




The role of Universities
and Research Organisations
as drivers for

Smart Specialisation at regional level



*Research and
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The role of Universities and Research Organisations as drivers for Smart Specialisation at regional level

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Executive Summary

The present report explores the role of Higher Education Institutions (HEIs) and Research Organisations (ROs) in Research and Innovation Strategies for Smart Specialisation (RIS3) for regional development. It was commissioned by the EC's DG Research and Innovation in view of the conditionality on smart specialisation in the management of Cohesion Policy Funds.

RIS3 is a novel approach to regional economic and social development promoted by the EU, specifically designed to address issues of economic competitiveness, growth, and social cohesion as outlined in Europe 2020 strategy. The approach is based on the principle that the discovery of well-defined domains for specialisation in a region or country, e.g. of research and innovation (R&I) areas in which it could excel and have comparative advantages, may trigger economic advancement in that region or country.

In the policy context of Europe 2020, HEIs and ROs have key roles to play in initiatives for 'smart growth': Innovation, Education, and the Digital Agenda. With RIS3, HEIs and ROs are potentially significant stakeholders in regional development policy and may act as a link between place-blind and place-based strategies for innovation-driven growth.

RIS3 challenges revolve around interpretations of the prioritisation process and stakeholder involvement. The features of HEIs and ROs determine their distinctive contributions within the innovation chain and in consequence in RIS3. Whichever role predominates, the issue of high quality and the pursuit of excellence is a necessary prerequisite even if not sufficient for knowledge-based regional growth.

Key parameters concerning the role of HEIs and ROs in the innovation chain are addressed in this report, together with synergies of relevant EU actions for capacity building. It is concluded that all aspects involved in the innovation chain, including financial and regulatory measures, should be brought into sharp focus. Successful implementation of RIS3 thus relies to a large extent on identifying and closing gaps in the innovation chain (bridging the 'death valley'), i.e. on the existence of an innovation-friendly environment, with the cultivation or establishment of high-quality academic and research environments as a central element.

Existing EU initiatives for R&I capacity building offer significant bridgeheads for HEIs and ROs in RIS3, as well as synergies between cohesion and research funding. Notable among these are European and Regional Research Infrastructures (RIs), which can be hotspots facilitating the formation of regional hubs where good science, technology, talent and entrepreneurship may cluster and have a significant socio-economic regional impact, thus promoting the goals of RIS3 as well as linking regional and European R&I resources. Those HEIs or ROs which form the nuclei of RIs therefore have key roles in RIS3. Other capacity building initiatives which may provide bridgeheads for HEIs and ROs in RIS3 were the Research Potential (REGPOT) and Regions of Knowledge programmes under FP7, which dovetail with new initiatives under Horizon 2020 aimed at upgrading existing or creating new high-quality research institutions in low performing RDI Member States and regions: ERA Chairs, Teaming and Twinning. A critical element for successful synergy between the above initiatives with RIS3 is the impact of recent developments in ICTs and the emerging digital research and innovation environment. HEIs and ROs are well placed to act as enablers in utilising ICT tools and the associated transformational potential of knowledge and information flows from and to the regions.

It is noted that the knowledge creation process has a global character, but in the context of RIS3 its application needs to be regional. There is a clear role here for HEIs and ROs as links for effective knowledge and technology transfer and for the adaptation of R&I activities, both originating from other regions or being transferred to other regions. Due to their competitive presence and international networks, HEIs and ROs can act as conduits linking and scaling-up at inter-regional, national and global levels. ICT tools are (still for many regions) emerging instruments for this purpose. However, it is geographic proximity that serves primarily the fermentation and evolution of new ideas and, most importantly, the establishment of an entrepreneurial culture locally.

Geographic proximity and thematic focusing are defining features of innovation clusters. Clusters and technology platforms which group HEIs and ROs with companies, together with multiple funding instruments and support mechanisms operating in the frame of regional or national Technoparks, can be effective means for promoting interactions and translating intellectual and scientific potential into commercially successful new products and services.

Mobilising HEIs and ROs for regional smart specialisation process is a challenge for many EU regions because of a number of constraints at national, regional and institutional level. Constraints at national level stem from national HE and research policies, with a limited and weakening regional agenda, as well as funding constraints. Proactive national policies could mobilise HEIs/ROs as lead institutions in smart specialisation strategies, as has been the case in Austria where HEIs are encouraged in their annual performance contracts to develop place-based 'location concepts' (Standortkonzept) as part of their internationalisation strategy for research.

At regional level the role of HEIs and ROs in RIS3 is linked to their integration (or lack of it) in regional governance structures. Also, regions which have research-intensive HEIs and ROs but lack absorptive capacity for R&D, witness the phenomenon whereby an invention created in a region is exploited elsewhere with minimal benefits for the region. Facing this phenomenon and satisfying the place-based idea of RIS3 requires a range of financial and framework measures to overcome the 'death valley' as discussed in this report.

At the institutional level, the extent to which HEIs and ROs will engage in regional smart specialisation strategies depends on the role the institution chooses for itself and its governance, leadership and management. Certain features of potentially successful HEIs and ROs in RIS3 are listed and compared with the characteristics of entrepreneurial universities. It is evident, however, that smart specialisation and the regional agenda will be a challenging task to both ROs and research-intensive universities, which have a stronger focus on national and international excellence than local utility, and also to smaller institutions with limited human resources and research and capital infrastructure.

In conclusion: As key knowledge producers, HEIs and ROs have a critical role in regional smart specialisation processes – in the strategy design, implementation and capacity building. While HEIs form an economic sub-system in their own right that builds the long-term knowledge base in the regional, national and European economy, they can also play an important role in the RIS3. The same applies to ROs which often, by their organisation and structure, may have a direct role to play in RIS3.

The extent to which this role is realised and HEIs and ROs are engaged in regional RIS3 or more generally in regional development – human capital and skills development, knowledge transfer, innovation and enterprise formation and wider community development – depends on the policy context at the national, regional and institutional level. The key policies relate to financing, regulation and governance. Although RIS3s are context-specific there are common issues which have implications for policy development. The report concludes with recommendations and pointers for policy development in the EC, national and regional governments and HEIs/ROs. Some of these pointers are of general significance for engaging HEIs and ROs in regional development (which is a prerequisite for RIS3) and others are more specific for establishing and realising RIS3.

1. Introduction

The objective of this report is to look into the role of universities and research organisations in smart specialisation initiatives, examine associated strengths and weaknesses, identify opportunities and propose recommendations to stakeholders and policy makers. It was commissioned by the EC's DG Research and Innovation in view of the ex-ante conditionality on smart specialisation for the future Cohesion Policy Fund Regulation (European Regional Development Fund). This occurs on the cusp of the wave of EU policy developments that have been maturing over the last 3-4 years as a means of facing the economic recession and associated social crises. *Europe 2020*, the EC 'strategy for smart, sustainable and inclusive growth' and associated policy instruments, are being debated in the European Council and European Parliament at the time of writing. There is in tandem an unprecedented focus of expectations on Universities and other Higher Education Institutions (HEIs) as well as Research Organisations (ROs) as 'drivers' of knowledge-based growth. Discussion of their roles encompasses the skill-mix of graduates, research and innovation, knowledge transfer and regional engagement. This report contributes to this discussion by exploring the role of HEIs and ROs in the process of smart specialisation.

