well linked 'inter-regionally' or internationally but may operate in 'splendid isolation' from the regional innovation system.

Moreover, the regional innovation paradox concept stresses the contradiction between the comparatively greater need to spend on innovation in less favoured regions and their relatively lower capacity to absorb public funds earmarked for the promotion of innovation and to invest in innovation related activities, compared to more advanced regions (Oughton et al., 2002). Muscio et al, 2015 found only limited evidence of 'catching-up' in the Eastern European (EE) regions and tended to confirm the existence of the 'regional innovation paradox'. In particular, the authors found that:

- A 1% increase in ESIF spending on research & innovation (R&I) leads to a 7% growth in value added per capita grows.

- FP6 grants drove growth moderately considering funding relative to the stock of researchers per region.

- However, ESIF support had a lower effect on growth in EE regions than in other EU regions and FP6 funding did not have a significantly different effect on the EE compared to other EU regions. Similarly, human resources for science and technology investments did not have higher effects in EE regions than elsewhere.

- A 1% increase in ESIF 2000-06 funding for R&I generated a 28% increase in ESIF funds for R&I in 2007-13. In the case of both FP6 and ESIF, attracting a large amount of funding in the previous programming period increased a region's capability to attract SF funding in the following programming period. However, once all other factors are controlled for, EE regions have no greater capability to attract funding than other regions, confirming the regional innovation paradox.

Partly in response to this paradox, the concept of smart specialisation strategies was launched with a view to fostering structural change through both building capabilities and mobilising 'extra-regional' resources. The basis for smart specialisation is a process of entrepreneurial discovery (involving firms, academic and public research centres, users, the public sector, etc.) to explore and open new 'domains of activities' where competitive advantage can be built (see Foray) around 'micro-systems of innovation. While the 'stairway to excellence' has not (yet) yielded the hoped for results, it may be that 'pockets of excellence' can be identified that serve as one possible input to the entrepreneurial discovery process.

3. A METHODOLOGY FOR IDENTIFYING POCKETS OF EXCELLENCE

This section of the report explores in more depth the concept of pockets of excellence and sets out a proposed methodology for identifying PoEs. The basic premise of the approach is that there is a disconnect or mis-match between highly performing localised research or innovation eco-systems and their ability to drive growth in a regional economy. If a region grows faster than all other EU regions, including those in the same country, growth may or not be a result of well performing local or regional research or innovation eco-systems. In order to test, the extent to which regional research and innovation eco-systems are (or have a potential) to contribute to growth, the methodological framework is structured in three steps:

1. Identify potential pockets of excellence (PoE) where research and/or innovation performance is relatively higher (or growing relatively faster) than in other less favoured regions (nationally or across EU13).

2. Assess the extent to which the PoE (region, specific public, academic or industrial units or groupings in a PoE region) is linked to or has a potential to contribute to the regional smart specialisation priorities;

3. Assess the potential for co-operation and synergies in specific specialisation areas amongst PoE intra- or inter-regionally or existing or potential links between PoE in one region and other 'structurally similar' regions.

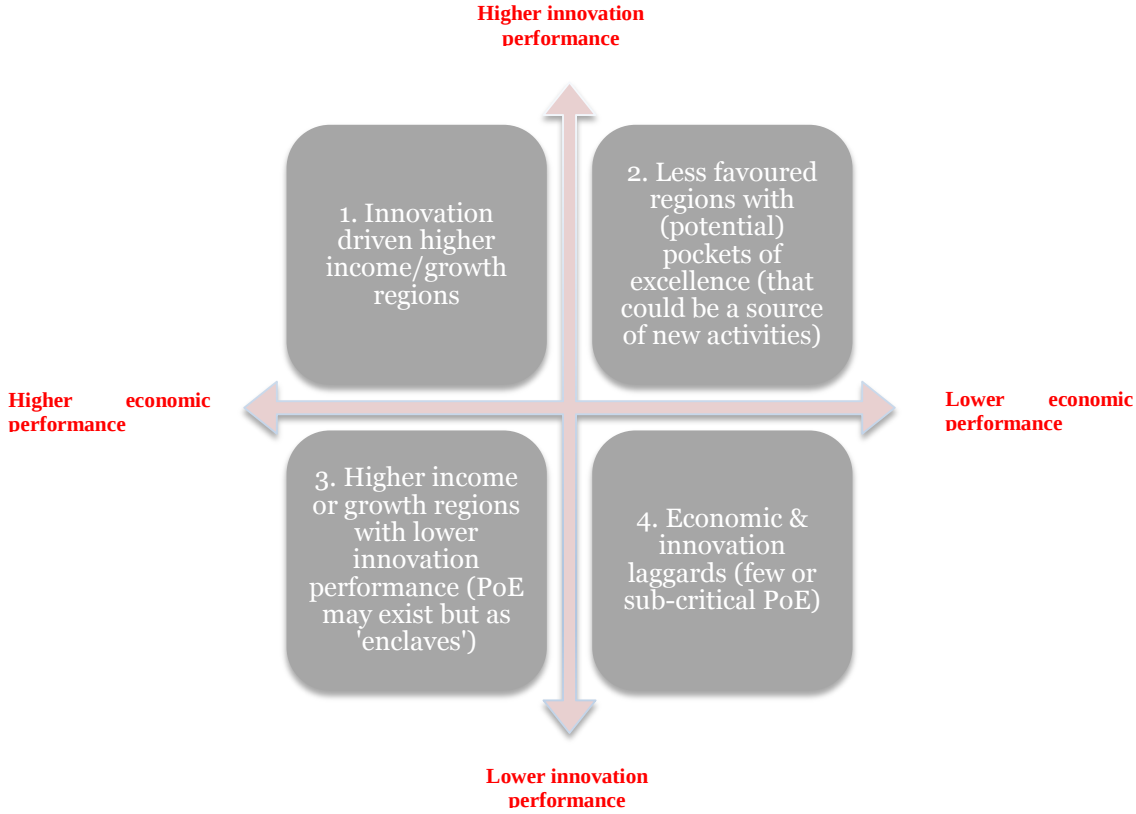
The term pockets of excellence (PoE) term has been used, previously, to refer to specific departments or units in "teaching universities" that manage to compete with recognised research universities that have top researchers across the board".[2] In a similar vein, but from a regional perspective, a region may not stand out in European wide-rankings in terms of economic performance but may contain one or more 'scientific' pockets of excellence. As Radosevic (presentation to RISE meeting, October 2015) pointed out scientific excellence is '*much easier to achieve than compared to innovation excellence*' and '*spillovers from such PoE to regional (or even national) innovation systems are seldom automatic'*. Hence, there is a significant risk that PoEs remain 'enclaves' (linked externally to other 'pockets of excellence but with limited or non-existent local knowledge spillovers) rather than a spark for developing new innovation driven activities.

Following the above logic, PoEs may exist in all types of regions, indeed, as Bonaccorsi (presentation to RISE meeting, October 2015) has shown there are many pockets of scientific excellence in universities located in less developed regions. However, universities in less developed regions excel in three times fewer scientific fields (on average) than those in more developed regions. Moreover, excellence tends to be highly fragmented with universities tending to be smaller so covering fewer scientific fields and excelling in a much smaller number relative to developed regions.

[2] For instance, in the UK, see http://www.theguardian.com/money/2006/feb/09/highereducation.tuitionfees

Figure 3 outlines a simplified option for categorising regions based on their overall relative innovation performance (or rate of change over time in innovation performance) – this can be measured by one or more variables which are possible to construct on the level of specific public, academic or industrial units or groupings (such as publications/citations, patents, web-based indicators) or by a composite indicator available on the regional level, such as the regional innovation scoreboard index; and their competitive position. Again this can be based on either their relative economic performance (or the rate of change measured in terms of GDP/value added per capita growth).

Figure 3: Identifying pockets of excellence



The proposed method has two parts. One part identifies those regions where PoEs exist and may be influencing overall regional performance and the other part identifies specific public, academic or industrial units or groupings (henceforth micro PoEs) as potential PoEs. The two parts when merged provide us with a dual typology of localised PoEs (e.g. at the level of a city or 'NUTS3' statistical unit) within regional PoEs (NUTS 2 statistical unit).

The first step in the analysis is therefore to identify the 'localised' pockets of excellence independent of the type of region in which they are located. However, in reality, what is interesting from a policy point of view is the extent to which PoEs are already or may have the potential to drive future growth in less favoured regions. In this context, the main emphasis is likely to be on PoEs in type 2 regions (where a PoE may be already a factor explaining higher 'innovation performance' or where there may be potential for a PoE to contribute more to enhancing economic performance) and in type 3 regions, where PoEs may be highly performing but represent an outlier in the system so that the high scientific performance of one or two organisations is not sufficient to influence overall region performance.

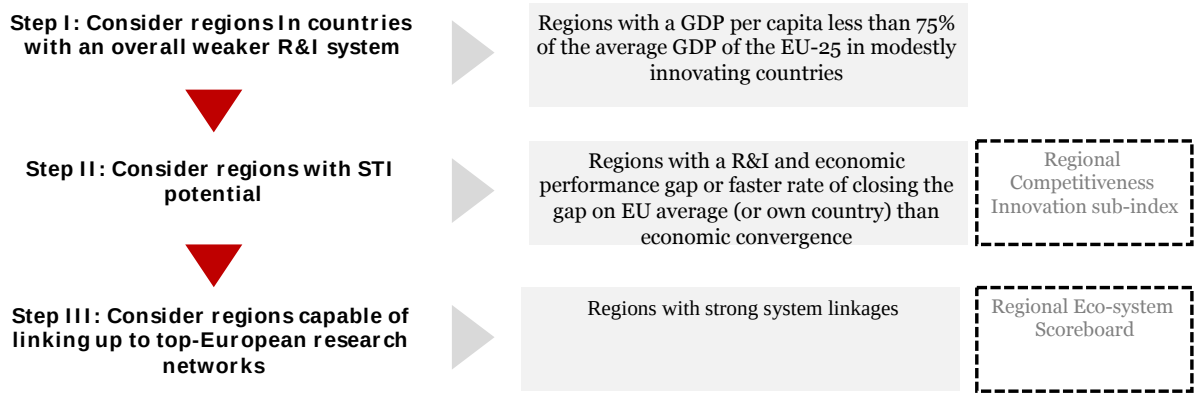
The second step is to assess whether there is a match between scientific fields of excellence and technological/business specialisation (e.g. as defined through the smart specialisation strategy). Some PoEs may provide insufficient potential for knowledge spillovers to the regional economy so that their contribution needs to be considered in a more indirect way (e.g. suppliers in regional economy, etc.). The second analytical step is performed at the individual PoE and regional level.

Finally, in a third step, the potential for 'pockets of excellence' in less favoured regions to be linked to pockets of excellence in other regions (less developed or more developed) to mutualise and complement capabilities (given the fragmentation that Bonaccorsi has pointed out) is examined. Similarly, as in step 2 the third analytical step is performed at the individual PoE and regional level.

3.1. Criteria and method for identifying pockets of excellence

The pool of regions in which PoE may be identified covers all ESIF designated less-developed regions (less than 75% of EU average GDP per capita)[3]. Within this group of potential regions, the focus is placed on those with an above average potential (for one or more indicators) that indicates that a PoE may be influencing performance. They are identified based on either the existing gap between R&I and economic performance or the trend data where R&I performance is closing the gap on the EU (or national) average faster than economic convergence. Further to that, regions with stronger linkages to European research and innovation networks make up the final list of statistically identified regions with PoEs (see Figure 4).

Figure 4 Steps in identifying PoEs statistically



Source: Technopolis

Regions that satisfy the above criteria classify as PoEs, either within their own country or in Europe as suggested in step II. The final list of PoE regions can be further filtered by adding qualitative dimensions or insights that are not captured (well) by quantitative information.

The operationalisation of the approach in terms of the set of indicators for step 2 and step 3 is based, respectively, on the regional competitiveness innovation sub-index and the regional ecosystem scoreboard pillar on system linkages (see Figure 5). Alternatives could be considered where only part of the regional competitiveness innovation and/or regional innovation ecosystem linkages sub-index are used.

Figure 5 Indicators for the operationalization of the method to identify PoEs

Step 2: STI gap	Step 3: Linkages
Innovation patent applications	Firms cooperating with HEIs and PROs
Total patent applications	Frequency of HEI's/PROs collaboration with the private sector for R&D&I
Core creative class employment	Number of spin-offs; Innovative SMEs collaborating with others
Knowledge workers	FP7 leverage (per capita)

[3] http://ec.europa.eu/regional_policy/sources/what/future/img/eligibility20142020.pdf

Scientific publications	SMEs participation in private sector in FP7
Total intramural R&D expenditure	FDI and technology transfer
Human Resources in Science and Technology	Foreign nationals in skilled occupations
Employment in technology and knowledge-intensive sectors	Number of international co-publications
High-tech-inventors	
ICT inventors	
EPO Biotechnology Patent applications authors	

The pool of micro PoEs to be considered may be identified by criteria of scientific excellence (bibliometrics), and/or linkages between innovation, inventions and the marketplace (patents, web based indicators).

3.2. Assess the extent to which the PoEs are linked to or have a potential to contribute to regional smart specialisation priorities

The analytical framework for assessing the potential for PoEs to contribute to RIS3 priorities is based on three grids applied to each S3 priority in the region(s) analysed.

Grid I: technological and non-technological skills

- Technological skills:
- key technology groups concerned or technological bricks and regional potential by key technology;
- outputs: patents, scientific publications of high level;
- key actors in the region: laboratories, companies, technology transfer and commercialisation, etc.

Non-technological skills:

- non-technological skills of key regional players, strategic priorities, available resources;
- critical mass of non-technological skills: scholars in the humanities and social sciences, professional training, etc.;
- skills of key players in the regional economy (clusters, value chains, emerging activities, etc.).

Grid II: regional synergies between research, innovation and economic policies:

- Key regional actors and past investment/funding allocated by ESIF / FP to regional organisations;
- Extent to which 2014-20 priorities building coherently on past investment by ESIF or funding received through FPs, etc.

Grid III: markets / targets:

- Global market potential, value, growth, time horizon
- Coherence with existing regional economic base: e.g. existing firms/employment may benefit from spill-over effects, etc.
- Expected market in terms of sales, turnover from exports, potential for employment creation (where data available)
- Key external players (partners / competitors), national and in relevant regions laboratories, companies, clusters, that can provide complementary skills or know-how to support regional value chains, etc.

The indicators per Grid are described in Figure 6.

Figure 6. Overview of data/information per grid

Dimensions	Data/Information	Data type
Grid 1: technological and non-technological skills		
Technological skills:		
Patents, scientific publications of high level (outputs)	PCT applications per population (EUROSTAT) Scientific publications per population (Scopus) Scientific publications within the 10% most cited scientific publications worldwide as % of total scientific publications (Scopus)	Quantitative
Key actors in the region: laboratories, companies, technology transfer and commercialisation, technology groups concerned or technological bricks etc.	Research Performing Organisations (Scopus based H-index) Technology Transfer/Spin offs/ Cluster organisations etc. (Clusters Observatory) Companies (e-corda)	Semi Quantitative
Non-technological skills:		
Non-technological skills of key regional players, strategic priorities, available resources		Quantitative
Critical mass of non-technological skills: scholars in the humanities and social sciences, professional training, etc.;	Scopus, e-corda	Semi quantitative
Skills in the regional economy	Availability of technical skills in enterprises Availability of design/creative skills in the private sector	Qualitative

	Availability of interdisciplinary skills Individuals with high levels of E-skills as a percentage of active population (European Clusters Observatory)	

Grid 2: regional synergies between research, innovation and economic policies

Past investment/funding allocated by ESIF / FP to regional organisations.	Structural Funds Allocations/ Expenditures, e-corda	Quantitative
Extent to which 2014-20 priorities building coherently on past investment by ESIF or funding received through FPs, etc.	Structural Funds Allocations/ Expenditures, e-corda	Semi quantitative[4]

Grid 3: markets / targets

Global market potential, value, growth, time horizon	Industrial or knowledge based service industries outlook; Agriculture Outlook[5]; World Tourism Report (tourism market trends)[6]	Qualitative
Coherence with existing regional economic base: e.g. existing firms/employment may benefit from spill-over effects, etc.	Regional sector specialisation (location quotient: specialised regions are those with overrepresented employment in sector x) Regional structural business statistics[7]	Quantitative
Expected market in terms of sales, turnover from exports, potential for employment creation (if data available)	Sectoral forecasts (if available)	Qualitative
Key external players (partners / competitors), national and in benchmark regions laboratories, companies, clusters, that can provide complementary skills or know-how to support regional value chains, etc.	Based on e-Corda data	Quantitative

[4] The link between SF, FP and regional priorities is not a 1-1 concordance.