1.1. The Need for a New Approach

In the context of the current socio-economic crisis, coupled with an increasingly globalised economy, Europe and its regions are facing new challenges for economic recovery and growth.

The concept of smart specialisation, based on the development and exploitation of the knowledge economy in a novel way, is one response to this new landscape, aiming to bridge the gap between European regions and also increase their competitiveness at a global level. HEIs and ROs, as sources for the creation and dissemination of knowledge and innovation, have a critical role to play in this process. The question is how this can be achieved in an optimal manner.

The basic premises of the current EU policy thrust are that the research and innovation (R&I) potential of Europe is under-exploited and that closing the competitive gap requires new approaches to opening up the national and European educational and research eco-systems. Consequently a great number of EU actions aim at enhancing the engagement of HEIs and ROs in the development of European regions. These actions, which strive to translate the resulting knowledge and innovation into economic growth and jobs, are the subject of a great deal of literature and commentary.

The potential contribution of HEIs to regional development has been the subject of a recent analytical EU Guide *Connecting Universities to Regional Growth* (European Commission 2011). Other important guidance on this subject is provided by the work of the OECD in its Reviews of Higher Education in City and Regional Development 2005-2013¹; the report on *European Drivers for a Regional Innovation Platform* by ESMU² for DG Education and Culture (ESMU 2011); the final report of the *EUIMA Programme*³ by EUA⁴ for DG Research (EUA 2012) on *Sharing Innovative Practices in University Management/Collaborative Research*; and the Report on Joint EUA-JRC Expert Workshop (JRC 2012).

Research and Innovation Strategies for Smart Specialisation (RIS3), aiming to foster development by targeted support of R&I at regional level, are a quantum leap from promoting regional engagement of HEIs and ROs. Accordingly, in this work on the role of HEIs and ROs in RIS3 we consider regional engagement actions as a baseline from which to move forward. **That is, in the context of RIS3, new thinking is necessary for adding value to existing initiatives.**

1.2. Setting the Scene

RIS3 are place-based approaches to regional growth that aim to capitalise on the knowledge-innovation potential of HEIs and ROs, identifying and exploiting the potential of a region's distinctive industry structures and knowledge bases.

HEIs and ROs may be involved in both the design and implementation phases of RIS3. In the *design phase*, they can contribute to a rigorous assessment of the knowledge assets, capabilities and competencies, including those embedded in their own departments as well as in local businesses. They can identify research domains with significant strengths and a high potential at a national or regional level, contribute to setting strategic priorities and making the right political decisions. In the *implementation phase*, they can be involved in developing, refining and achieving the RIS3 objectives.

¹ For city- and region-specific review reports see: www.oecd-ilibrary.org

² ESMU - European Centre for Strategic Management of Universities. www.esmu.be

³ EUIMA - Sharing Innovative Practices in University Modernisation; www.eua.be/euima

⁴ EUA - European University Association - www.eua.be

In both the design and implementation phases, potential challenges are likely to arise. For example, there may not be sufficient interaction between HEIs and ROs and regional businesses and other stakeholders; there may be limited capacity within the region to absorb research output, and regional authorities may be fragmented and unable to act beyond their immediate boundaries to pursue similarities or complementarities with other regions. Well networked HEIs and ROs may be able to offer solutions, particularly on those issues requiring a region to look outside its boundaries and assess its overall position in global value chains.

To explore the role of HEIs and ROs in RIS3, this report is organised as follows: Section 2 outlines the background and context. It addresses the concept of 'smart specialisation' within the current European policy and economic context, and then looks at the basic features of HEIs and ROs relevant to regional engagement and RIS3. Section 3 examines the role of HEIs and ROs in the innovation chain, and considers the features of this environment which are important for the design and implementation of RIS3. This section then reviews EU actions/initiatives which may strengthen the base for HEI and RO involvement in RIS3, with particular reference to capacity building (human capital and infrastructure) and the role of Information and Communication Technologies (ICTs) Section 4 examines the opportunities and challenges for HEIs and ROs in RIS3. It considers issues of complementary specialisation and the mechanisms involved in up-scaling from regional and European partnership to a global dimension. It then gives a detailed analysis of the constraints and opportunities for optimising HEI and RO involvement in RIS3. Section 5 presents the conclusions and recommendations.

1.3. Expert Group

The group comprised the following independent experts:

Costas Fotakis (Chair) is President of FORTH (Foundation for Research and Technology – Hellas), a public research organisation, since 2011. He has served as Director of the Institute of Electronic Structure and Laser (IESL) at FORTH (1997-2013) and is Professor of Physics at the University of Crete. Fotakis' research interests are in the fields of lasers and photonics. He has been chair and co-chair of major international scientific conferences and a member of EU and national scientific policy panels and expert groups, including the European Strategy Forum for Research Infrastructures (ESFRI), the Advisory Group for Research Potential, the Expert Committee for the Interim Evaluation of the EC's FP7 (Research Infrastructures), and the National Advisory Board for Research and Technology. He has over 300 publications in refereed scientific journals, with more than 5,000 citations. His distinctions include the 2004 'Leadership Award' of the Optical Society of America (OSA), the Springer Professorship at the University of California, Berkeley for 2005-6 and an Honorary Doctorate from the Mediterranean University of Marseille.

Magdalene Rosenmöller (Rapporteur) holds a Ph.D. in Health Policy (University of London), an MBA from IESE, and is a Medical Doctor (University Louis Pasteur, Strasbourg, France). She is Professor of IESE's Operations Management Department, teaching health management and innovation in the MBA and executive education, and as visiting professor in numerous institutions around the globe. She held an executive position at the World Bank (2000-2) and has served as expert and rapporteur in a series of assignments with the European Commission, i.e. IMI, the innovative Medicine Initiative. Her main areas of expertise are health management, managing innovation and entrepreneurship, European health and research policies and global health issues.

John Brennan (Member) is Emeritus Professor of Higher Education Research at the Open University, where he directed the Centre for Higher Education Research and Information for many years. He is also a Visiting Professor at the London School of Economics, the University of Bath, and London Metropolitan University. Previously he was Director of Quality Support at the UK Council for National Academic Awards and has held academic posts at Lancaster University and Teesside Polytechnic. A sociologist by background, his interests lie broadly in the area of higher education and social change, graduate employment, quality assurance, the academic profession, and universities and social transformation. He has directed many national and international research projects and published widely on these themes.

Liviu Matei (Member) is Professor of Higher Education Policy and the senior vice-president of the Central European University in Budapest. He has extensive experience in higher education policy acquired through research, teaching, consulting, and advising in Europe, Asia, Africa, and the United States. He has taken part in projects of the European Commission, UNESCO, the Council of Europe, the European University Association, the Council of Graduate Schools, and the International Higher Education Support Program. He is a member of the editorial board of the Journal of the European Higher Education Area, and serves on the Board of Trustees of the American University of Central Asia.

Roumen Nikolov (Member) is Professor in Computer Science and UNESCO Chair-holder at the University of Library Studies and IT in Sofia. He is also Member of the Management Board of Knowledge4Innovation, Brussels, Chair of the Board of the Institute of Technology and Development (ITD, Sofia) and President of Virtech Ltd in Sofia. Involved in a large number of European research projects, Dr. Nikolov has a long

track record of national and international innovation / start-up initiatives, such as: the Virtual Services and Open Innovation Living Lab, the Technology Transfer Office at Sofia University, the European Day of the Entrepreneur in Sofia, and the Masters programme in Technology Entrepreneurship and Innovation in Sofia.

Caroline Petiot (Member) holds a Ph.D. in Material Sciences (Ecole Centrale de Lyon). After a post-doctoral position with the National Scientific Research Centre at Laboratoire de Mécanique des Solides (Ecole Polytechnique, Palaiseau), she joined the research and innovation department of a large, private European company. She acts as a researcher and project leader in the field of structures, and mechanical modelling. She is also involved in teaching in undergraduate and Masters programmes for engineers. She is a graduate of the first ERASMUS FOR ALL promotion spending a year at the University of Sussex in the UK.

Jaana Puukka (Member) is a specialist in higher education and regional development. She is the Founder and President of *Innovation Engage*, and a Senior Policy Fellow of Conseils sans Frontières. Previously, she served as analyst and project manager at the OECD, where she led the reviews of higher education in regional and city management which involved HEIs in 35 cities and regions in 25 countries. As leader of international review teams in Europe, North and South America, Asia, Australia and Africa, she co-authored the OECD's flagship publication 'Higher Education in Regions - Globally Competitive, Locally Engaged' (2007) and 20 city-/region-specific review reports that analyse higher education system's role in socio-economic development. She provides expert advice to governments, higher education institutions, science park associations and international organisations, including the OECD, the European Commission and the Council of Europe.

1.4. Working Methods

The Expert Group met over the period May to October 2013. The report is based on extensive literature reviews and document studies, monitoring current developments through consultations with key people in policy making and policy implementation, and feedback through RIS3 and other relevant meetings attended by members of the group. Invited experts who made presentations and were interviewed at the Expert Group meetings include:

- **Dimitri Corpakis**, Head of Unit B5 Spreading Excellence and Widening Participation, DG Research and Innovation
- **Pierre Godin**, DG Regional Policy
- **Ralitsa Atanasova**, Unit B5 Spreading Excellence and Widening Participation, DG Research and Innovation
- **European Commission**
- **John Goddard**, Centre for Urban & Regional Development Studies at Newcastle University
- **John Edwards** from the S3 Platform, JRC, Seville
- **Adeline Kroll**, Unit B5 Spreading Excellence and Widening Participation, DG Research and Innovation, European Commission
- **Colombe Warin**, Unit B5 Spreading Excellence and Widening Participation, DG Research and Innovation, European Commission

The contribution of these experts is gratefully acknowledged, as well as the input of **Dimitris Kyriakou** of the S3 Platform (JRC, Seville) and **Maria Douka** of DG Research and Innovation (Unit B4 Research Infrastructure) in discussions with Costas Fotakis.

2. **Background and Context**

This section outlines the background and context for considering the role of HEIs and ROs in RIS3. It addresses the concept of 'smart specialisation', sets this within the current European policy and economic context, and then looks at the basic features of HEIs and ROs relevant to regional engagement and RIS3.

2.1. **Understanding Smart Specialisation and RIS3**

Smart Specialisation was first articulated by academics (Foray, David et al. 2009) and subsequently adopted by policy makers. Interpretations made by policy makers and by the various stakeholders may diverge considerably. Therefore it is critical to clarify what we understand by the term 'smart specialisation' and to identify the inherently novel elements this concept includes so as to have a common starting point in assessing the role of HEIs and ROs in RIS3, as well as the potential impact of RIS3 on HEIs and ROs. This is particularly important as smart specialisation could have a significant influence on HEIs and ROs institutional missions, as well as administratively and financially.

Smart Specialisation is conceived and promoted by the JRC S3 Platform⁵ as

"a strategic approach to economic development through targeted support to Research and Innovation (R&I). More generally, smart specialisation involves a process of developing a vision, identifying competitive advantage, setting strategic priorities and making use of smart policies to maximize the knowledge-based development potential of any region, strong or weak, high-tech or low-tech" (JRC 2012).

The mode of action in determining these priorities for RIS3 at regional level has been termed *the entrepreneurial process of discovery*: a bottom-up, evidence-based learning process for discovering the R&I activities or niches in which a region can expect to excel. RIS3 will be built on developing existing strengths and comparative advantages (e.g. methodologies, technologies, products or services) with the potential for creating economic growth or resolving societal challenges. For many regions, particularly in convergence regions, these could effectively become designs for transformation to an innovation-driven economy. Exploitation of the innovative potential of HEIs and ROs and their ability to disseminate knowledge and technology transfer are critical ingredients for the success of these growth strategies.

Conversely, it is a misinterpretation of 'smart specialisation' to see strategies for innovation-driven growth as simple foresight exercises of scientific fields, ignoring the specific regional environment and potential. Similarly, it is an oversimplification of the 'entrepreneurial discovery process' to define regional development only on the basis of current areas of economic dominance, and to limit the role of HEIs and ROs to servicing these areas. Prioritisation of this type is likely to lead to transactional activities, cut off options and lock HEIs and ROs into certain research and educational "portfolios", thereby disabling the ability to exploit their full transformational potential.

In short, RIS3 is expected to mobilise relevant stakeholders so as to identify regional strengths and combine them with R&I for promoting regional development and/or for transforming the regional economy.

2.2. **The European Policy Context**

The adoption of the RIS3 concept marks an important new development in the policy context of the EU. It follows directly from earlier concerns for social cohesion, but it is expressed in a **new commitment** to combine regional development and research and innovation policies.