[5] http://ec.europa.eu/agriculture/markets-and-prices/medium-term-outlook/index_en.htm

[6] http://dtxtq4w60xqpw.cloudfront.net/sites/all/files/pdf/unwto_annual_report_2014.pdf

[7] http://ec.europa.eu/eurostat/statistics-explained/index.php/Structural_business_statistics_at_regional_level

; http://ec.europa.eu/eurostat/statistics-explained/index.php/Tourism_statistics_at_regional_level

3.3. Assess the potential for co-operation and synergies in specific specialisation areas

The potential for co-operation and synergies among PoEs is investigated in terms of areas of specialisation and relevant regions. Three different cases are conceptualised and empirically tested using information from Grids I, II and III. Namely, co-operation and synergies among:

4. structurally similar regions with similar RIS3 priorities

5. convergence regions and structurally similar regions with past co-operations

6. convergence regions and structurally similar regions with expertise related to similar RIS3 priorities. The following leading indicators are selected:

    - Technological skills (grid 1): Patents

    - Regional synergies between research, innovation and economic policies (grid 2): FP7 projects

    - Markets/Targets (grid 3): Regional Economic base (specialisation - employment based).

4. THE CASE OF CRETE: POCKETS OF EXCELLENCE IN A CONVERGENCE REGION

4.1. Background: Crete's smart specialisation strategy

In a review carried out for DG REGIO in 2012 (Reid et al), the regional innovation system of Crete was characterised by a dichotomy between, on the one hand, the highest Greek regional scientific potential, outside of Athens, and, on the other, weak business innovation intensity. The major scientific research centres located on the island, after several decades of public investment, are significant players in both the Greek and European scientific fields in which they operate, scoring well in terms of scientific impact. At the same time, and despite past efforts to foster stronger linkages with and research commercialisation to the local economy, there is a significant mismatch between business innovation needs and scientific know-how.

The Regional Competitiveness Index of DG REGIO suggests that this dichotomy is still present, with Crete ranking 240th out of 260 regions, based on index scores on a range of indicators (covering institutions, macroeconomic stability, infrastructure, health, basic education, higher education and lifelong learning, labour market efficiency, market size, technological readiness, business sophistication, innovation). However, in terms of scientific publications, Crete ranked 47th underlining the strong scientific potential built up over two decades, notably with support from ESIF.

For the period 2014-20, the RIS3 strategy for Crete outlines seven challenges:

- reconstruction of the agri-food complex taking into consideration climate change, strengthening export sectors and promote Cretan diet, which constitute intangible cultural heritage of Crete.

- increase the competitiveness of the cultural -tourism complex by promoting its unique elements

- limit the dependence of Crete on conventional energy

- rational use Crete's natural resources

- exploit the potential offered by the sea

- development of educational and training activities of an international character that built on and take advantage of the educational fabric of Crete

- the development of production of high value added activities in emerging areas that built on and take advantage of the research fabric of Crete.

The RIS3 is structured around four broad 'complex' (or priorities):

1. The agrifood complex composed of primary sector activities and specifically the cultivation/husbandry, processing/preparation and handling/marketing of agricultural products that:

- are important for the GDP of Crete including mainly: olive oil, vegetables, dairy

- are significant components of the Cretan diet: the aforementioned products plus, aromatic herbs, honey and wine.

- Belong to emerging sectors of primary production (e.g. highly nutritious products from the sea)

The objective is the production of high quality, safe and internationally competitive products

2. The cultural - tourism complex includes activities:

- in the tourism sector (attract, reception, hosting, transportation, food, entertainment and browsing of visitors)

- in the field of culture (protection - promotion of the cultural resources, support and facilitate visiting of monuments - museums, interconnection of cultural resources with society and the local economy, development of cultural activities of international scope and high added value)

The aim in the cultural-tourist complex is the use of scientific knowledge, innovation and ICTs technologies to enhance the international competitiveness of tourism:

- upgrade tourism services

- diversification of the tourism product in areas where Crete can develop comparative advantages

- upgrade gateways

- promote the rich cultural reserve of Crete and the interface between society and the local economy.

3. The environmental complex is composed of a number of related activities:

- reduction of emissions of carbon dioxide (energy saving, renewable energy in terms of sustainable development applications)

- rational use of natural resources of Crete with emphasis on water and

- fighting the consequences of climate change.

The aim is to use scientific knowledge, innovation and ICT in order to address major environmental problems and challenges, while promoting innovative businesses:

- Reduce dependency on conventional energy sources through energy savings in buildings, lighting, and infrastructure (wastewater management and water) and exploiting the opportunities offered by renewable energy resources.

- Rational management of water including water saving in irrigation and water supply

- waste management by using innovative applications for prevention, treatment and reuse of materials.

- foster innovative entrepreneurship associated with green technologies (bioclimatic construction and materials, sensors and measuring systems, etc.)

4. The knowledge complex including:

- research activities in research and academic institutions of Crete in areas of advanced technologies (nanotechnology, biomedicine, biology, microelectronics, materials, information technology, etc.), which could support the creation of innovative business activities in emerging sectors.

- education and training activities in research and academic institutions of Crete in areas of high demand internationally.

The aim is to:

- The development of new (start-ups) business building on the scientific work and scientific potential of institutions of Crete

- Attract investments aiming to collaborate with the existing strong research groups of Crete and to use of research infrastructures

- Developing well focused education and training programmes (e.g. summer schools) aiming at students and entrepreneurs in critical sectors, which are also related with the identified comparative advantages of the island (eg laser applications in the protection and promotion of cultural heritage).

4.2. Crete – identification as PoE

4.2.1. Crete a PoE in Greece?

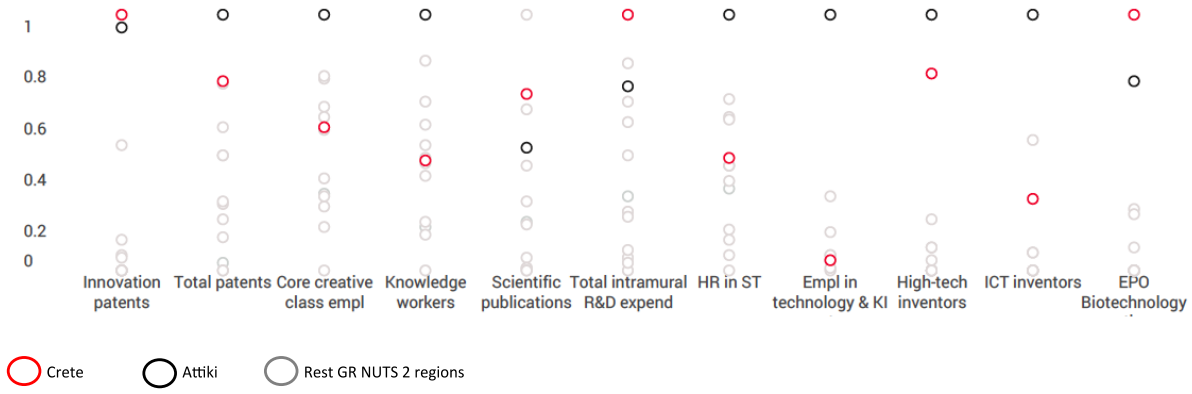
In the case of Crete the gap between economic performance and R&D is investigated in terms of the existing gap between R&I and economic performance. A trend analysis is a more data intensive approach and the availability of regional data with long enough time series is limited to a few indicators (such as patents and bibliometrics). Moreover, interpreting trends in the case of Greece particularly, from 2008/2009 onwards must account for the impact of the crisis on STI indicators and GDP values.

The first step in exploring whether Crete can be classified as a PoE is an empirical step and investigates whether Crete stands out in Greece in terms of STI performance and/or potential than of economic performance.

In terms of R&I, looking at the pre-crisis period (period from 2005-2008) according to the data of the Regional Competitiveness Index on innovation (2010), Crete ranks at the top in terms of innovation patent applications, total intramural R&D expenditures and biotechnology patents. In other indicators such as total patent applications, scientific publications, high technology inventors, Crete ranks second after the capital Attiki. The indicators Crete demonstrates average performance or below average performance is on employment in technology and knowledge intensive sectors, human resources in science and technology, Knowledge workers and ICT inventors.

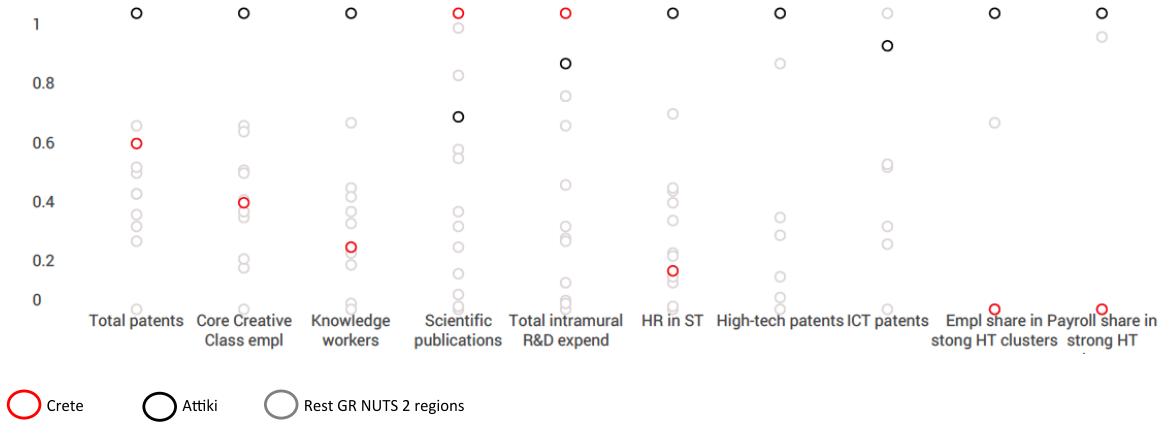
Compared to RCI 2010 for those indicators followed up in the RCI 2013 and available the following observations are made: 1) Core Creative Class employment: dropped one place ranking 7th; 2) Human Resources in Science and Technology: dropped from 5th to 9th place; 3) Knowledge workers: remained stable ranking 7th; 4) Scientific publications: improved by one place ranking now 1st; 5) Total intramural R&D expenditure: remained at the top; 6) Total patent applications: dropped one place ranking 3rd.

Figure 7 Innovation data - Regional Competitiveness Index 2010



Source: own elaboration based on 2010 RCI data; data has been normalised to 0-1 range

Figure 8 Innovation data - Regional Competitiveness Index 2013



Source: own elaboration based on 2013 RCI data; data has been normalised to 0-1 range

In terms of linkages according to FP7 projects and hence on scientific linkages, Crete ranks third after Attiki and Central Macedonia (the two largest urban areas of the country). According to CIS data on the cooperation of innovative SMEs with other companies (as calculated for the Regional Innovation Scoreboard) Crete (and Nisia Aigaiou) has been ranking second since 2010 and until 2014 among the four Greek (NACE 1 regions). Finally according to the composite indicator on collaboration and internationalisation of the Regional Ecosystem Scoreboard Crete ranks first among the Greek regions.

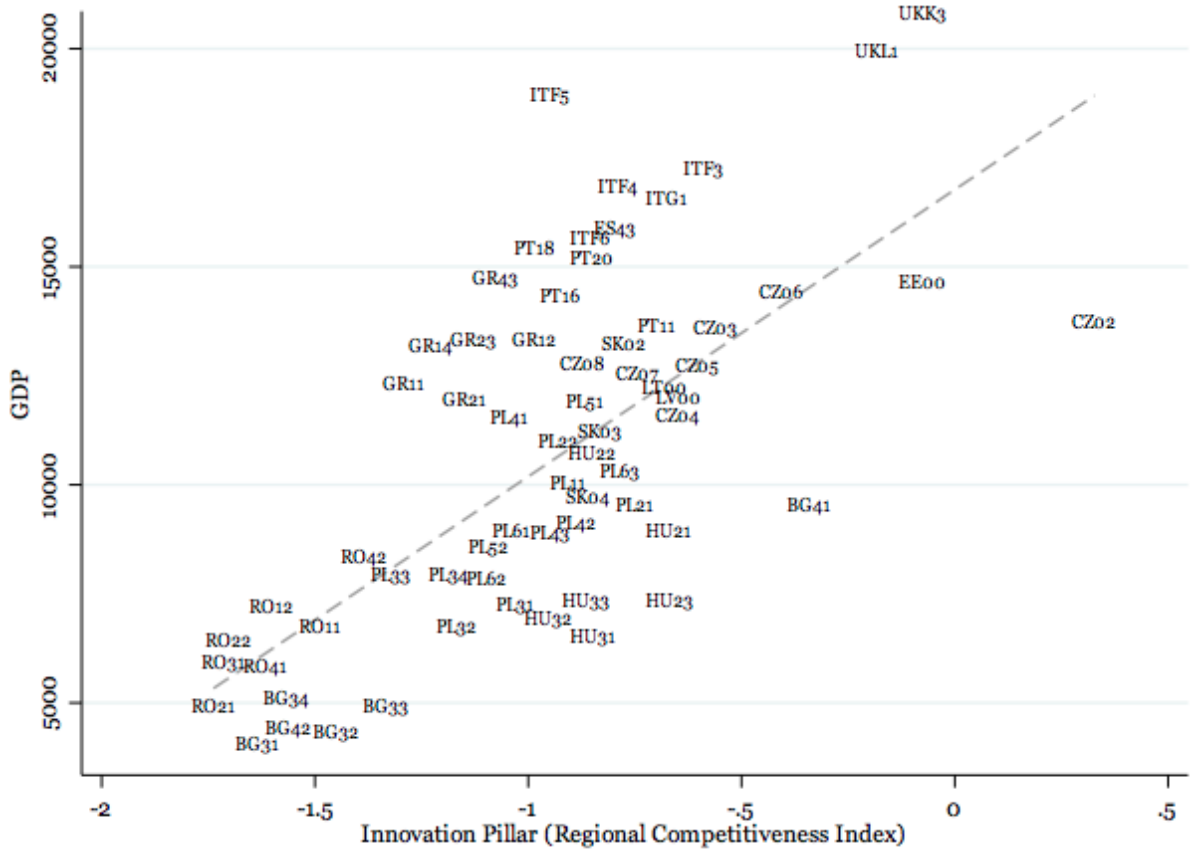
In terms of GDP (per capita) Crete has systematically since 2005 been ranking 6th out of the 13 NUTS 2 regions in Greece until 2013, during which year it climbed up, ranking 4th. Note though that the average annual growth during the period 2005-2013 has been negative (ca. -1%) as has been the case for all Greek regions.

Based on the available data, Crete does qualify as a pocket of excellence within Greece as a result of its performance in science and technology.

4.2.2. Crete a PoE in Europe?

Plotting the data for Crete[8] and convergence regions using the regional competitiveness innovation sub-index it appears that PoEs may include regions in Estonia followed by regions in Bulgaria, Slovakia, Poland, Lithuania, Latvia and Hungary. Crete, according to the PoE typology and based on the available data falls under regions of economic leaders and moderate innovators (see Figure 9).

Figure 9 POEs identification: STI gap (2013)



Source: own elaboration based on Regional Competitiveness Innovation pillar (2013) and Eurostat data.

In fact, when empirically tested, the following cluster of regions is obtained[9]: BG41; CZ04; HU21; HU22; PL11; PL21; PL22; PL41; PL42; PL43; PL52; PL61; PL63; SK03; SK04.[10] Within this bigger cluster and based on the dissimilarity distance, four smaller clusters are formed among which the following two: 1) BG41; PL21; HU21; PL11; SK04; PL42; PL43; PL61; PL52 and 2) CZ04; HU22;

[8] Crete is designated as transition region.

[9] A cluster analysis has been performed using Innovation and GDP and ward's linkage as the hierarchical clustering method for the observations.

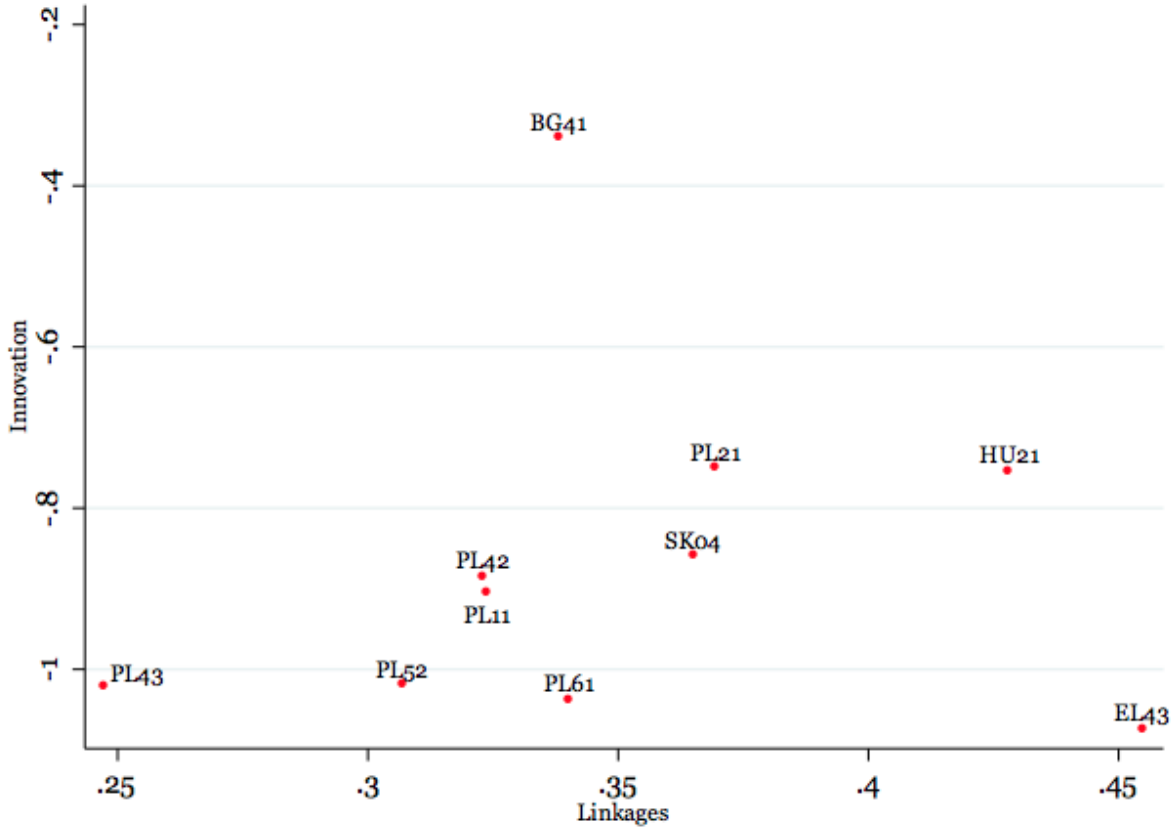
[10] Lithuania and Latvia are accounted for on the country level.

PL22; PL41; PL63; SK03 (see appendix F). The latter two sub-clusters according to the available data and the proposed typology are assumed to potentially include PoEs.

Among the potential PoE regions/countries, Közép-Dunántúl (Hungary) positions itself strongly in terms of linkages as measured by the regional ecosystem scoreboard. It is followed by Malopolskie in Poland and Východné in Slovakia. Crete while also positioned strongly in terms of linkages within the group of potential PoEs remains as previously shown at the lower end in terms of innovation.

Hence, based on the available data, Crete does not qualify as a PoE at European level due to overall innovation performance (the composite proxy of innovation).

Figure 10 POEs identification: Linkages



Source: own elaboration based on Regional Competitiveness Innovation sub-index and Regional Ecosystem Scoreboard.

4.3. Crete's PoEs linkages and potential to contribute to RIS3 priorities

4.3.1. Applying grid 1: technological skills and non technological skills

4.3.1.1. Technological skills

Key Actors: Key actors in the region are primarily Research Performing Organisations (RPOs).

The majority of Cretan FP7 and Horizon 2020 participants are research organisations (65% in FP7 and 76% in Horizon 2020) followed at a significant distance by higher secondary education organisations (26% in FP7 and 17% in Horizon 2020), private for profit (8% in FP7) and public bodies (1% in FP7 and 3% in Horizon 2020).

Based on counts of peer reviewed publications and reviews, two Cretan hospitals rank at the top 10 affiliations, the University of Crete Medical School and the Heraklion University Hospital. Other relevant actors include:

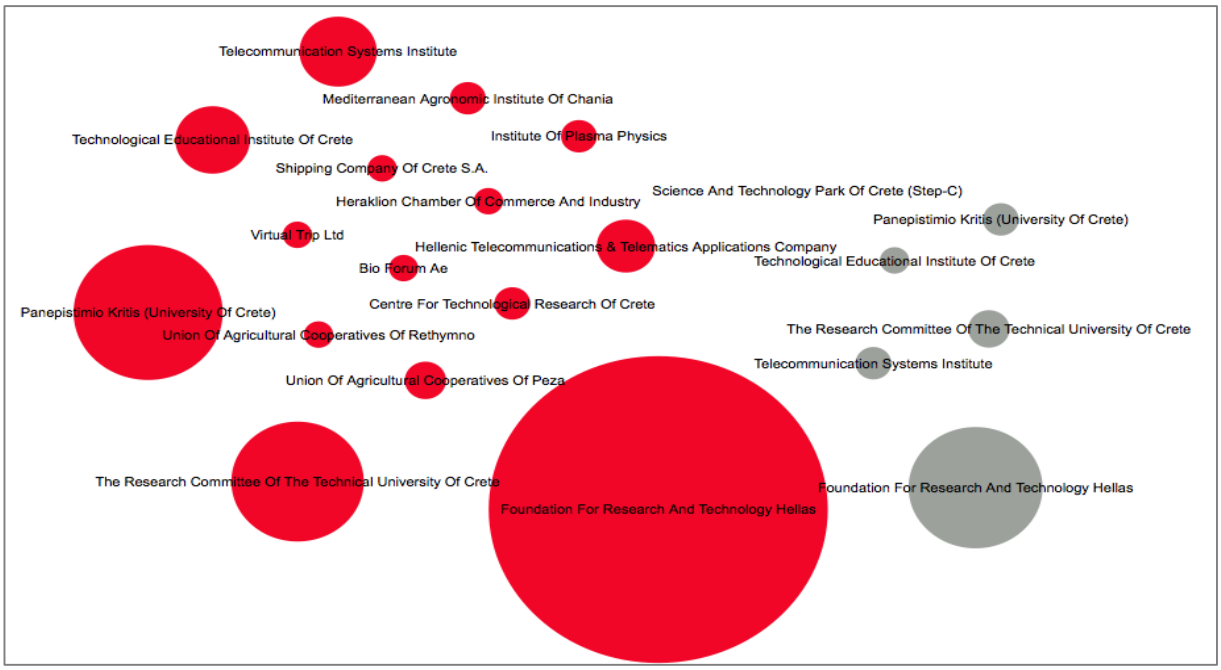
- In ICT: The Institute of Computer Science Crete (with 296 publications[11])
- In Agricultural and Biological sciences: the Hellenic Centre for Marine Research (with 342 publications); the Hellenic Agricultural Organisation-Demeter (with 132 publications) and the Mediterranean Agronomic Institute Chania (with 106 publications).

According to the European cluster observatory there is information about one Science and Technology Park (an initiative of FORTH) called STEP-C which offers, incubating facilities and services to start up companies with new and emerging technologies and specialized professional services (related to for instance intellectual capital, innovative products and services, etc.).

Finally, RIM plus includes also the School of Pedagogical & Technological Education (ASPETE). Other STI related organisations are the Intermediate Managing Authority (IMA) of Kriti; Region of Kriti; and Regional Development Fund of Kriti.

[11] It should be noted that in ICT there is a tendency to publish more in conference proceedings, which were excluded from the query.

Figure 11 Key actors Based on FP7, Horizon 2020



Source: based on e-Corda data

Notes: The size of the bubble represents participation counts (to either FP7 or Horizon 2020)

Scientific Performance Rankings: Cretan RPOs scientific performance warrants their inclusion in global rankings. For instance, the 2015 Leiden Ranking ranks the university of Crete first among the six Greek universities included in the list.[12] In the global ranking it ranks as 320th. Moreover, beyond in fact the standard scientific performance indicators calculated for the university of Crete, collaboration with industry stands out as the weakest indicator positioning the university of Crete last among all Greek RPOs.

Figure 12 University of Crete CWTS indicators

Number of top 1% publications	Number of top 10% publications	Number of top 50% publications	Collaboration international	Collaboration industry
0.9	10	52.5	60.1	3.4
(rank 2)	(rank 1)	(rank 1)	(rank 1)	(rank 6)

Another scientific performance ranking of RPOs, the Scimago Institutions ranking (SIR), also includes Cretan affiliations. In terms of innovative knowledge within Greece (global rankings are in the parentheses) it ranks the university of Crete 2nd followed by FORTH 5th, the Technical University

12 In total 750 universities are selected based on their publications in international scientific journals in the period 2010–2013.

of Crete 13th and finally the university General hospital of Heraklion 15th. In terms of technological impact within Greece the aforementioned affiliations occupy the rankings 4th until 7th (see Figure 13).

Figure 13 Scimago Ranking

Innovative knowledge		Technological Impact	
University of Athens	1 (188)	National Hellenic Research Foundation	1 (205)
University of Crete	2 (238)	Academy of Athens	2 (255)
University of Patras	3 (238)	Centre for Research and Technology Hellas	3 (282)
Aristotle University of Thessaloniki	4 (241)	Heraklion University General Hospital	4 (285)
National Technical University of Athens	5 (248)	University of Crete	5 (288)
Foundation for Research and Technology Hellas	6 (254)	Foundation for Research and Technology Hellas	6 (289)
University of Ioannina	7 (257)	Technical University of Crete	7 (290)
Demokritos, National Centre for Scientific Research	8 (264)	Harokopio University	8 (307)
Academy of Athens	9 (270)	Agricultural University of Athens	9 (312)
University of Thessaly	10 (271)	Demokritos, National Centre for Scientific Research	10 (315)
Attikon Athens University Hospital	11 (272)	University of Patras	11 (317)
National Hellenic Research Foundation	12 (272)	Aegean University	12 (327)
Technical University of Crete	13 (27	Hellenic Open University	13 (32

	2)		8)
Agricultural University of Athens	14 (273)	Attikon Athens University Hospital	14 (330)
Heraklion University General Hospital	15 (273)	Evaggelismos Hospital	15 (332)
Aegean University	16 (275)	Hippokration General Hospital	16 (332)
Democritus University Of Thrace	17 (275)	University of Athens	17 (332)
Centre for Research and Technology Hellas	18 (277)	University of Peloponnese	18 (332)
Harokopio University	19 (277)	National Technical University of Athens	19 (333)
Hippokration General Hospital	20 (278)	University Hospital of Ioannina	20 (333)

Patents: In terms of patenting, that are perceived as providing a link between innovation, inventions and the marketplace, Crete specialises the most in biotechnologies, nanotechnologies, general environment management and medical technology from among the eleven technology fields calculated by the OECD[13] (see

[13] The full range of Cretan patents is not accounted for.

Figure 14 listing the technology fields and specialisation index for Crete). These technology fields in which Crete patents correspond to the research activities in advanced technologies performed by Cretan RPOs (see section on publications) and strategically chosen in Crete's RIS3 demonstrating not only the high quality output of Cretan RPOs but also the alignment of policy and STI activities.

Figure 14 Patents Specialisation Index

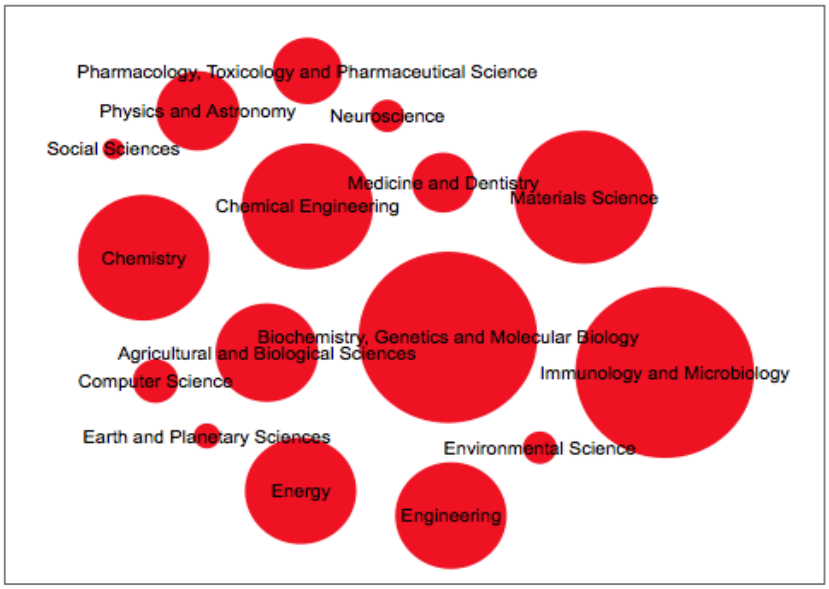
Technology	Specialisation index
Biotechnology	75
Combustion technologies with mitigation potential (e.g. using fossil fuels, biomass, waste, etc.)	na
Emissions abatement and fuel efficiency in transportation	na
Energy efficiency in buildings and lighting	na
Energy generation from renewable and non-fossil sources	-68
General Environmental Management (air, water, waste)	49
ICT	-28
Medical technology	34
Nanotechnology	72
Pharmaceuticals	-37
Technologies specific to climate change mitigation	na

Source: own calculation based on OECD Regpat database; Notes: above +20 highly specialised; below -20 significant under specialisation; between -20 and +20 around field average.

The latter is further confirmed when looking specifically at FORTH whose main patenting fields[14] include: Biochemistry, Genetics & Molecular Biology; Immunology and Microbiology; Materials Science; Chemical Engineering; Chemistry.

[14] The fields of the OECD vary from those of Lexis Nexis.

Figure 15 Patent Subject Areas FORTH



Source: based on Lexis Nexis for the period 2005-2015

Notes: bubble size shows counts of patents allocated to the respective subject areas

Publications: Cretan RPOs impact in terms of publications is partly demonstrated by the RPOs inclusion in international ranking lists (which are themselves based on bibliometric outputs – see section scientific performance rankings).

Considering all Cretan affiliations with publications (peer reviewed publications and reviews) included in journals accounted for by Scopus the following observations can be made in terms of publication counts:

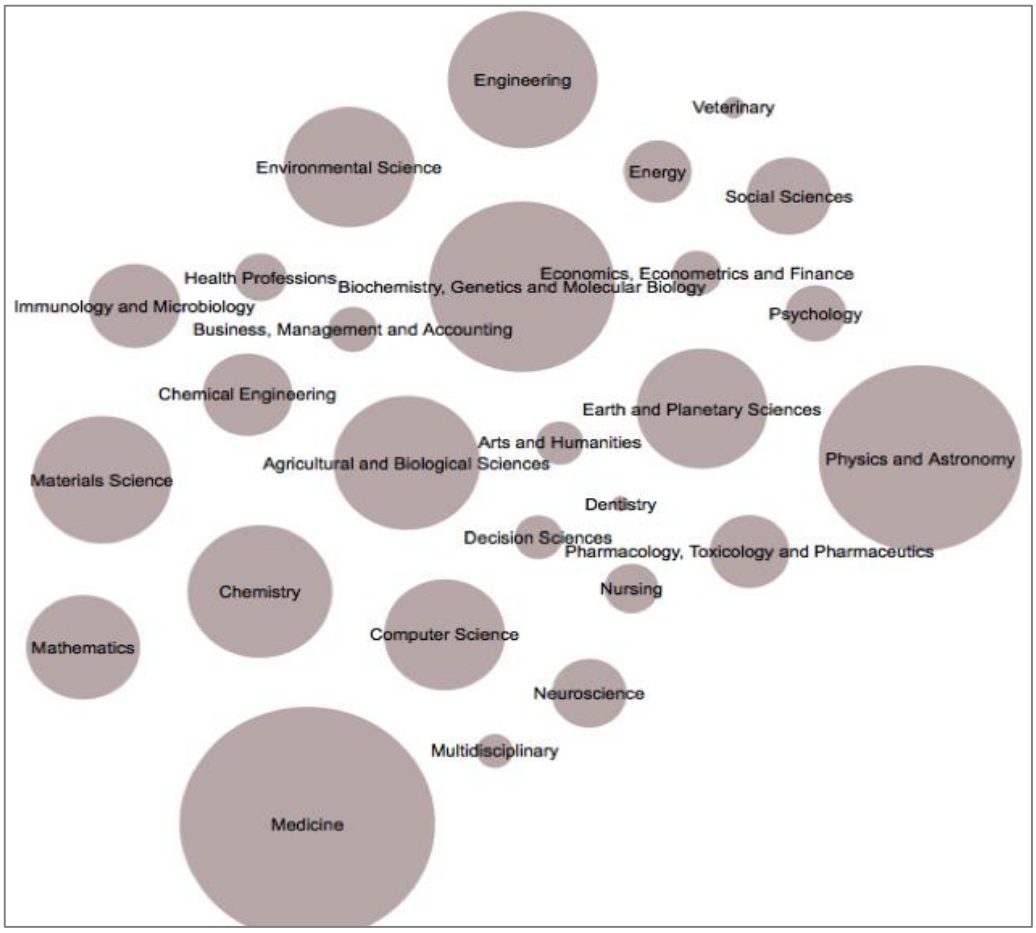
- Top 10 subject areas[15]: Medicine (31%); Physics and Astronomy (20%); Biochemistry, Genetics and Molecular Biology (17%); Engineering (11%); Agricultural and Biological Sciences (10%); Chemistry (10%); Materials Science (9%); Earth and Planetary Sciences (8%); Environmental Science (8%); Computer Science (7%);

- Top three collaborating countries: United States (17%), United Kingdom (13%), Germany (10%).