Knowledge and Innovation have been key priorities in the European policy agenda since the adoption of the Lisbon strategy in 2000. Their central place in policy formulation and action at EU level has been further strengthened as part of 'Europe 2020', the European Union's political strategy to support increased competitiveness, social cohesion, and regional development during the period 2014-2020. Simultaneously the EU cohesion policies, aiming to reduce disparities among European regions, have also relied on fostering and exploiting regional innovation. Specialisation in the form of prioritisation of regional strengths and opportunities has often been promoted, and indeed occasionally applied towards this end. In this sense, the idea of 'smart specialisation' is not new. However, the existence of a Strategic Policy Framework for Smart Specialisation is an ex-ante conditionality for the use of European Structural and Investment Funds for funding Research and Innovation. In fact, as part of the 'Europe 2020' strategy, RIS3 can potentially have major, far-reaching implications for regional and national development as well as for overall European competitiveness.

⁵ JRC S3 Platform S3platform – www.s3platform.jrc.ec.europa.eu

The role of HEIs and ROs in RIS3 is to be considered in the context of the 'Europe 2020' strategy's priority themes of *smart, sustainable* and *inclusive* growth and in particular the initiatives aimed at catalysing *smart growth*, an economy based on knowledge and innovation. These initiatives relate to:

- Innovation
- Education
- Digital Society

Innovation: The aim of the *Innovation Union Flagship Initiative*⁶ is 'to re-focus R&D and innovation policy', and thereby strengthen every link in the innovation chain from basic research through to commercialisation (European Commission 2010). A central element of the research and innovation agenda of the Commission is the development of an open and competitive European Research Area (ERA). ERA has been established as a policy for facilitating European integration and scaling-up initiatives for the production and exploitation of knowledge; that is, strengthening the knowledge-based economy. The promotion of European R&D activities takes place via inter-European partnerships and networks which bring together HEIs and ROs with SMEs and larger companies. They also include dissemination activities between sectors and regions. ERA focuses also on removing barriers which prevent seamless access to online research services and e-infrastructures and on building a "digital ERA" (European Commission 2012)⁷. A policy for Open Access and Open Innovation will be further promoted in order to strengthen the knowledge triangle and research cooperation in the EU and on a global scale. A driving force for ERA within the next years is the implementation of 'Horizon 2020', the new Framework Programme for R&I. Embedded within the different actions of Horizon 2020 is the idea of *scientific and technological excellence*.

Education: Europe 2020 highlights higher education as a key policy area where collaboration between the EU and Member States can deliver positive results for jobs and economic development. The Higher Education Modernisation Agenda⁸ is designed to contribute to these goals. The basic tenets are that (i) higher education, with its links with research and innovation, plays a crucial role in personal development and economic growth, providing the highly qualified people and the articulate citizens that Europe needs to create jobs and prosperity; and (ii) that if Europe is not to lose out to global competition in the fields of education, research and innovation, national higher education systems must be able to respond effectively to the requirements of the knowledge economy. The main areas for reform identified in the new agenda touch on all aspects of 'the knowledge triangle' and HEI's role therein: from delivery of education and research activities through to their potential as drivers of innovation. Again, achieving excellence is one of the guiding principles. These areas are: to increase the number of higher education graduates; to improve the quality and relevance of teaching and researcher training, to equip graduates with the knowledge and core transferable competences they need to succeed in high-skill occupations; to provide more opportunities for students to gain additional skills through study or training abroad, and to encourage cross-border co-operation to boost higher education performance; to strengthen the "knowledge triangle", linking education, research and business and to create effective governance and funding mechanisms in support of excellence.

'Digital Agenda for Europe' (DAE): This aims at delivering "sustainable economic and social benefits from a digital single market based on fast and ultra-fast internet and interoperable applications" (European Commission 2010)⁹. "Research and innovation" and "Enhancing digital literacy, skills and inclusion" are among the main pillars of the Digital Agenda which are concerned with making full use of information and communication technologies (ICTs) and creating open knowledge environments for research and education. The EC highlights that excellent research depends upon world-class facilities and research infrastructures, including e-infrastructures which enable eScience, i.e. data-intensive collaborative research carried out by geographically dispersed teams. Such concepts, including the concept of Virtual Mobility (ESF 2013), are particularly relevant to HEIs and ROs in less developed European regions in the context of developing and implementing RIS3. It is noted that an explicit Digital Growth Chapter is required in each RIS3.

Regional development policy fits into this framework, having as a prime target the facilitation of cohesion between European regions using Structural Funds for smoothing regional disparities. For this purpose, increased emphasis has been placed on improving connections between the different R&I stakeholders in Europe; that is, the so called "triple helix" model of relationships within and between Member States' private and public sectors, governance institutions, and academic and research communities. It should be noted that of the 325 billion euros targeted to support cohesion policies during 2014-2020, about 100 billion euro are earmarked for R&I to bolster RIS3 in European regions. Also, for the promotion of

⁶ Innovation Union. A Europe 2020 Initiative - http://ec.europa.eu/research/innovation-union/index_en.cfm

⁷The European Research Area http://ec.europa.eu/research/era/index_en.htm

⁸ The Higher Education Modernisation Agenda http://ec.europa.eu/education/higher-education/agenda_en.htm

⁹ <http://ec.europa.eu/digital-agenda/digital-agenda-europe>

European scientific and technological excellence, 70 billion euro has been allocated for the actions of the Horizon 2020 programme. It should also be noted that the knowledge economy as targeted by RIS3 may have a non-linear impact on regional growth, particularly in less developed regions.

The need for increased synergies and coordination among EU policies and actions has also been recognised during the previous programming period and has been receiving great attention over the last few years. RIS3 is expected to act as a link between these policy areas, as shown in Figure 1. This needs to be done by *securing continuity and catalysing change* to ensure investment in R&I that meets regional socio-economic challenges and promotes transformation and growth of regional economies. It requires consistency and congruence between policy instruments directed at harnessing the R&I potential of HEIs and ROs for RIS3 strategies in regional development. These issues are explored in this report.

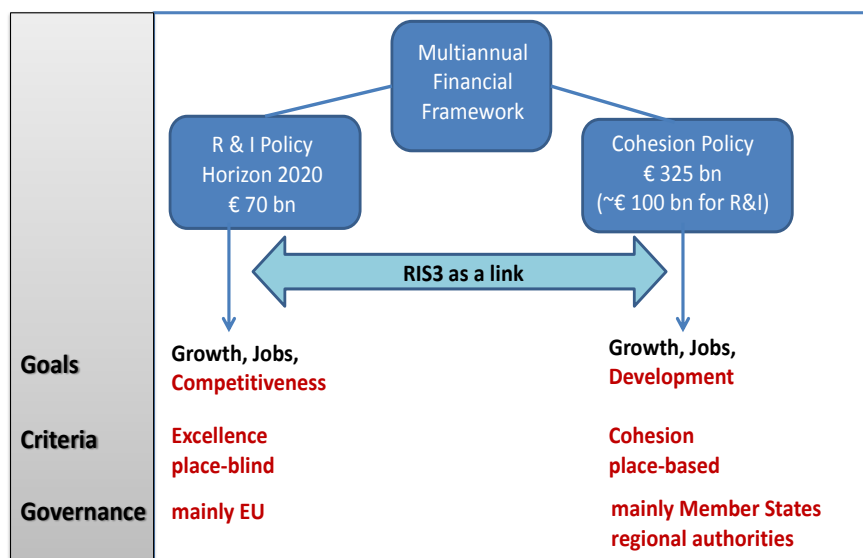


Figure 1: The Role of RIS 3 as a link between Cohesion and Research & Innovation Policy