- Top international collaborators: Iowa State University; Imperial College London; Max Planck Institute for Polymer Research; Universiteit Gent; CNRS Centre National de la Recherche Scientifique; UCL; University of Cyprus; Centre de Recerca en Epidemiologia Ambiental, Barcelona; Harvard-Smithsonian Center for Astrophysics; L'Observatoire de Paris; Cornell University.

[15] Percentages represent share of publications per subject area. Note that a single publication may have multiple corresponding subject areas.

Figure 16 Peer Reviewed publications subject areas



Source: Based on Scopus for the period 2005-2015

Notes: bubble size shows % share of publications allocated to the respective subject areas based on publication counts)

Publication counts however provide no insights on the quality of scientific output, which is why **citations** are considered:

The top 10 publications in terms of citations (considering a three year citation window i.e. year of publication plus two years) are in Medicine Physics and Astronomy; Biochemistry Genetics and Molecular Biology; Materials Science; Earth and Planetary Sciences; Immunology and Microbiology (see

Figure 17).

Journals of top 200 publication in terms of citations, are among the top journals (see Figure 18).

Figure 17 Subject areas of top 200 cited publications

Figure 18 Publication Quartiles of top 200 publication (citation wise)

Journal	Counts of publications in Journal	Subject area	SJR Quartile
Physical Review Letters	8	Physics and astronomy	Q1
Annals of the Rheumatic Diseases	7	Biochemistry, Genetics and Molecular Biology	Q1
Nucleic Acids Research	7	Genetics	Q1
Astrophysical Journal	6	Astronomy and Astrophysics; Space and planetary science	Q1
Optics Letters	5	Atomic and Molecular Physics, and Optics	Q1
Physical Review B - Condensed Matter and Materials Physics	5	Condensed Matter Physics Electronic, Optical and Magnetic Materials	Q1
Science	5	Multidisciplinary	Q1

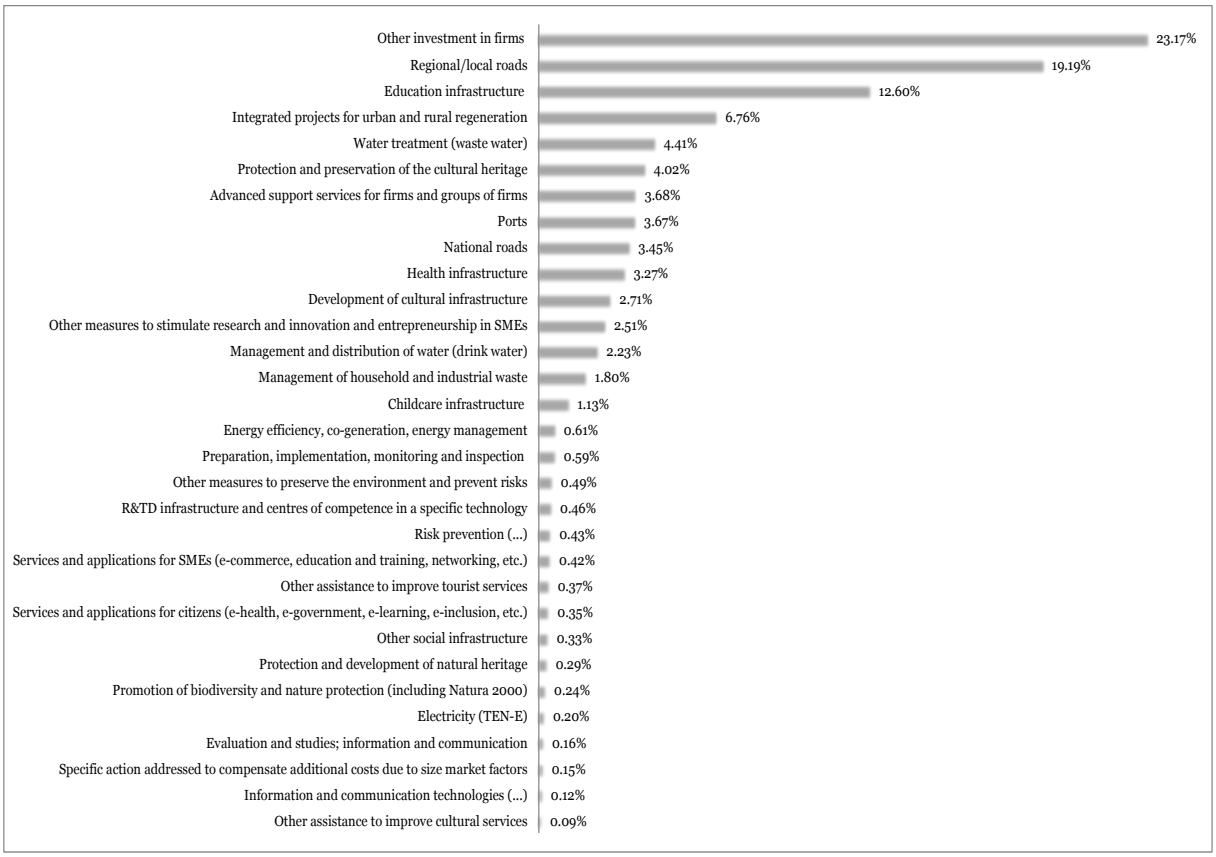
Source: own calculations based on CWTS Journal Indicators
Notes: SJR quartile provides information about the journal distribution within a given field or sub-field. The quartiles indicate if a journal is among the top (Q1).

4.3.2. Applying grid 2: regional synergies between research, innovation and economic policies

4.3.2.1. Investment/Funding through SF

Structural Fund categories: Past funding allocated by SF to regional organisations reflects RIS3 priorities particularly with respect to the Cultural Tourism complex and the Environmental complex. The support to businesses as expressed by "other investment in firms" or "advanced support services for firms and groups of firms" could partially be linked to the knowledge complex but it is expected that investments and support are often provided to non or low knowledge intensive activities.

Figure 19 SF 2007-2013 - Crete and Aegean Islands



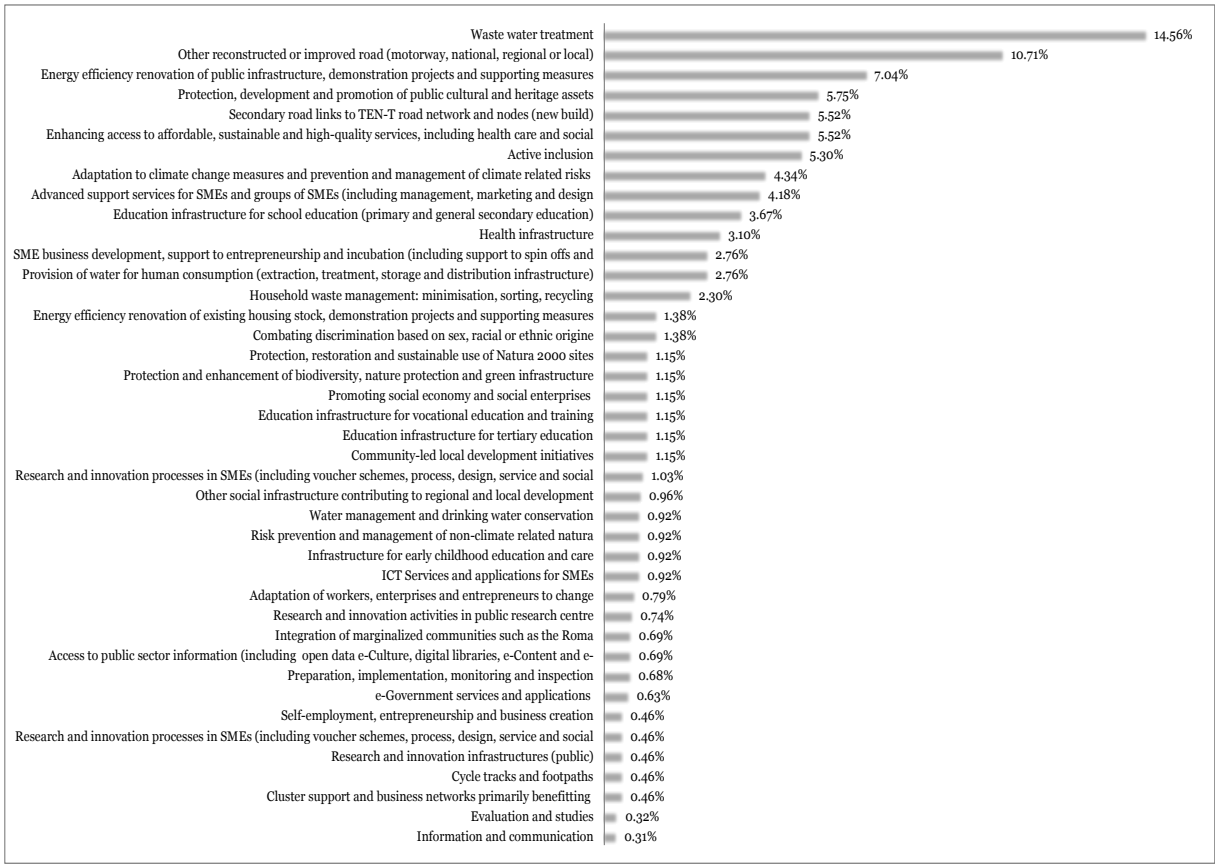
Source: own elaboration based on data from DG Regio

Notes: Figures are based on expenditures obtained in 10/2015. Another update of those figures will be released in the near future but is expected to only have minor changes; This programming period includes Crete and the Aegean islands and hence a comparison between the two periods must be made with caution.

Compared to the previous programming period where more than 50% of funding had been dedicated to the first three categories the new programming period appears to be slightly more spread out across the categories with 50% of funding going to the first seven categories. Firm investment is no longer allocated the highest budget and it appears that more resources are being allocated to the environmental complex. The knowledge complex is partly represented by the categories on support to business by making an explicit link to innovation activities and

entrepreneurship. Innovation and entrepreneurship however goes beyond advanced technologies and it is not yet possible to investigate which sectors will benefit the most.

Figure 20 SF 2014-2020 - Crete



Source: own elaboration based on data from DG Regio

Notes: Figures are based on allocations obtained in 10/2015. This is different from the previous programming period for which expenditures are available; the categories for the SF 2014-2020 period have changed and consequently a direct comparison across all the categories is no longer possible; This programming period includes Crete separately from the Aegean islands and hence a comparison between the two periods must be made with caution.

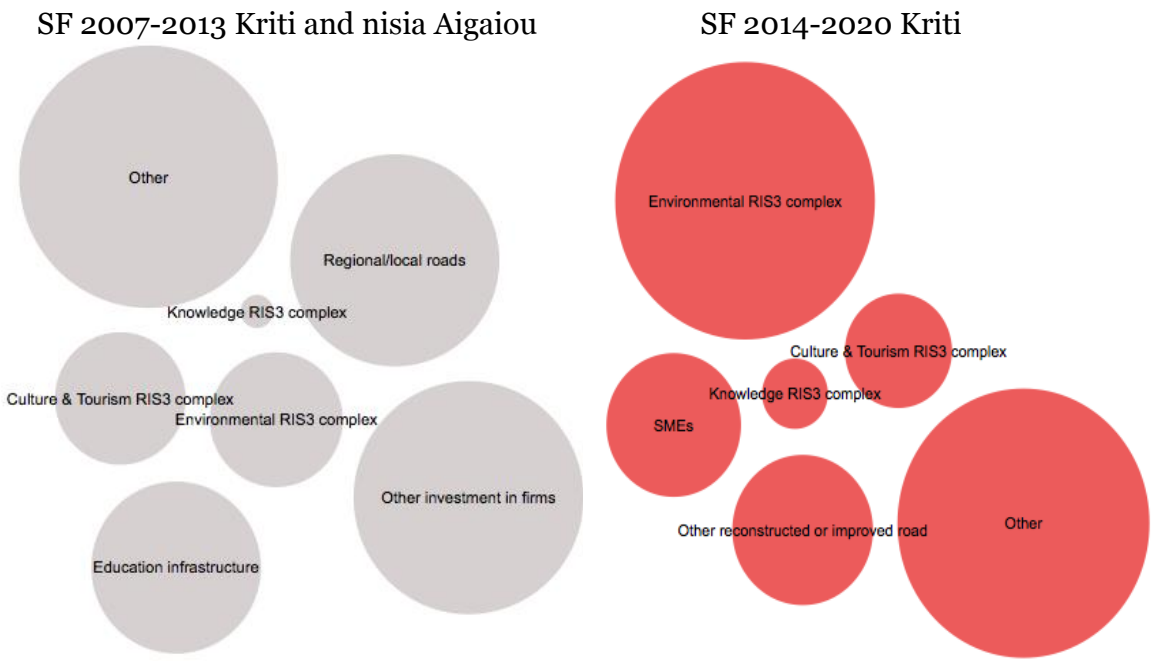
SF budgets and RIS3 priorities: RIS3 priorities appear to be reflected in SF budgets particularly as regards the Culture and Toursim complex and the Environmental complex (see Figure 21 linking RIS3 priorities to SF categories - note that the linkage is arbitrary and is not a result of a careful review of Operating Programmes and beneficiaries and is hence only meant to provide a preliminary indication).

In particular the Environmental complex (ca. 36.0% of total SF budget) appears to be represented, while the Culture and Tourism complex (ca. 6.2%) consumes a small part of the total budget as is the case for the Knowledge complex (ca. 2.4%).

The bubble labelled SMEs we believe contains budgets for the Agriculture complex but is expected to be relevant for other sectors too. Related to that, ERDF traditionally has not targeted agri-

food/rural development - but in Greece it does by default. However, there also the CAP for agriculture and implementing rural development.

Figure 21 Link between SF budgets and RIS3 priorities

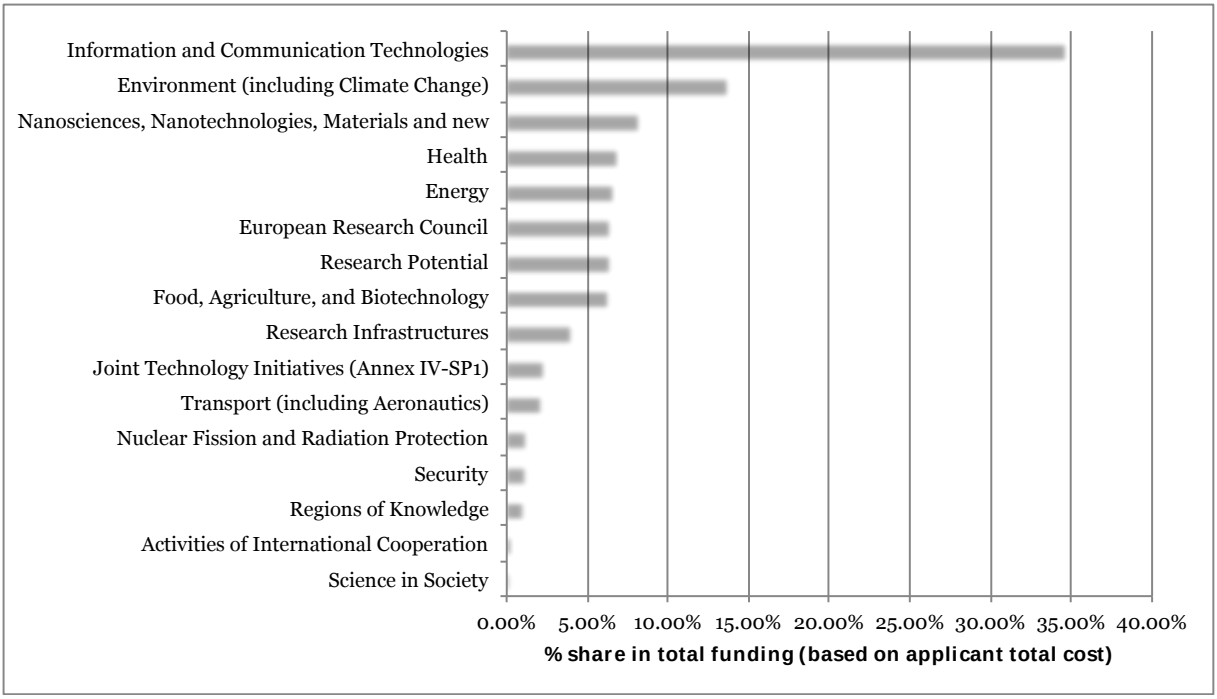


Notes: bubble size shows the % shre of total SF budget; based on own "concordance" linking Crete's RIS3 priorities to SF categories (appendix D). The match is arbitrary and could be re-assessed particularly if/when granular information on expenditures become available.