As shown in Figure 1, although the targets of these policies are European growth and the creation of jobs, either through increasing competitiveness or regional development, there are major differences in the guiding criteria and governance that apply. A major challenge for RIS3 as a link between these policies is to promote socio-economic development of European regions i.e. a place-based policy, without sacrificing the issue of scientific and technological excellence which is inherent in Horizon 2020, a place-blind policy. Given that scientific and technological excellence provides the base for long-term and sustainable European competitiveness, a way for facilitating the effectiveness of this process would be to include the pursuit of high-quality or place-based excellence in initiatives aiming to promote cohesion. In such a case regional relevance and impact should be a major consideration. Furthermore, another challenge for the successful implementation of RIS3 is the issue of governance and associated spending power and financial management. For Horizon 2020 EU governance and financial control are centrally managed while for cohesion policy it is decentralised and regionally based. The role of HEIs and ROs in RIS3 may be influenced by tensions and anomalies between place-blind and place-based governance and funding for R&I. Alternatively, as explored in section 3.4, if combined skilfully they could create HEIs and ROs of the highest quality.

2.3. The Economic Context

As part of Europe 2020 strategy, RIS3 represents a key policy response to a particular economic context. Three main aspects have influenced the adoption and the envisaged use of the RIS3 concept:

- **Uneven economic landscape and the concern for European cohesion.** Member States have adopted a set of shared economic objectives for the Union as a whole, but different regions in the EU have different capacities to contribute to and/or to reach these objectives. The level of economic development in the EU is uneven, with significant disparities between the most and the least advanced regions. RIS3 was conceived as a policy tool to give a new impetus to economic and social development, placing special attention on unlocking regional potential, including in currently less economically advanced regions. To achieve this, RIS3 proposes a particular type of engagement of HEIs and ROs in place-based development initiatives - in cooperation with the authorities, with the business sector and with the civil society. The basic idea is that a new approach to cohesion policies,

which combines, systematically and in a novel manner, regional development with research and innovation policies, would permit a more vigorous advancement of all regions towards the achievement of shared economic and social objectives, and at the same time it would help raise the overall level of economic development and competitiveness in the EU.

- **Global economic crisis and its specific manifestations in the EU.** The EU has been affected in significant ways by the financial crisis and the recession that started in 2007-2008. The impact of the crisis included contraction of real GDP, a sharp decline in industrial production, or high unemployment in several Member States. The economic crisis generated a large discussion about economic governance in the EU. The adoption of the policy principle according to which investment in R&D, as well as in higher education, is part of the solution to exit from the economic crisis, represented an answer to this situation. RIS3 has emerged as a policy tool designed to help restore growth by promoting the expansion and application of science/research and innovation at regional level. It calls for formal strategies that bring together HEIs, ROs, national and regional authorities, and the business sector, while combining and taking advantage of various sources of support from the EU.
- **Funding of HEIs and ROs.** The economic crisis has generated a new discussion about and approaches to the funding of HEIs and ROs. Some EU countries have experienced significant reduction in the public funding for research and education. The adoption of RIS3 has been aimed in part at significantly increasing funding opportunities for HEIs and ROs, while stimulating them to engage more and in new ways in regional development.

2.4. RIS3 Challenges

RIS3 inevitably brings with it new challenges that need to be addressed if the innovation is to be successful. The idea of Smart Specialisation is based on better use of resources and concepts of critical mass. At this stage, the evidence base for RIS3 is anecdotal and the trade-offs stemming from HEI and RO involvement in regional engagement have yet to be determined. Even so, it is clear that HEIs and ROs can have a critical role to play in addressing the challenges and in reducing unintended consequences of smart specialisation initiatives. These could arise from the ways new concepts and financial strategies are applied, especially within the fragile socio-economic environment of the current economic crisis which may have the unintended consequence of, for example, intensifying regional disparities. This could come about as a result of agglomeration of R&I resources and a spatial division of scientific potential and talent.

Another potential risk from misinterpretation of RIS3 is that of overspecialisation. Overspecialisation may lead to lock-ups of skilled human potential and thus narrow the pool for talent and resources in HEIs and ROs, reducing their ability for flexible responses and undermining their potential for new innovation to emerge.

Other challenges at regional level may arise from limited local capacity to absorb research output. Particularly in the case of economically less developed regions in which high-quality HEIs and ROs operate, having strong international links and collaborations with businesses and other stakeholders, the phenomenon of 'invent here – exploit elsewhere' may be pronounced and extensive, thus limiting the full range of potential benefits for the local economy.

Another challenge is the limited continuity of policies of either national or regional governments, coupled with fragmentation or lack of capacity of local authorities for acting beyond their boundaries.

In such contexts, there may be a need for a larger perspective to be brought to bear on particular place-based regional initiatives that HEIs and ROs are likely to be well-placed to provide within RIS3 endeavours.

The challenges of building collaborative regional partnerships and effective 'boundary spanners' between the stakeholders involved in RIS3, and the way in which these can act as constraints to effective HEIs and ROs involvement in RIS3, are reviewed in detail in section 4.4 of this report. Briefly, it is worth noting here that challenges of this type that will need to be effectively managed in RIS3 initiative are:

- to recognise that different stakeholders may have different interests and objectives
- to address communication gaps between them
- to identify and engage the 'right' kinds of expertise that different stakeholders could bring to the different elements and stages of the smart specialisation process
- to address from the outset of the process the challenge of achieving sustainability for successful innovations
- to recognise and avoid compromising other important functions of HEIs and ROs which may not be relevant to the RIS3

- to recognise and exploit the differentiation and diversity of HEIs and ROs: different kinds of expertise may be found in different places, allowing for different types of interactions with other relevant stakeholders
- to recognise that the knowledge base for a local smart specialisation initiative is located within a wider knowledge context in order to maximise the competitive advantage from the resulting activity.

We note, however, that the role of HEIs and ROs in RIS3 is contingent on the larger systemic challenge of political commitment to knowledge-based growth and associated policy actions or reforms for creating or developing the necessary research structure and innovation-friendly environment. That is, a critical challenge for the role of HEIs and ROs in RIS3 is the vision conceived by national and regional governments for long-term commitment in supporting R&I actions and providing the necessary political legitimacy.