- Investment/Funding through FP/Horizon 2020

Thematic areas Crete has been aiming to strengthen its research basis: The prevalent thematic area of Cretan affiliations during the FP7 period of 2007-2013 had been Information and Communication Technologies with ca. 35% of the budget. The second most desired area of Cretan affiliations follows with a significant distance from the first with ca.14% in the Environment (including Climate Change). The latter two are also the ones with the highest number of submitted proposals. In the third place Nanosciences, Nanotechnologies, Materials and new Production Technologies proposals are placed with ca. 8%.

Figure 22 Prevalent thematic area FP7

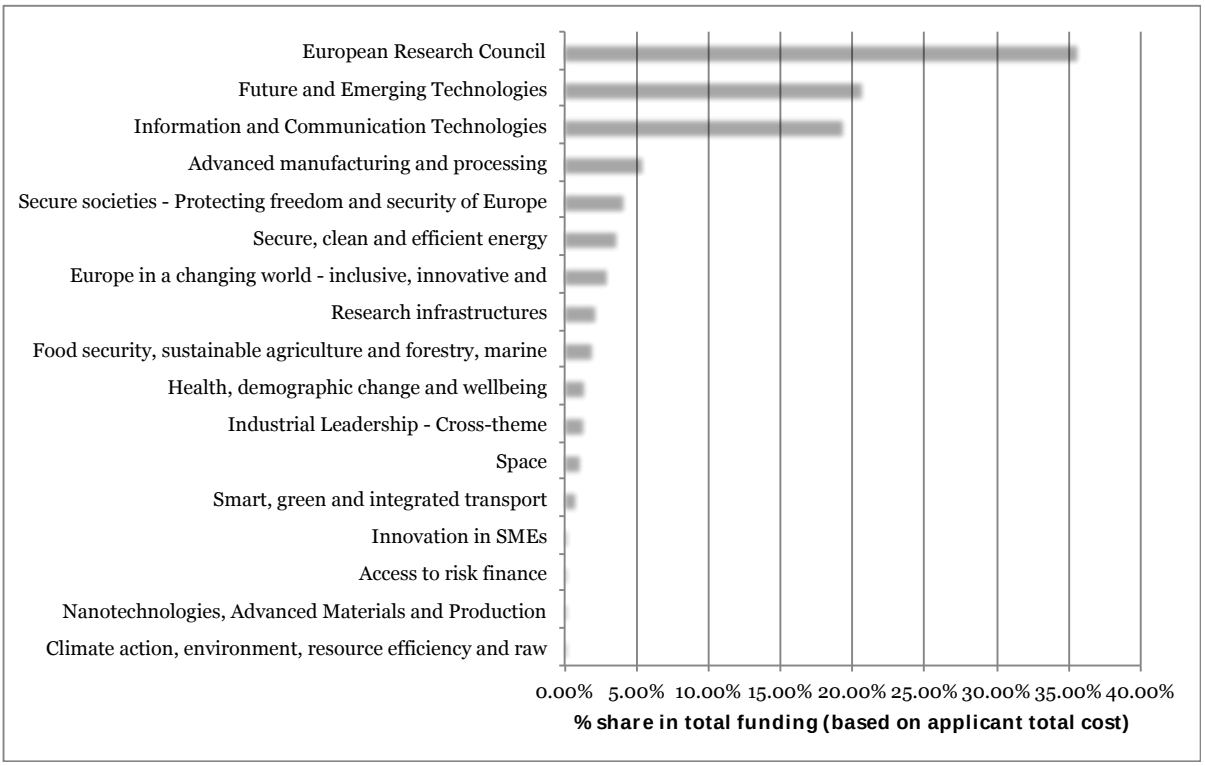


Source: e-Corda

Notes: measured based on figures of total budget of submitted proposals including hence main-listed, rejected and reserve proposals;

The prevalent thematic area of Cretan affiliations during the on-going Horizon 2020 period of 2014-2020 is labelled "European Research Council" (covers "Excellent Science" and is non-thematic) and represents 35% of the total budget. The second thematic area standing out is "Future and Emerging Technologies" with ca. 21% followed by "Information and Communication Technologies" as has been the case in the entire FP7 period with ca. 19% of the total budget.

Figure 23 Prevalent thematic area Horizon 2020

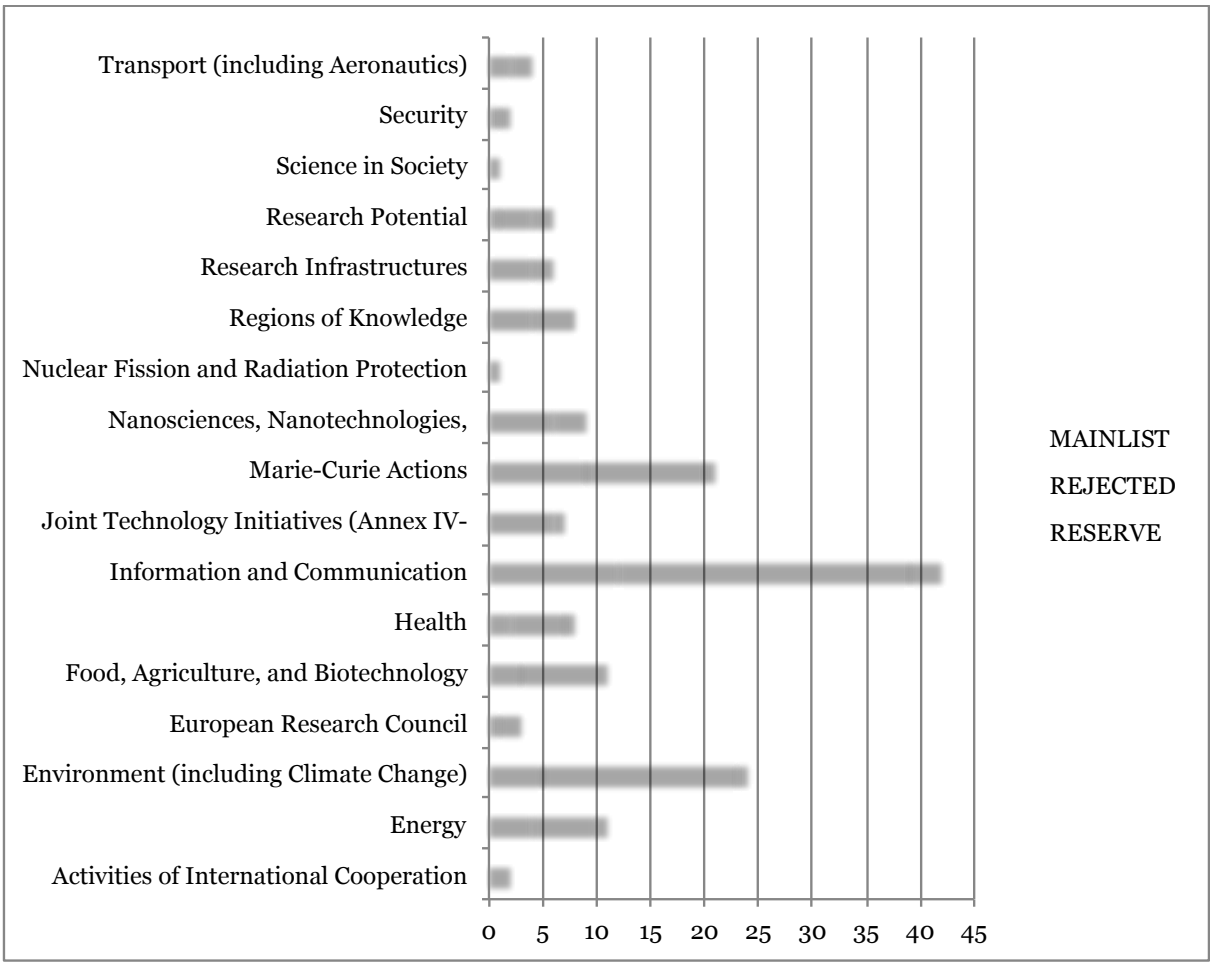


Source: e-Corda

Notes: measured based on figures of total budget of submitted proposals including hence main-listed, rejected and reserve proposals;

Thematic areas Crete has not succeeded in obtaining funding: Under FP7, the primary thematic area for which Cretan affiliations were positively evaluated but finally rejected is "Information and Communication Technologies" representing ca. 35% of the total FP budget (measured based on figures of total budget of rejected proposals). The second most "unsuccessful" thematic area had been the "Environment (including Climate Change)" with ca. 14% of rejected proposal funding. In terms of proposal counts 27 of the 42 submitted proposals in "Information and Communication Technologies" were rejected and 18 of the 24 submitted proposals in "Environment (including Climate Change)". The aforementioned thematic areas in rejected FP7 proposals of Cretan affiliations correspond to RIS3 priorities.

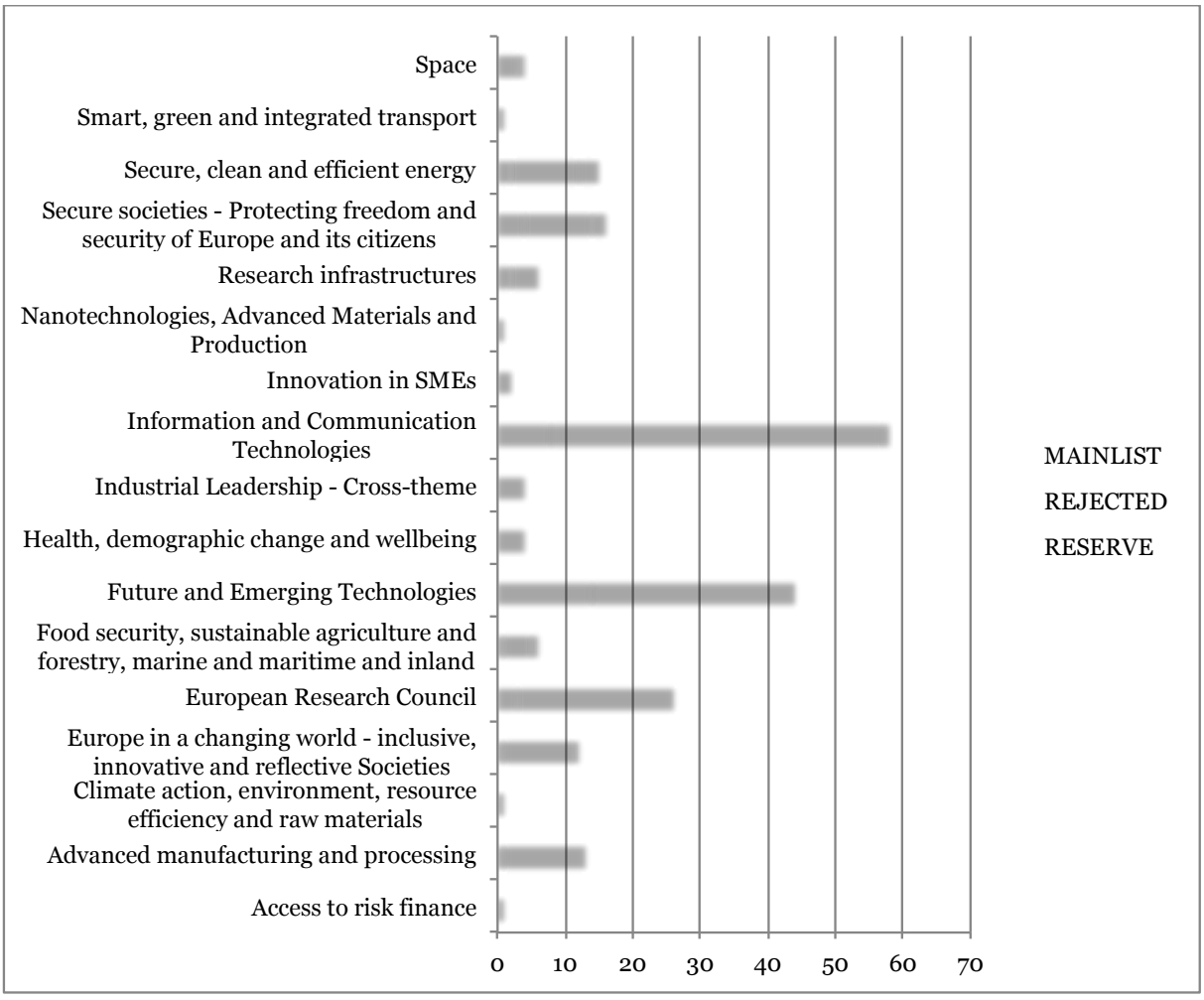
Figure 24 FP7 proposal outcome



Source: Own elaboration based on e-Corda

Under Horizon 2020 prevalent thematic areas in rejected proposals of Cretan affiliations also correspond to RIS3 priorities. In particular, the European Research Council with ca. 35% of total budget which covers excellent science impacts Crete's Knowledge complex. One would however need to look at project level to assess the link and relevance to Crete's Future and Emerging Technologies with ca.21% of total budget also impacts the Knowledge complex while Information and Communication Technologies with ca. 19% impacts the latter but can be considered a cross cutting area with applications on all RIS3 complexes. So far, in the majority of thematic areas the share of rejected proposals is significant.

Figure 25 Horizon 2020 proposal outcome



Source: e-corda, analysis Technopolis Group

Notes: Calculations are based on the % share of mainlisted proposal funding, this is the sum of the funding including the applicants total cost and the contribution requested to the EC per Cretan affiliation); Only proposals with Cretan participation and with a positive experts evaluation status have been considered.

FP7/Horizon 2020 project funding, proposals positively evaluated that did not get funding (PENF) and RIS3 priorities: Thematic areas of PENF proposals in FP7 and the on-going Horizon 2020 correspond to RIS3 priorities. Whether funding gaps are increasing as a consequence, particularly accounting for the fact that Greece is a country relying on EU funding for RI, requires further investigation. It is for example possible that those proposals get funding from other EU funding schemes such as COST. It can also be possible that by looking at the individual projects the link to RIS3 becomes less direct varying in its degree of relevance.[16]

[16] This is partly due to the unavoidable reliance on broad categorisations of FP7 and Horizon 2020 which are appropriate as a first step to unveil areas where further investigation is necessary but mask a more precise estimation of the linkage to RIS 3 due to the broad grouping of projects.

To establish whether Crete's PENF proposal gaps are covered by SF 2014-2020 more granular information is required. On at least theoretical ground however there can be synergies between FP7/Horizon 2020 and SF (see Figure 26 on ERDF).