In this context, RIS3 calls on HEIs and ROs to be involved in the efforts to achieve increased competitiveness, social cohesion, and regional development. It envisages HEIs and ROs being involved in systematically addressing regional economic and social challenges in coordination with local and national authorities, representatives of the business sector and civil society, based on research and innovation, but strictly as part of formal regional/national development strategies, supported by significant funding from EU sources. For European HEIs and ROs in particular, RIS3 may thus represent one of the most important challenges to be faced within the next few years. But the reverse is also true: delineating the role of HEIs and ROs, which are key sources generating knowledge and innovation, may be crucial for the successful implementation of RIS3.

2.5. Features of HEIs and ROs relevant to Regional Engagement

Both HEIs and ROs are pillars of the Knowledge Triangle and in consequence, the Knowledge Economy. For assessing their specific roles in the design and implementation phases of RIS3 their features relevant to regional engagement are considered here.

Higher education institutions

HEIs have been around for a long time and have always been engaged with the communities (local, regional and national) of which they are a part. Martin Trow famously distinguished the elite, mass and universal forms of higher education (Trow 1974), defining their respective functions as "shaping mind and character of ruling class; preparation for elite roles"(elite); "transmission of skills; preparation for a broader range of technical and economic elite roles" (mass) and "adaptation of 'whole population' to rapid social and technological change" (universal). While the definitions relate mainly to the teaching role of higher education, the formulation relating to 'universal higher education' can readily embrace the research and knowledge transfer functions within knowledge societies. And here it is important to note that Trow emphasised that mass and universal systems would need to retain elite elements. As far as research is concerned, a smaller system of elite 'world class' research intensive higher education institutions is frequently referred to, although with an often disputed membership.

Of course, much has changed and continues to change. Today, the responsibilities of higher education extend beyond producing graduates and research outputs to include greater public engagement. This takes a variety of forms and involves collaboration with government agencies, businesses, local communities and regional authorities. Mechanisms of interaction between society and higher education reflect the increasing social embeddedness of institutions within a multitude of communities. The implications for higher education arise from the expectations that higher education should be more visibly useful for economy and society, though this usefulness may apply to both global and regional/local levels with a different emphasis for different institutions and the basic units within them.

Three main roles

It is common today to distinguish between the three roles of teaching, research and knowledge transfer in considering the work of HEIs. For each of them, it is important to be aware of history, of diversity, of boundaries, and of stakeholders. It is also important to be aware of the debates about 'what needs to be changed' and 'what needs to be preserved' when considering the change agendas which face higher education and its stakeholders.

While the teaching function is the longest established and the most universal role of higher education, there is growing differentiation and diversity in the forms that it takes as well as in its intended beneficiaries. Regarding the research role, it is necessary to consider its importance to both the individual and the institution and how it is managed and rewarded including the balance between autonomy and responsiveness, the balance and relationship between individual and collaborative work, the extent of boundary crossing between disciplines, institutions and professions, where the work takes place and the nature of its outcomes, the audiences to which it is directed, the impacts it makes, the ways in which it is assessed and rewarded, and the relationship it has with the teaching and knowledge transfer functions of

higher education. The notion of 'knowledge transfer' is sometimes referred to as the 'third mission' of higher education and this reflects its relatively recent arrival as an identifiable role of higher education, although not dissimilar functions can probably be identified in the long histories of higher education institutions. Here, the emphasis is less about the production of new knowledge and more to do with the application and utilisation of existing knowledge. Although much of the focus of knowledge transfer has been given to the application of scientific knowledge to societal developments of potential economic significance, there is in fact much greater diversity in practice with universities engaging with public institutions of various sorts – in education, health, governance etc. – with teaching-linked activities including workplace learning, graduate start-ups and a variety of entrepreneurial endeavours sitting alongside more applied research functions.

Differentiation and diversity

Modern expanded systems of higher education are differentiated systems, though the differentiation takes different forms in different places. A number of commentators have made the distinction between 'vertical' and 'horizontal' forms of differentiation. The former refers to the stratification or hierarchy of institutions. This partly reflects a growing emphasis on market competition evidenced by the attention given to rankings and league tables along with the use of terminologies such as 'world class' and 'top' universities. Such rankings are typically based largely on the research function, to a much lesser extent on the teaching function and only very rarely on the knowledge transfer function. Horizontal differentiation reflects differences in activities of higher education, the 'clients' who are served, as well as the contexts – geographical, economic and social – in which the activities take place. It allows that different institutions may be good at different things. It also implies that different things are increasingly needed from higher education, and a division of labour between institutions is an effective way of supplying them. Other forms of differentiation lie in the relative focus on local, regional, national or international factors in the pursuit of different higher education functions. There are different positions that can be taken on the costs and benefits of institutional specialisation on the one hand, against comprehensiveness on the other. Perhaps the most salient conclusion on this issue is that not all institutions – or sub-units within them – can be good at everything.

This also raises the question of whether the HEI is always the most appropriate unit of analysis for issues of differentiation and diversity. 'Basic units' of departments and faculties often possess considerable autonomy and may reflect different values and networks in both academic and professional worlds. The links they possess with external stakeholders may differ massively.

University models

As already indicated, there are different traditions and an increasing differentiation of types of university. To some extent, these are a product of top-down national policies and funding mechanisms and to some extent a product of bottom-up institutional developments and responses to stakeholder requirements. This is an area where generalisations can be dangerous. Categories used such as 'world-class', 'entrepreneurial', 'technological', 'widening participation' can mean different things in different contexts. They may also fail to capture the internal diversity of HEIs. A couple of departments may be 'entrepreneurial' but the term may have little significance in the rest of the institution. However, since the issue of 'entrepreneurial university' is discussed extensively recently, its relevance to RIS3 is considered in section 4.5.

For the outsider, this differentiation can produce considerable challenges for 'finding your way around' and getting in touch with the relevant expertise and interests. Regions will inevitably differ in the numbers and types of HEIs located within their region, in terms of the specialisms the institutions possess, their orientation to local, national or global agendas, their balance between teaching, research and knowledge transfer functions, their reputations within different networks. Expertise needed for smart specialisation initiatives will inevitably sometimes require regional stakeholders to collaborate with HEIs from outside their region. And for many purposes, the adaptation of IT developments means that 'distance' is no longer an obstacle to collaboration. Partnerships and networks are increasingly global – finding and working with the most suitable partners wherever they may be located.

We might summarise the broad challenge facing universities as being how to reinvent and position themselves in a world of 'networked knowledge societies' and whether their role within such societies should be a central or a peripheral one. For the individual institution / department / academic, the challenges may be ones of deciding what kind of institution / department / academic one wants to be, working out how to become it and how to communicate with any necessary partners. For the many and diverse external stakeholders, there are challenges about how and where to find the most suitable partners for collaboration, what to expect of them in terms of roles and expertise. Is the higher education role to initiate, to implement, to evaluate or to critique? Or is it some combination of all of these? There will be different answers in different cases.