Figure 26 Synergies between ERDF and Horizon 2020

Thematic Objectives	ERDF	Horizon 2020
TO1. Strengthening research, technological development and innovation	• Support for Research and innovation infrastructure, centres of excellence and business investment in R&I • R&D centres, promotion of product and service development, technology transfer, social innovation, eco-innovation, public service applications, networking, clusters and open innovation • Early product validation actions, advanced manufacturing capabilities, key enabling technologies and diffusion of general purpose technologies	Excellent Science. Support for world-class science in Europe (ERC, future and emerging technologies, Marie Sklodowska-Curie actions, research infrastructures including e-infrastructure). Industrial Leadership. Support for key technologies across existing and emerging sectors (Leadership in enabling and industrial technologies - LEITs; access to risk finance; innovation in SMEs. Societal Challenges. Support for R&I that target society and citizens (health, demographic change and wellbeing; food security, sustainable agriculture and forestry, marine/maritime/inland water research and the bioeconomy; secure, clean and efficient energy; smart, green and integrated transport; climate action, environment, resource efficiency and raw materials; inclusive, innovative and reflective societies; secure societies); Spreading excellence and widening participation; Science with and for society.
TO2. Enhancing access to, and use and quality of ICT	Development of ICT products and services, extend broadband deployment and high-speed networks Adoption of emerging technologies and networks Strengthening of ICT applications for e-commerce, e-government, e-learning, e-inclusion, e-culture and e-health	ICT is present in many areas of Horizon 2020: Excellent Science. Future and Emerging Technologies, European research infrastructures (eInfrastructures) Industrial Leadership. LEITs and ICTs Societal challenges. Multi-disciplinary application-driven research and innovation leveraging iCT to tackle societal challenges

TO3. Enhancing the competitiveness of SMEs of agricultural sector (EAFRD) and of the fishery and aquaculture sector (EMFF)	Entrepreneurship through business incubators, on developing new business models for SMEs Support the creation and extension of advanced capacities for product and service development Support the capacity of SMEs to grow in regional, national and international markets and to engage in innovation	Innovation in SME SME instrument EUREKA/Eurostars Initaitive LEITs Actions Access to risk finance
TO4. Supporting the shift towards a low-carbon economy in all sectors	Energy efficiency and renewable energy use in public and residential buildings and SMEs Renewable energy production, high-efficiency cogeneration, smart distribution grids Integrated low-carbon strategies, sustainable action plans for urban areas, urban mobility	Secure Clean and Efficient Energy Smart, green and integrated transport
TO5. Promoting climate change adaptation, risk prevention and management	Strategies and action plans for adaptation to climate change and risk prevention Management plans at national, regional and local level Investment in adaptation to climate change and risk prevention and management Development of tools and investment disaster management systems Support to societal responses to industrial risks	Food security, sustainable agriculture and forestry, marine, maritime and inland water research and the bioeconomy
TO6. Preserving and protection of the environment and promoting resource efficiency.	Investment in efficient water supply, waste water treatment and water reuse, waste management and green infrastructure Investment in actions to reduce transport related air pollution, replacement programmes for bus fleets, incentive schemes for cleaner transport, improved transport infrastructure, alternative forms of transport	Climate Action, environment, resource efficiency and Raw Materials
	Investment in the diversification of local economies, protection of cultural heritage and landscape Sustainable integrated urban development, sustainable urban	

	drainage, soil desealing measures, rehabilitation of contaminated sites, rehabilitation of cultural infrastructure	
TO7. Promoting sustainable transport and removing bottlenecks in key network infrastructure	Support investments to implement the TEN-T network, environmentally-friendly transport systems, interoperable railway systems, smart energy distribution, storage and transmission systems	Smart, Green and Integrated Transport

Source: Technopolis Group

4.4. Grid 3: markets / targets

4.4.1. Global Market Potential - Highlights of trends

Trends - Global market for industry/services: The OECD (2015) refers to a new industrial revolution brought about by the convergence of IT, bio, nano and cognitive sciences. This includes the digitalisation of production linked to smart industry concepts and innovation for an ageing society to name a couple.

Highly performing RPOs in Crete are in fact specialising in the aforementioned areas (i.e. nano and bio) while in IT there is a clear intention to strengthen expertise (i.e. through FP7 and Horizon projects). The link however between science and industry has been a weak aspect of Crete's STI system.

Trends - Innovators: In domestic R&D a major role is played by multinationals. Moreover, national innovation hubs are increasingly connected to global innovation networks and engage in international cooperation (OECD, 2015).

In Crete RPOs appear well connected in European and Global networks as demonstrated by peer reviewed publications and their FP7 and Horizon 2020 participation. In terms of FDI and Technology Transfer however Greece ranks 27th among the EU28 countries (World Economic Forum - Global Competitiveness Index, 2012/2013).

Trends - Patenting: According to Thomson Reuters (2015) the industries showing the largest growth in patent volume were Food, Beverages & Tobacco (21%); Pharmaceuticals (12%); Cosmetics & Well-Being (8%); and Biotechnology (7%). That said the growth in patenting volumes has been slowing down with a worldwide increase in 2014 of ca. 3%. Moreover, what is revealed through patenting trends is that the traditional boundaries between industries and companies' areas of specialization are no longer neatly separated. This is demonstrated by dozens of companies (such as Apple, DuPont, General Electric, IBM, and Samsung) that appear among the top patent assignees in multiple industries outside of their core areas of focus.

In Crete while patenting in areas of high growth does take place (i.e. Biotechnology and Agriculture and Biological sciences identified for FORTH[17]), the Technological adoption and Firm level technology absorption is among the lowest in EU28 countries, (Greece ranks 27th in the aforementioned dimensions according to the World Economic Forum, 2012/2013). At the same time however the availability of latest technologies is similarly among the lowest in EU28 countries. This points to difficulties stemming from both the industry itself but also the intermediaries and their networks.

[17] An in depth analysis of patenting is needed to fully assess the specialization of Crete considering all subject areas.

Trends - Trade: According to the World Trade Organisation (2015) among the most notable trends has been within the computer services trade with it ranking as the most dynamic services export sector (with an 18% growth on average annually from 1995 to 2014). Within computer services global trade in commercial services increased by 8% on average annually and has been recording double-digit growth from 2002 to 2008. Other strong sub-categories are computer and information services, and financial services. Another category within the services trade is communications services which has also expanded 8% annually in the last two decades.

Innovation in services is not key in Crete's RIS3 priorities buts makes part of the Cultural Tourism complex objectives. While the emphasis is on a technology driven model other forms of innovation such as creativity and organisational innovation applies to sectors of tourism and culture.

4.4.2. Existing regional Economic base

According to structural business statistics on employment from Eurostat (at least for the available sectors in NACE rev.2) Crete is an economy specialised in 'Agriculture, forestry and fishing' and 'Wholesale and retail trade, transport, accommodation and food service activities'. The regional economic base is thus coherent with the RIS3 priorities, the Agrofood and Culture and Tourism complexes respectively.

Figure 27 Regional Specialisation based on employment

Link to RIS3 priorities	Sector	Location quotient
Agrofood Complex	Agriculture, forestry and fishing	3.7
Cultural Tourism Complex	Wholesale and retail trade, transport, accommodation and food service activities	1.6
Knowledge / Environment Complex	Professional, scientific and technical activities; administrative and support service activities	0.6
Cultural Tourism Complex	Arts, entertainment and recreation; other service activities; activities of household and extra-territorial organizations and bodies	0.9

Source: Own calculations based on Eurostat

4.5. Potential for co-operations and synergies between Crete and other relevant regions

4.5.1. Structurally similar regions with similar RIS3 priorities

The assumption is that co-operation and synergies are more likely to occur between regions with similar specialisation objectives. The basis of the analysis is hence regions' RIS3 priorities. The areas of potential co-operation are thus those that correspond to the priorities set by Crete. The regions with which cooperation and synergies can be sought are among those structurally similar regions with similar RIS3 priorities.

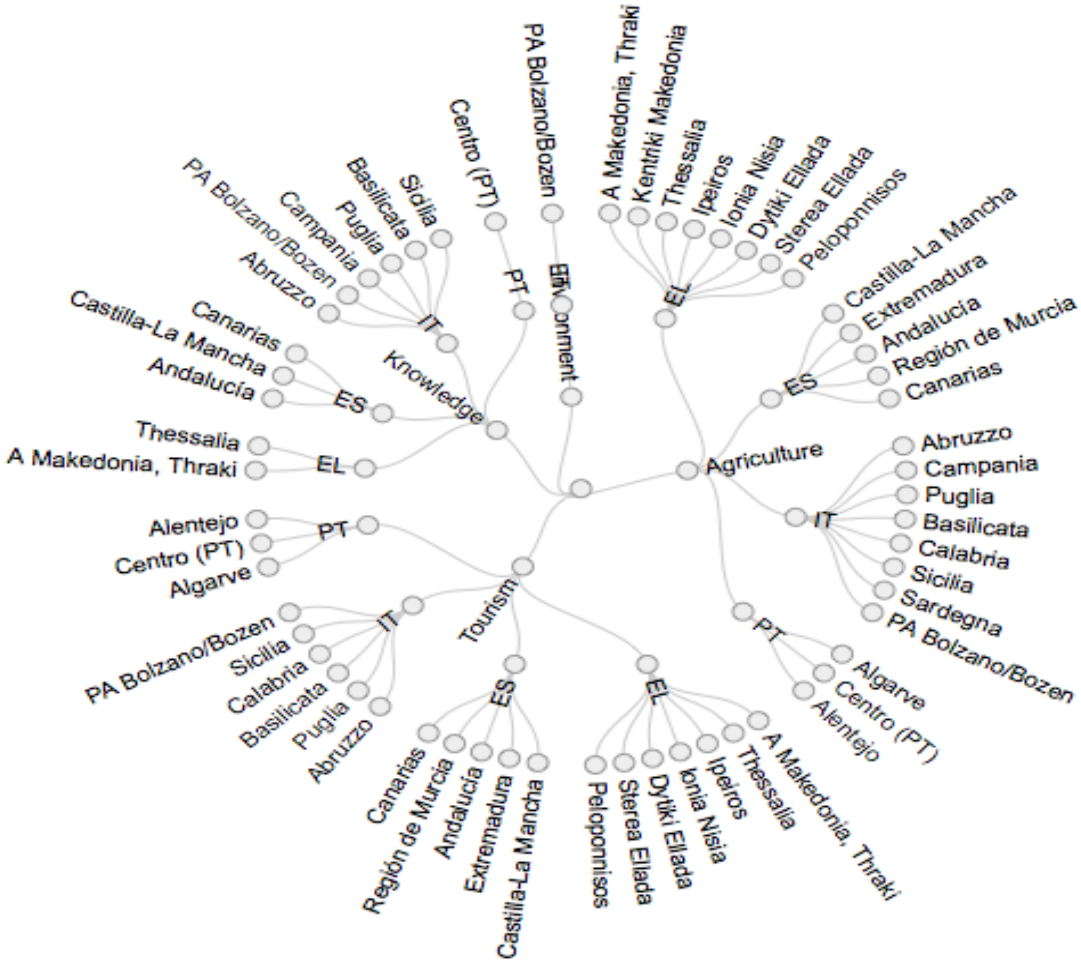
Structural similarity is defined on the basis of social, economic and geographical characteristics. In fact those structurally similar regions also share similar specialisation patterns given the dimensions of technology specialisation, economy and industry specialisation accounted for in the S3P benchmarking tool.[18]

RIS3 similarity of structurally similar regions is defined based on the information available in the Eye@RIS3 database managed by the Smart Specialisation Platform (S3P).[19] Hence, the selection criteria regions must meet in order to classify as relevant regions for the purpose of this study are based on Crete's Eye@RIS3 information describing the priorities and classifying them according to research and innovation capabilities (see Appendix E). This approach results in four different pools of regions corresponding to Crete's RIS3 complexes as described in sub-section 4.1.

[18] The other five are: geo-demography, human resources, firm structure, openness, and institutions and values.

[19] It should be noted that RIS3 priorities as defined by the regions do not necessarily represent sectors of current specialisation of the regions but potentially a statement of intention to specialise in. The analysis of information and data in the subsequent steps allows us to distinguish those regions from those specialised regions and interpret accordingly in the analysis. Another caveat to bear in mind is that the descriptions of priorities may be broader and more encompassing in order to cover future activities. Moreover the assumption made is that the priorities as included in Eye@RIS3 are up to date. Both points will be controlled through the analysis of information and data that follows.

Figure 28 Structurally similar regions by Crete RIS3 priorities



4.5.2. Convergence regions and structurally similar regions with past co-operations

The assumption is that co-operation and synergies are more likely to occur in areas and among regions that have already been co-operating in the past. Existing linkages between regions partly demonstrate common objectives and facilitate further and broader co-operation.

To identify areas and collaborators, FP7 and Horizon 2020 thematic areas of Crete's projects are considered with partners qualifying as either convergence and/or structurally similar regions. On the basis of the projects Crete has been participating, the most frequent partners are selected (i.e. partners with who Cretan affiliations have collaborated in at least two projects) (see Figure 29). The same approach could eventually be followed to identify more advanced regions with which Crete co-operates.

The predominant FP7 thematic areas Crete has participated in (besides Marie Curie actions) are ICT (ca. 26%), Environment including climate change (ca. 6%) and Activities of International Cooperation, Research for the benefits of SMEs and Nanosciences, Nanotechnologies, Materials and new Production Technologies (all between ca. 4-5%).[20] Opportunities thus for co-operation and synergies are particularly relevant given the direct link of the projects' thematic areas to Crete's RIS3 priorities.

[20] Percentages represent the share of FP/Horizon 2020 themes in total measured as counts.

Figure 29 Crete's Collaborators - FP7 and Horizon 2020

Notes: Collaborators with at least two project participations with Crete as partner.

4.5.3. Convergence regions and structurally similar regions with expertise related to Crete's RIS3 priorities

The assumption is that co-operation and synergies are more likely to occur in the areas of specialisation of PoEs and other convergence regions in order to strengthen their collective presence in the European market.

To identify areas of specialisation and regions specialised in the areas Crete specialises in according to RIS3 the following dimensions are investigated:

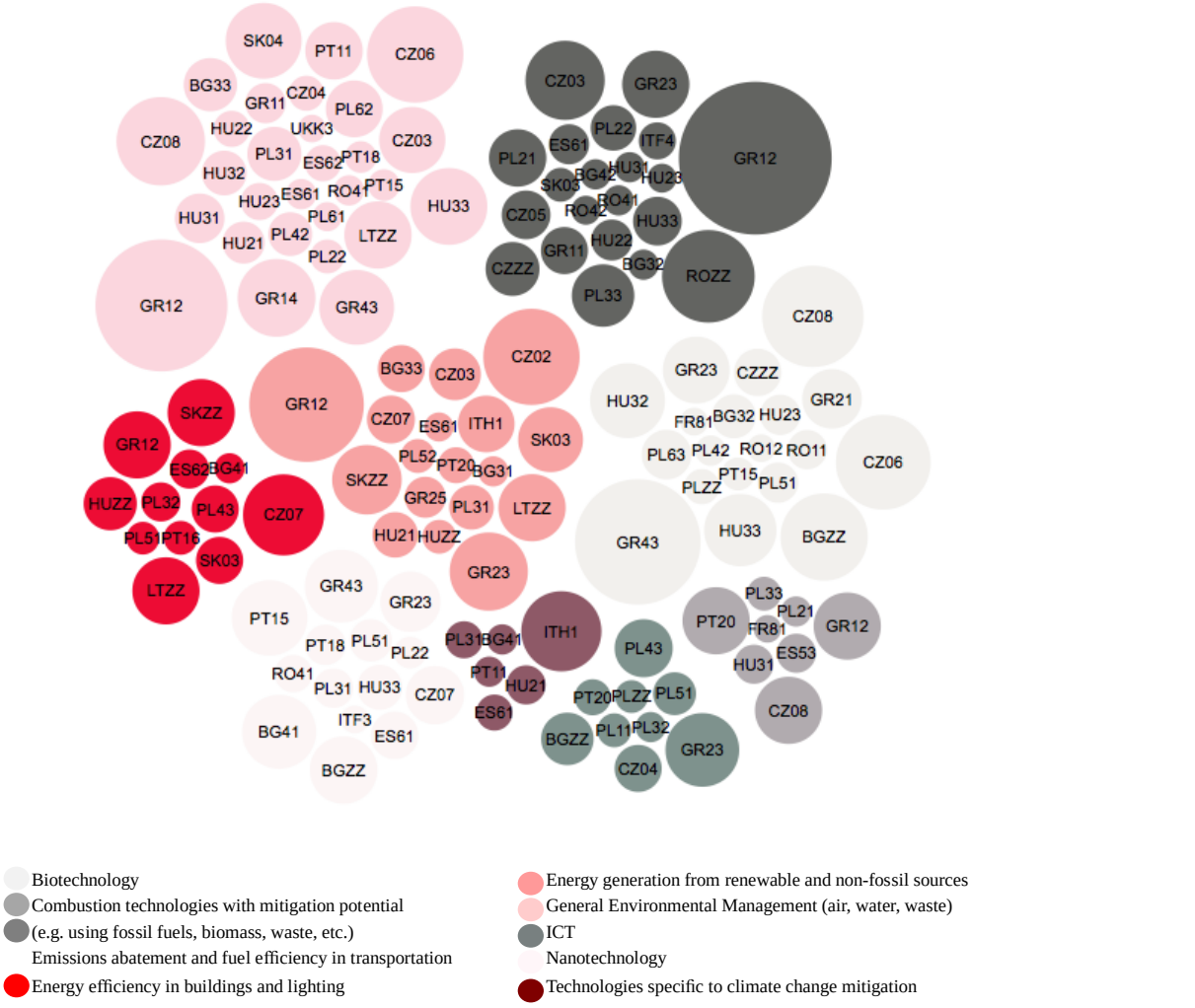
- Technological skills (grid 1): Patents;
- Regional synergies between research, innovation and economic policies (grid 2): FP7 projects;
- Markets/Targets (grid 3): Regional Economic base (specialisation - labour based).

4.5.4. Patents

Potential for co-operation and synergies is investigated on the basis of common patenting specialisation with convergence regions (see

Figure 30).

Figure 30 Specialisation - Patents



Results point to potential co-operations/synergies in areas aligned with Crete's RIS3 priorities between Crete and regions in:

- Hungary and the Czech republic in Biotechnology;
- Greek regions, the Czech Republic and Slovakia in General Environmental management;
- Portugal, Bulgaria and other Greek regions in Nanotech.