Research organisations

The focus here is on ROs located outside universities. Many research and technology organisations were founded around the time of the Second World War based on the rationale of science and technology as a driver of economic, social and geo-political development. Many of Europe's largest ROs have faced an evolution from purely national public laboratories, with largely scientific missions and budgets predominantly coming from government, through to "Contract Research Organisations", reflecting a growing proportion of R&D work for companies and a consequently rising share of commercial contract income. Some others reduced their laboratory R&D services in favour of technical consultancy and business-solution delivery. Recent estimates suggest that some 10% of business R&D is outsourced (Aho 2006).

ROs have been defined as "organisations with significant core government funding (in many cases 25% or greater) which supply services to firms individually or collectively in support of scientific and technological innovation and which devote much of their capability (50% or more of their labour) to remaining integrated with the science base" (EARTO 2005). ROs are generally non-profit organisations. Their revenues from dissemination and deployment are re-employed to fund new innovation cycles, but some ROs are also "privately owned" and stock-exchange quoted companies, such as Qinetiq¹⁰.

ROs occupy nodal positions within innovation eco-systems¹¹, bringing together key players across the whole innovation chain, from fundamental to technological research, from product and process development to prototyping and demonstration, and on to full-scale implementation in the public and private sectors. ROs generally operate according to a three-stage innovation dynamic, which broadly correlates with a three-part funding model: (i) Public core funding to support exploration of needs and competence building; (ii) Competitive public and private income for technology development; (iii) Customer revenues from dissemination and deployment.

Many European intergovernmental scientific ROs are acting as world leaders within their respective fields. These organisations constitute the vanguard of European science, enabling European scientists to engage in truly cutting-edge research and be competitive on a global scale. By combining international facilities and human resources, they can achieve world-class scientific and technological excellence in interdisciplinary fields. They provide training possibilities for young scientists in an international environment with state-of-the-art equipment, and attract world-class scientists from overseas. These organisations¹² have a key role to play in the future of the ERA and "Europe 2020" strategy to exit the crisis and prepare the EU economy for the next decade.

Depending on their status and geographical dimension (European, national, regional), ROs can have various impacts on the regional development process:

- **European:** bringing world class specialists and infrastructures into the region, with resources capable of economic impact and potential for regional dissemination and research impact.
- **National or multi-regional:** some large ROs may be distributed in various regions (e.g.: The Fraunhofer in Germany¹³, CEA in France¹⁴, TNO in the Netherlands¹⁵, VTT in Finland¹⁶, The Carnot Institutes network in France¹⁷), offering to these regions an inter-connected regional dimension, with access to extended networks, facilities for mobility of researchers, other inter-regional development opportunities. As an example, some regional sectoral bodies take on the role of multi-regional infrastructures, like DLR¹⁸ which has been given responsibility by the federal government for the planning and implementation of the German space programme.
- **Regional:** they are often developed to sustain regional or even national development in response to the strategic importance of a given technology in certain sectors. An example is found in a public-private partnership FIDAMC¹⁹ founded in 2006 as the result of an agreement between the Spanish Industry, Tourism and Trade Ministry, Madrid Regional Government and EADS NV. The research centre is located at the Southern Technological Area (Getafe – Madrid). 50% of the project is financed by the

¹⁰ Qinetiq, British multinational defence technology company - www.qinetiq.com

¹¹ EARTO - European Association of Research and Technology Organisations - www.earto.eu/about-rtos.html

¹² Research Index <http://ec.europa.eu/research/index.cfm?lg=fr&pg=newsalert&year=2010&na=na-240610>

¹³ Fraunhofer Institute www.fraunhofer.de

¹⁴ CEA Commissariat à l'énergie atomique et aux énergies alternatives (Atomic Energy and Alternative Energies Commission) - www cea fr

¹⁵ TNO – Innovation for Life The Netherlands www.tno.nl/en

¹⁶ VTT Technical Research Centre of Finland www.vtt.fi

¹⁷ Institute Carnot www.institut-carnot.eu/en/carnot-network-presentation

¹⁸ DLR - Deutsches Zentrum für Luft- und Raumfahrt - German Aerospace Centre - www.dlr.de

¹⁹ FIDAMC - Fundación para la Investigación, Desarrollo y Aplicación de los Materiales Compuestos Composites Research, Development and Application Centre - www.fidamc.es/

Centre for Industrial and Technological Development and Madrid Community, 50% by EADS NV. Consequently, the decision to create FIDAMC came about as a result of the importance given by successive Spanish governments to the aerospace sector due to its strategic nature and to the need to create a Centre of Excellence for research into the industrial application of composite materials.

Regional development can also be facilitated by large companies with R&D departments acting as company-based ROs within a strategic network. The on-going dialogue between the company researchers and outside research teams enables knowledge to be shared and working hypotheses to be mutually scrutinised and advanced. This complementarity gives rise to high-level scientific collaborative work on priority themes (e.g. Danone²⁰).

HEIs and ROs: overlaps and boundaries

HEIs and ROs represent a highly diversified field of interests and expertise. Table 1 below attempts to summarise the salient characteristics of HEIs and ROs within three broad categories but it must be emphasised that these categories simplify very significant differences between individual institutions and organisations. Research intensive HEIs as well as ROs are prime knowledge and innovation generators as well as training grounds for highly skilled researchers and technical personnel. The principal contribution of other HEIs which focus on teaching is general human capacity building. All these are important elements for the success of RIS3. However, from a RIS3 perspective, the expertise needed is unlikely to be found in *any single* HEI or RO. The specialist partner needs to be identified and this will not always be a simple process. It should also be remembered that research and knowledge transfer activities increasingly draw on networks of expertise which cut across institutional and organisational boundaries. Smart specialisation at regional level requires the identification of partners possessing the right kinds of expertise and interests. This in itself will not always be a straightforward task. The operation of HEIs and ROs in environments in close proximity with businesses and support agencies, as for example in locally-based clusters within Technoparks, could well be an effective means of tackling this problem for the purposes of RIS3.

The features of HEIs and ROs in Table 1 determine their distinctive roles within the innovation chain and in consequence in RIS3. Whichever role predominates, the issue of high quality is a necessary prerequisite even if not sufficient for their effective role in regional growth. Each avenue has its own value and there are excellent examples of synergies between HEIs and ROs which operate either as independent entities or as ROs operating within a university. ROs often include or operate other major players of the research and innovation ecosystem such as Research Infrastructures (RIs) and Science & Technology Parks. The latter usually operate as facilitators for start-ups and hosts of other SMEs and/or R&D branches of larger companies having interest in the research carried out at the RO. Overall, HEIs and ROs may form the nuclei of R&I **Technoparks**, that is, innovation-friendly and vibrant ecosystems which also include thematic clusters of companies (SMEs or larger) and support mechanisms, as for example liaison and technology transfer offices, innovation incubators –Business and Innovation Centres – and access to financing instruments. Such environments provide the necessary prerequisites for bridging the gap ('the death valley') and exploiting the innovation produced, developing the market, and creating wealth (see also section 4.1).