4.5.5. Clusters

Potential for co-operation and synergies is investigated through cluster based linkages. According to the European Cluster Panorama there are 16 sectoral clusters in Crete (see

Figure 31) and one cross-sectoral cluster in Environmental industries. The sectoral clusters are linked to RIS3 priorities particularly the Environmental, Agrofood and Cultural Tourism complexes.

Potential co-operation and synergies could thus be explored with those convergence regions which either qualify as hotspots of sectoral clusters or cross sectoral clusters matching Crete's clusters. Such analysis goes beyond the available resources for this study.

Figure 31 Sectoral Clusters

Sector	Star	Link to RIS3
Total	16	
Biopharmaceuticals	1	Knowledge Complex
Electric Power Generation and Transmission	1	Environmental Complex
Environmental Services	1	Environmental Complex
Financial Services	1	na
Fishing and Fishing Products	2	Agrofood Complex
Food Processing and Manufacturing	1	Agrofood Complex
Hospitality and Tourism	1	Cultural Tourism Complex
Insurance Services	1	na
Jewelry and Precious Metals	1	na
Livestock Processing	1	Agrofood Complex
Performing Arts	1	Cultural Tourism Complex
Recreational and Small Electric Goods	2	Cultural Tourism Complex
Water Transportation	2	Environmental Complex

Source: European Cluster Observatory

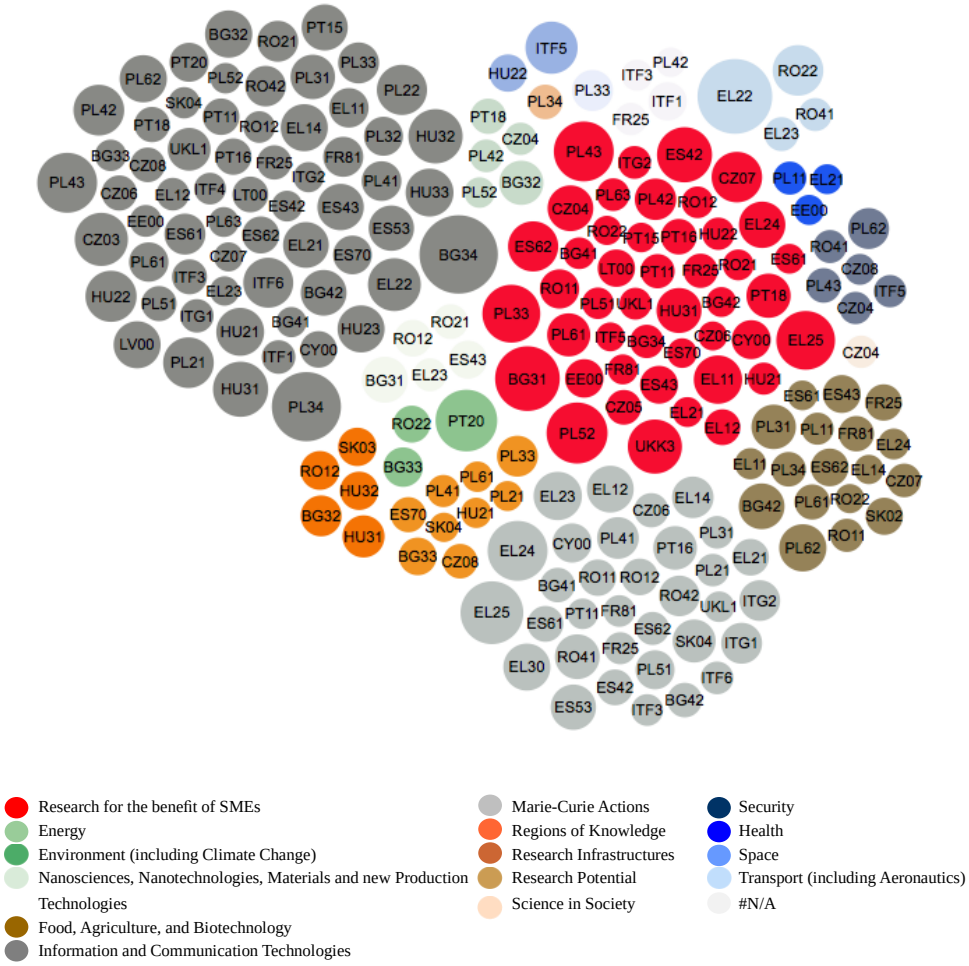
Notes: It should however be noted that with an overall cluster strength of 16 (based on the total number of stars in a region where stars are defined for the 51 Sectoral Clusters for the year 2013), Crete ranks within Greece at the bottom of the scale (range of 4-16 stars) together with EL53 (Western Macedonia), EL54 (Epirus), EL63 (Western Greece), EL62 (Ionian Islands), EL41-42 (North and South Aegean).

4.5.6. FP7 projects

To identify the expertise structurally similar and convergence regions have built through FP7 projects the thematic areas regions specialise in are considered.

The results obtained show a great number of regions specialising in various FP7 thematic areas. By matching FP7 thematic areas to Crete's RIS3 priorities i.e. the RIS3 complexes (see Figure 33)[21] the results obtained point to ICT and Research for the benefit of SMEs as the thematic areas with the vastest range of other specialised regions. On the other hand the Agrofood, Environmental and Knowledge complexes appear to be less relevant with hence less evident potential for co-operations and synergies besides maybe Portugal in the case of Environment.

Figure 32 Specialisation – FP7



Notes: based on specialisation index of regions in their country and size of bubble represents the share in total projects of the region. The visual excludes specialised regions with a share of less than 1%.

[21] The match is arbitrary and could be further adjusted according to policy objectives.

Figure 33 Links between RIS3 priorities and FP7 thematic areas

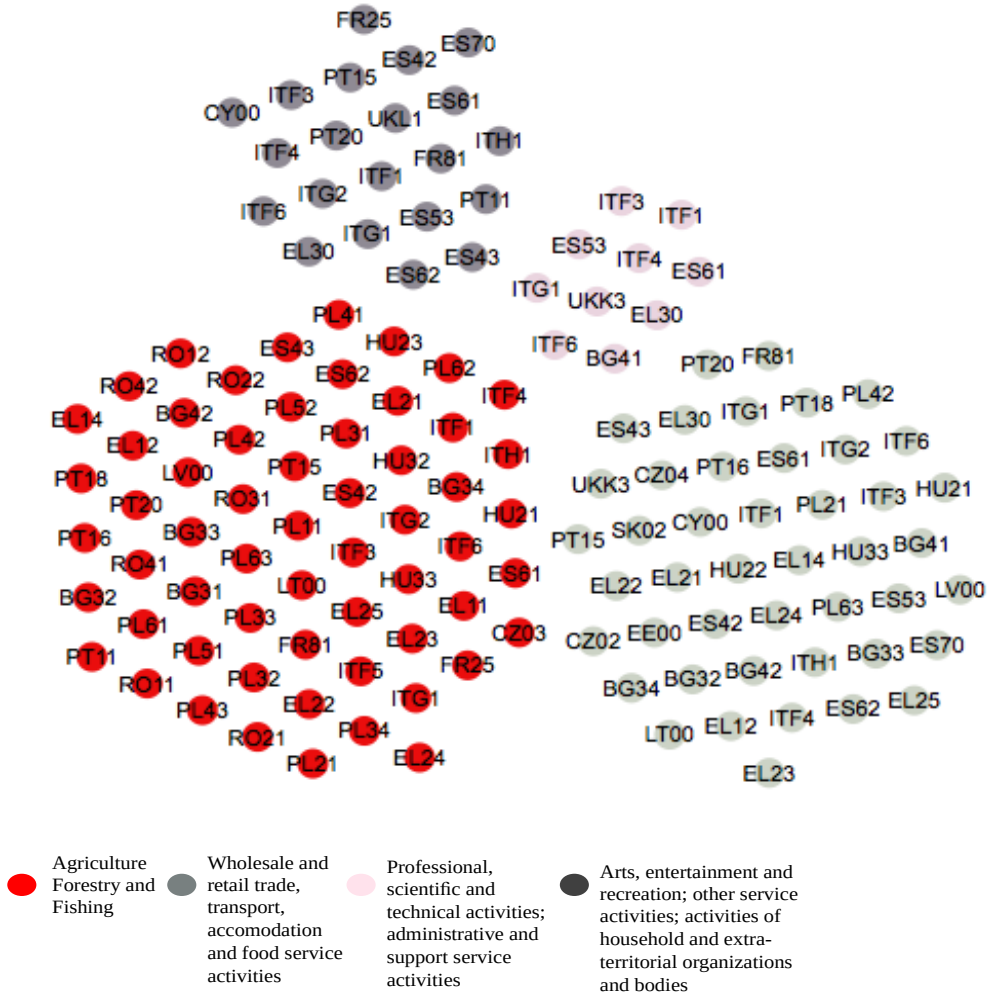
RIS3	FP7 thematic areas
Agrofood	Food, Agriculture, and Biotechnology
Environmental	Energy Environment (including Climate Change)
Knowledge	Nanosciences, Nanotechnologies, Materials and new Production Technologies
	European Research Council Research Infrastructures Regions of Knowledge Research Potential
	Activities of International Cooperation Research for the benefit of SMEs
Multiple	Information and Communication Technologies

4.5.7. Regional Economic base

Areas of potential cooperation and synergies between convergence regions and Crete can be found in the sectors of 'Agriculture, forestry and fishing' and 'Wholesale and retail trade, transport, accommodation and food service activities'. As visualised in

Figure 34 there is a great number of regions specialised in the latter two sectors.

Figure 34 Specialisation - employment



5. CONCLUSIONS

5.1.1. The gap between research performance & innovation performance and the role of regional complementarity

The necessity to stimulate and enhance science and industry linkages has been identified and included in regional strategies already for some time. In fact, linkages go beyond science and industry and include beyond knowledge based linkages also supply/value chain integration etc. The persistent gap however raises questions on the effectiveness of existing means pointing towards the need to go beyond the triple helix approach.

According to the OECD a fourth factors includes the *socio-cultural regional environment and the extent to which the forming of coalitions at regional level contributes to the creation of "constructed regional advantages".* As such complementarity between regions with similar specialisation patterns expressed in the real economy by clusters, or co-operations between private companies and RPOS in FP7/ Horizon 2020 and other EU funded initiatives help pave the way to strategic coalitions among PoE regions. The competitiveness of those coalitions vs. more advanced regions with an established market presence is however an important factor to be taken into account.

5.1.2. The role of FPs-Horizon 2020 and Structural Funds in shaping the research and innovation profile of the pockets of excellence

Particularly and for convergence regions ESIF are the most important if not the only sources of funding for research and innovation. As such their role is critical and plays a major role in stimulating and driving growth in the future. That said, an alignment between the sectoral specialisation of the economy and the EU funded knowledge basis is needed should the expectation of growth through innovation be a realistic one. Synergies thus through combinations of different EU funding streams to further enhance PoEs require strategic thinking and choices must be made given the limited resources available.

5.1.3. Horizon 2020 contribution to excellence and better innovation performance

Horizon 2020 is by design meant to tackle the disparities between Member States in research and innovation by introducing measures targeted at low performing Member States and regions (i.e. teaming, twinning, ERA Chair schemes, Policy Support Facility, COST, National contact points). The risk is that the measures do manage to stimulate and support excellence in those Member States which would on its own be deemed as a success story but may not lead to innovation performance either because of the lack of a market, or too small a market or an immature market in terms of absorption and readiness. Growth led by innovation should it be the ultimate objective risks not being realised due to a disconnect between excellence in research and innovation on the ground within and for the regional economy.

5.1.4. S3 procedure & governance of cohesion funds

For the pocket of excellence to work it implies a series of 'pre-conditions':

- Focus of (at least part) research carried out is relevant for regional economy (cross-cutting applications (e.g. bio- or IT sciences) or specific technologies driving existing or emerging industries

- Absorptive capacity of business eco-system (e.g. existence of strong clusters of smaller companies or one or two major firms organising local supply chains and well placed in international value chains)

- Strong public sector governance to both manage effectively ESI funds locally and help coordinate inter-regional co-operation

6. SUMMARY

This study developed and tested (on the Greek region of Crete) a methodology for identifying pockets of excellence (PoE) in less favoured European regions. PoE are defined as localised research or innovation systems, in countries with an overall weaker R&I system, which have the potential to drive regional growth or link up to top European research networks. A three-step methodology was used:

- Identify regions where research and/or innovation performance is relatively higher (or growing relatively faster) than in other less favoured regions.
- Within these 'PoE' regions, assess the extent to which one or more localised PoE (public, academic or industrial groupings) is linked to or has a potential to contribute to the regional smart specialisation priorities.
- Assess the potential for co-operation and synergies in specific specialisation areas intra- or inter-regionally.

In the case of Crete, the study confirmed that the region is a PoE within Greece and to some extent at European level. Crete has several potential 'micro' PoEs given scientific performance and linkages within its higher education and research institutions. These PoEs were shown to have the potential to contribute to the region's smart specialisation priorities. The analysis also highlighted the potential for co-operations and synergies between Crete and other structural similar regions in a number of scientific and technological fields.

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8. APPENDICES

8.1 List of relevant regions (structurally and RIS3 based) for Crete

Figure 35 Structurally similar regions by RIS3 complex

NUTS Id	Label	Complex
EL11	Anatoliki Makedonia, Thraki	Agrifood
EL12	Kentriki Makedonia	Agrifood
EL14	Thessalia	Agrifood
EL21	Ipeiros	Agrifood
EL22	Ionia Nisia	Agrifood
EL23	Dytiki Ellada	Agrifood
EL24	Sterea Ellada	Agrifood
EL25	Peloponnisos	Agrifood
ES42	Castilla-La Mancha	Agrifood
ES43	Extremadura	Agrifood
ES61	Andalucía	Agrifood
ES62	Región de Murcia	Agrifood
ES70	Canarias	Agrifood
ITF1	Abruzzo	Agrifood
ITF3	Campania	Agrifood
ITF4	Puglia	Agrifood
ITF5	Basilicata	Agrifood
ITF6	Calabria	Agrifood
ITG1	Sicilia	Agrifood
ITG2	Sardegna	Agrifood
ITH1	Provincia Autonoma di Bolzano/Bozen	Agrifood
PT15	Algarve	Agrifood
PT16	Centro (PT)	Agrifood
PT18	Alentejo	Agrifood
EL11	Anatoliki Makedonia, Thraki	Cultural Tourism
EL14	Thessalia	Cultural Tourism
EL21	Ipeiros	Cultural Tourism

EL22	Ionia Nisia	Cultural Tourism
EL23	Dytiki Ellada	Cultural Tourism
EL24	Sterea Ellada	Cultural Tourism
EL25	Peloponnisos	Cultural Tourism
ES42	Castilla-La Mancha	Cultural Tourism
ES43	Extremadura	Cultural Tourism
ES61	Andalucía	Cultural Tourism
ES62	Región de Murcia	Cultural Tourism
ES70	Canarias	Cultural Tourism
ITF1	Abruzzo	Cultural Tourism
ITF4	Puglia	Cultural Tourism
ITF5	Basilicata	Cultural Tourism
ITF6	Calabria	Cultural Tourism
ITG1	Sicilia	Cultural Tourism
ITH1	Provincia Autonoma di Bolzano/Bozen	Cultural Tourism
PT15	Algarve	Cultural Tourism
PT16	Centro (PT)	Cultural Tourism
PT18	Alentejo	Cultural Tourism
ITH1	Provincia Autonoma di Bolzano/Bozen	Environmental
ES61	Andalucía	Knowledge*
ITF1	Abruzzo	Knowledge*
ITH1	Provincia Autonoma di Bolzano/Bozen	Knowledge*
EL11	Anatoliki Makedonia, Thraki	Knowledge
EL14	Thessalia	Knowledge
ES42	Castilla-La Mancha	Knowledge
ES70	Canarias	Knowledge
ITF3	Campania	Knowledge
ITF4	Puglia	Knowledge
ITF5	Basilicata	Knowledge
ITG1	Sicilia	Knowledge
PT16	Centro (PT)	Knowledge

Notes: "Knowledge with asterisk is specific to Tourism and Culture or Agrofood complexes.

Figure 36 Collaborators (based on FP7 and Horizon 2020 projects)

Convergence Regions		Structurally similar	
NUTS label	**Count**	**NUTS label**	**Count**
Eesti	34	Abruzzo	2
Latvija	15	Algarve	2
Lietuva	20	Basilicata	2
Nord-Est	6	Basse-Normandie	3
Nord-Vest	2	Calabria	2
Norte	27	Campania	17
Pomorskie	2	Canarias	4
Sud - Muntenia	2	Castilla-La Mancha	2
Sud-Est	2	Centro (PT)	14
Sud-Vest Oltenia	2	Illes Balears	6
West Wales and The Valleys	13	Languedoc-Roussillon	13
Wielkopolskie	6	Puglia	10
Югозападен (Yugozapaden)	40	Sardegna	4
Közép-Dunántúl	3	Sicilia	5
Észak-Alföld	3	Κύπρος (Kýpros)	55
Łódzkie	6	Κεντρική Μακεδονία (Kentriki Makedonia)	53
Североизточен (Severoiztochen)	3	Θεσσαλία (Thessalia)	11
Югоизточен (Yugoiztochen)	7	Δυτική Ελλάδα (Dytiki Ellada)	23
Южен централен (Yuzhen tsentralen)	3	Στερεά Ελλάδα (Sterea Ellada)	6
Severozápad	3	Αττική (Attiki)	162
Severovýchod	2	Andalucía	27
Nyugat-Dunántúl	2	Región de Murcia	11
Észak-Magyarország	6	Ανατολική Μακεδονία, Θράκη (Anatoliki Makedonia, Thraki)	2

Śląskie	3	Ήπειρος (Ipeiros)	4
Západné Slovensko	4	Πελοπόννησος (Peloponnisos)	2
Stredné Slovensko	4	Dél-Alföld	3
Východné Slovensko	2		

Link between FP7, H2020 and RIS3

	LB_DESC	RIS3
FP7	Health	
	Food, Agriculture, and Biotechnology	Agrofood
	Information and Communication Technologies	Multiple
	Nanosciences, Nanotechnologies, Materials and new Production Technologies	Knowledge
	Energy	Environmental
	Environment (including Climate Change)	Environmental
	Transport (including Aeronautics)	
	Socio-economic sciences and Humanities	
	Space	
	Security	
	General Activities (Annex IV)	
	European Research Council	Knowledge
	Marie-Curie Actions	
	Research Infrastructures	Knowledge
	Research for the benefit of SMEs	Knowledge
	Regions of Knowledge	Knowledge
	Research Potential	Knowledge
	Science in Society	
	Coherent development of research policies	
	Activities of International Cooperation	Knowledge
	Fusion Energy	
	Nuclear Fission and Radiation Protection	
HORI	Cross-theme	
	Excellent Science - Cross-theme	Knowledge

ZON 2020	European Research Council	Knowledge
	Future and Emerging Technologies	Knowledge
	Marie-Curie actions	
	Research infrastructures	
	Industrial Leadership - Cross-theme	
	Leadership in enabling and industrial technologies (LEIT)	Knowledge
	Information and Communication Technologies	all
	Nanotechnologies, Advanced Materials and Production	Knowledge
	Advanced materials	Knowledge
	Biotechnology	Knowledge
	Advanced manufacturing and processing	Knowledge
	Space	
	Access to risk finance	business
	Innovation in SMEs	business
	Societal Challenges - Cross-theme	
	Health, demographic change and wellbeing	
	Food security, sustainable agriculture and forestry, marine and maritime and inland water research	Agrofood
	Secure, clean and efficient energy	Environmental
	Smart, green and integrated transport	
	Climate action, environment, resource efficiency and raw materials	Environment
	Europe in a changing world - inclusive, innovative and reflective Societies	
	Secure societies - Protecting freedom and security of Europe and its citizens	
	Spreading excellence and widening participation - Cross-theme	Knowledge
	Teaming of excellent research institutions and low performing RDI regions	Knowledge
	Twinning of research institutions	Knowledge
	ERA chairs	
	Policy Support Facility (PSF)	
	Supporting access to international networks	Knowledge
	Transnational networks of National Contact Points	
	Science with and for Society - Cross-theme	

	Make scientific and technological careers attractive for young people	
	Promote gender equality in research and innovation	
	Integrate society in science and innovation	
	Encourage citizens to engage in science	
	Develop the accessibility and the use of the results of publicly-funded research	Knowledge
	Develop the governance for the advancement of responsible research and innovation	Knowledge
	Anticipating and assessing potential environmental, health and safety impacts	
	Improve knowledge on science communication	Knowledge
	Euratom	

8.2 Link between SF and RIS3

	Crete RIS3 Priorities	SF Description of categories
SF 14 – 20	possibly Cultural Tourism Complex	Cycle tracks and footpaths
		Development and promotion of the tourism potential of natura
		Protection, development and promotion of public tourism …
		Development and promotion of public tourism services
		Protection, development and promotion of public cultural her
		Development and promotion of public cultural heritage services
	possibly environmental complex	Provision of water for human consumption (extraction, treatment …
		Water management and drinking water conservation (including
		Waste water treatment
		Environmental measures aimed at reducing and / or avoiding …
		Protection and enhancement biodiversity, nature protection …
		Protection, restoration and sustainable use of Natura 2000 ….
		Adaptation to climate change measures and prevention …
		Risk prevention and management of non-climate related natura …
		Rehabilitation of industrial sites and contaminated land
	possibly knowledge complex	Investment in infrastructure, capacities and equipment in SM
		Investment in infrastructure, capacities and equipment ….
		Research and innovation infrastructures (public)
		Research and innovation infrastructures (private, including …
		Research and innovation activities in public research centre
		Research and innovation activities in private research centre …
		Technology transfer and university-enterprise cooperation …
		Cluster support and business networks primarily benefitting
		Research and innovation processes in SMEs (including voucher …
		Research and innovation processes, technology transfer and …
SF	possibly Cultural	Protection and development of natural heritage

	Tourism Complex	Other assistance to improve tourist services
		Protection and preservation of the cultural heritage
		Development of cultural infrastructure
		Other assistance to improve cultural services
	possibly environmental complex	Renewable energy: wind
		Renewable energy: solar
		Renewable energy: biomass
		Renewable energy: hydroelectric, geothermal and other
		Energy efficiency, co-generation, energy management
		Management and distribution of water (drink water)
		Water treatment (waste water)
		Mitigation and adaption to climate change
		Other measures to preserve the environment and prevent risks
	possibly knowledge complex	R&TD activities in research centres
		R&TD infrastructure and centres of competence in a specific technology
		Technology transfer and improvement of cooperation networks ...
		Assistance to R&TD, particularly in SMEs (including access to R&TD services in research centres)
		Design, introduction and implementing of reforms in education and training systems ...
		Developing human potential in the field of research and innovation, in particular through post-graduate studies ...

8.3 Queries in eye@RIS3 for Crete

Queries are constructed according to the information available in the Eye@RIS3 for Crete (see Figure 37).

Figure 37 Indications of where Crete aims at with its priorities

Description (1)	**EU Priority** (2) (3)	**EU Priority (Sub)** (2) (3)	**Capability** (3)	**Capability (Sub)** (3)	**Target Market** (3)	**Target Market (Sub)** (3)
Technology and education (research centres, universities, technology park) and especially for agro-food and culture and tourism	NA	NA	Services	Scientific research & development	Services	Scientific research & development
Culture and tourism (hospitality, travel agencies, cultural capital, cultural activities)	NA	NA	Creative, cultural arts & entertainment		Tourism, restaurants & recreation	
Agricultural-food (production, packaging, food processing, Mediterranean diet)	NA	NA	Manufacturing & industry	Food, beverage & tobacco products	Manufacturing & industry	Food, beverage & tobacco products

Source: S3P Eye@RIS3 database [database download 24/09/2015; data on Crete dates from 09/2013]

(1) Data category that best describes the area of activity; and is always filled in; Many regional/national priorities are not confined to a single traditional sector, but are merging cross sector activities and/or specialised niches.

(2) Based on list of 10 top areas and around six subcategories, based on areas emphasised in the EU2020 and Innovation Union, notably Grand Challenges and prioritised policy areas. This field is not compulsory and hence not always available, as is the case for Crete.

(3) The idea is to capture both the regional research and innovation capabilities the business areas and target market and top down prioritise policy objectives envisioned as departure point.

Four cases are considered based on the following queries:

Query 1 - Agrifood Complex

Keyword: "Agriculture"[22] OR

Capability: "Manufacturing and Industry" AND

Capability (sub): "Food, beverage & tobacco products"

Query 2 - Cultural Tourism Complex

Keyword: "Tourism" OR

Capability: "Creative, cultural arts & entertainment" OR

Target Market: "Tourism, restaurants & recreation"

Query 3 - knowledge complex (+)

Advanced Technologies

Keyword: "Technology"

Agriculture

Agrifood Complex query AND

Keyword: "Research" OR "Technology"

Tourism

Cultural Tourist complex AND

Keyword: "Research" OR "Technology"

Query 4 - Environmental complex

Capability: "Energy production & distribution" OR

Market: ""Energy production & distribution"" AND

Description: "Environment"

[22] Keyword: "Agriculture" OR "Agri*" OR "Agro*" OR "Food"

8.4 Regional PoEs Identification

Figure 38 STI gap 2013

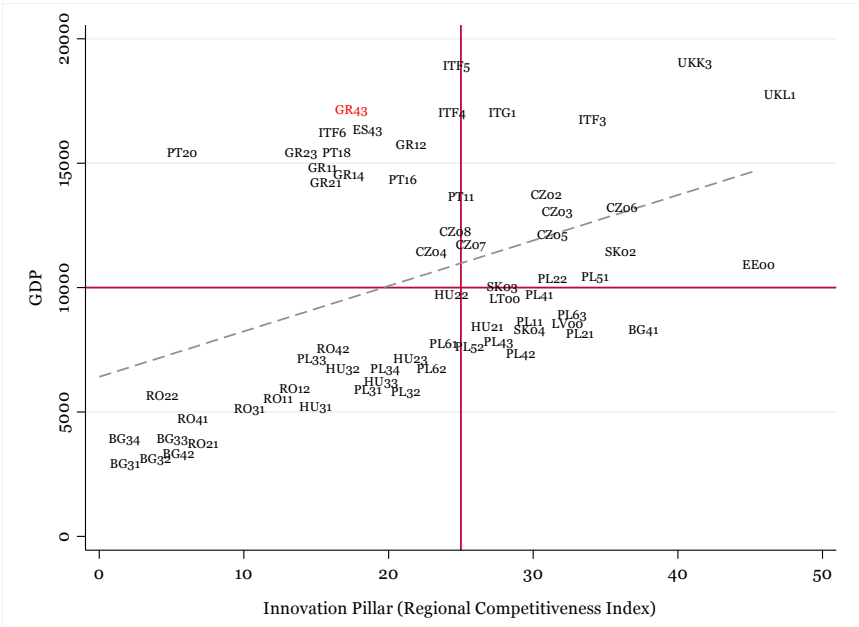


Figure 39 Linkages 2010

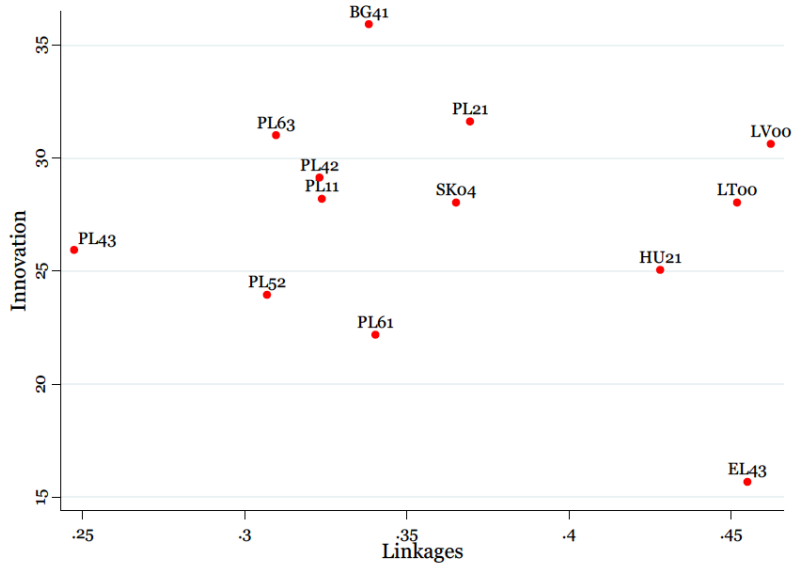


Figure 40 Dendogram 2010

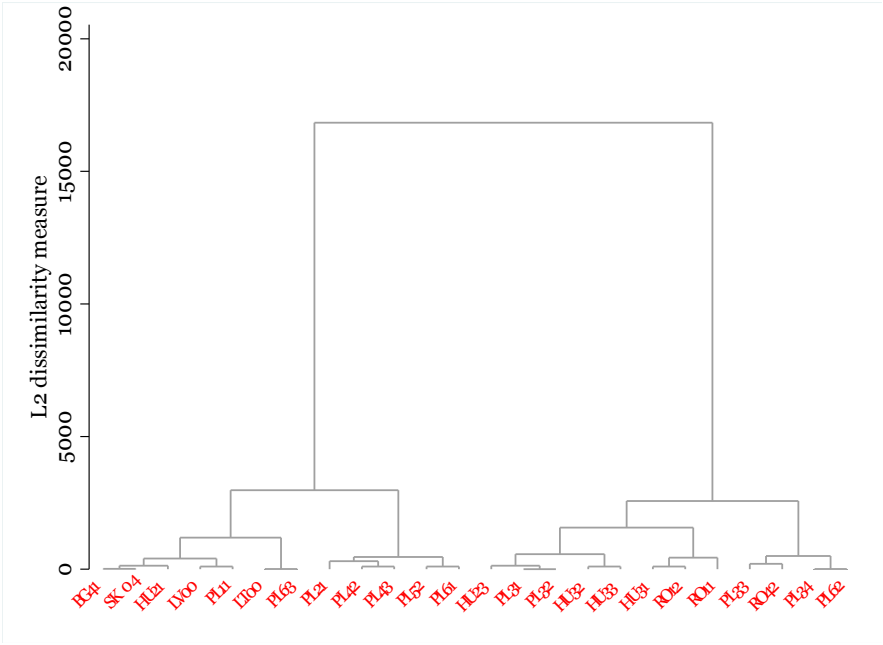
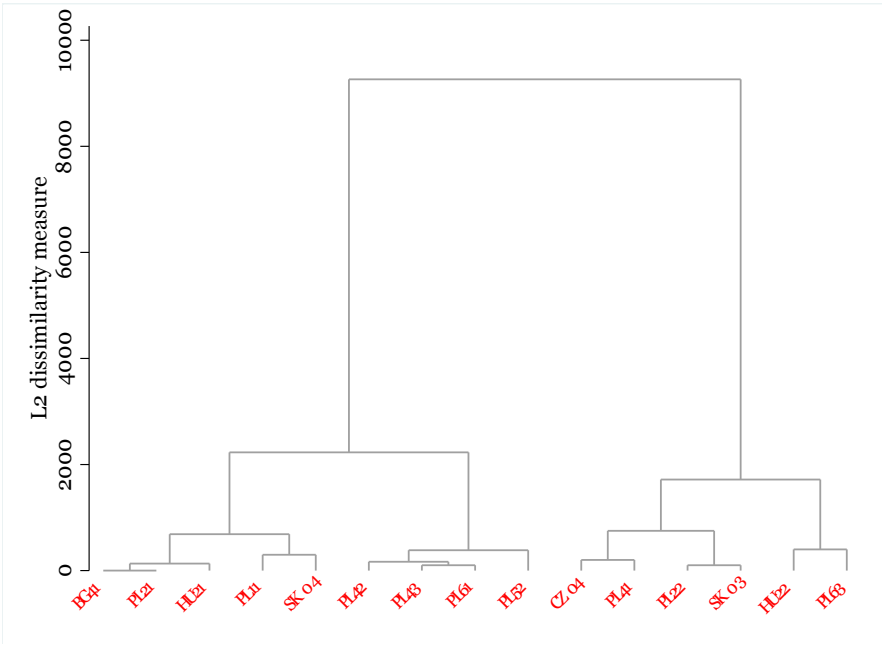


Figure 41 Dendogram 2013



KI-NA-27-900-EN-N

This study developed and tested (on the Greek region of Crete) a methodology for identifying pockets of excellence (PoE) in less favoured European regions. PoE are defined as localised research or innovation systems, in countries with an overall weaker R&I system, which have the potential to drive regional growth or link up to top European research networks. A three-step methodology was used:

- *Identify regions where research and/or innovation performance is relatively higher (or growing relatively faster) than in other less favoured regions.*
- *Within these 'PoE' regions, assess the extent to which one or more localised PoE (public, academic or industrial groupings) is linked to or has a potential to contribute to the regional smart specialisation priorities.*
- *Assess the potential for co-operation and synergies in specific specialisation areas intra- or inter-regionally.*

In the case of Crete, the study confirmed that the region is a PoE within Greece and to some extent at European level. Crete has several potential 'micro' PoEs given scientific performance and linkages within its higher education and research institutions. These PoEs were shown to have the potential to contribute to the region's smart specialisation priorities. The analysis also highlighted the potential for co-operations and synergies between Crete and other structural similar regions in a number of scientific and technological fields.

Studies and reports

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