Summary

This section has examined RIS3 as a policy instrument designed to promote knowledge-based regional growth: to promote innovation in activities or domains where regions are likely to have competitive advantage. This is considered in the policy context of Europe 2020 wherein HEIs and ROs have key roles to play in policy initiatives for 'smart growth': Innovation, Education, and the Digital Agenda. HEIs and ROs are now also potentially significant stakeholders in regional development policy, RIS3, and may act as a link between place-blind and place-based strategies for innovation-driven growth. RIS3 challenges revolve around interpretations of the prioritisation process and stakeholder involvement. The features of HEIs and ROs described in Table 1 determine their distinctive roles within the innovation chain and in consequence in RIS3. Whichever role predominates, the issue of high quality is a necessary prerequisite even if not sufficient for their effective role in regional growth.

²⁰DANONE R&D www.danone.com/en/research-innovations/organisation/collaboration-network.html

Table 1: Features of HEIs and ROs

	Research intensive HEIs	Other HEIs	Research organisations
Length of history	Wide diversity. Some with hundreds of years of history	Usually a shorter history	Decades
Governance and management	Wide diversity across national HE systems. Often loosely coupled systems but national differences in autonomy from state.	Often greater focus on management and implementation of distinctive 'mission'. But national and institutional differences.	Centrally managed
Key functions	Research, teaching and often third mission but research as priority	Teaching, applied research, enhanced third mission	Research
Education	Bachelor, Master, Doctoral, depending on the institution; LLL	Education provision often aligned with the regional priorities. Bachelor, sometimes also Masters and Doctoral level studies. Often strong LLL aspect	Training by research
Research profile	Defined bottom-up by academic disciplines	May be more centrally defined, with targeted applied research: thematic or problem-oriented	Top-down, targeted research: thematic or problem-oriented
	Open system, research fits academic prerequisites and merit basis	Growing R&D capacity often focused on particular subjects/themes.	Open or protected, some embedded in companies, engaging in both blue sky and applied research
Collaboration	Very diverse across institutions. Growing number of universities collaborate with companies, often bigger firms and/or high-tech SMEs. Much international collaboration	Usually broad ranged collaboration with local employers and SMEs. Often strong links with local government. Some national/international collaboration in niche areas	Diverse across institutions and companies. Also Research Infrastructures (RIs) and Thematic Clusters.

3. The Role of HEIs & ROs in the Innovation Chain

RIS3 is about growth through innovation. HEIs and ROs play a central role in the innovation ecosystem – from human capacity building through to generation of knowledge and innovation. Apart from basic research, typically researchers in HEIs produce innovation to the point of proof of concept, while researchers in ROs may produce innovation to the point of demonstration and/or prototype development. HEIs and ROs which have at least some pockets of excellence will influence in a positive manner the environment in which they operate, attracting and nurturing talent, including entrepreneurial talent. An average department or research group in an institution with a 'brand name' associated with excellence benefits from what can be called an "aura-effect". Simultaneously, the same effect attracts businesses and entrepreneurial activity, all of which contribute to RIS3.

Faced with the question of why R&I in Europe has not already realised its full potential for regional development and for bridging regional, national and global gaps, it is necessary to look at the full content of the innovation chain together with the role of HEIs and ROs. Accordingly, the first part of this section looks at types of innovation and the innovation chain, measures for overcoming the so called "death valley" where most innovation initiatives die before reaching the market, and issues related to technology readiness levels and innovation indicators. This section then goes on to examine the extent to which existing EU initiatives for innovation and growth may provide a base for HEIs and ROs in RIS3 to meet the challenges of the innovation divide and the impact of ICTs and the new Digital Information Environment in RIS3 implementation.

3.1. Types of Innovation and the Innovation Chain

Based on their origin, we may identify three major types of innovation:

- Scientific innovation, based on knowledge generated by scientific and/or scholarly research.
- Empirical innovation, based on intuition and previous practical experience. Empirical approaches are usually very focused and specific but may have useful economic consequences.
- Social innovation, originating from social needs and experiences (e.g. working conditions, immigration, distance learning, community development and health). Social innovation can generate indirect economic benefits by countering the costs associated with acute and/or chronic societal problems.
- Although HEIs and ROs may address the full spectrum of innovation types, their main contribution is in scientific innovation. In this context we may distinguish three types of scientific innovation:
- Innovation produced as a result of *demand driven* research, which is primarily transactional and covers current needs of society, companies, and markets (e.g. methodologies for improving existing manufacturing processes). This is commonly understood as market-based innovation and, being readily identifiable, usually attracts the bulk of attention. Ample mechanisms exist in promoting the role of HEIs and ROs in this type of innovation.
- *Supply-side* innovation, including that resulting from *curiosity-driven* research, basic (blue sky) or applied. This has a potential transformational character that may define and/or address needs and delineate future markets for products and services. The potential economic impact of this type of innovation may not be immediately obvious. Recent history, however, shows that exploitation of this innovation creates the 'protagonists' of tomorrow. For example, the origins of the Internet lie in supply-side innovation developed at CERN in the interests of particle physics research.
- Innovation resulting from *policy-led* research (regional, state, EC) aiming to resolve major societal challenges (e.g. demographic problems, climate change) or to meet specific goals (e.g. innovative spin-offs from space programmes).

The innovation chain comprises a dynamic linking between basic and applied research. As has been noted, "There is hardly any example of twentieth century innovation which is not indebted to basic scientific thought" (Moriarty 2008). Examples include advances in quantum physics, electromagnetism and nuclear physics that had pronounced economic impact in microelectronics, telecommunications, and the nuclear power sector. More specifically, concepts of quantum physics developed early in the last century, of no direct use at that time, led to the creation of lasers and the thriving field of photonics (displays, solid state lighting, sensors) which have multiple applications of high market value nowadays (e.g. mobile phone technologies). Along these lines, the *Key Enabling Technologies* (KETs) (nanotechnology, photonics, biotechnology, advanced materials and manufacturing processes) as well as ICT, play prime roles in contemporary scientific innovation.

Industry-led initiatives for Open Innovation, leading to open and interoperable solutions that exploit ICTs and drive value creation across all sectors are supported by the EC. (European Commission 2010). Open Innovation is defined as “the use of internal and other companies' ideas to develop new businesses”²¹. ICTs catalyse changes in the innovation chain by facilitating early involvement of end-users and Open Innovation. Five key elements in the Open Innovation process could be observed, namely: networking; collaboration among all stakeholders; corporate entrepreneurship (e.g. through start-ups and spin-offs); proactive Intellectual Property Management and creating markets for technology; and R&D as a means to achieve competitive advantage. HEIs and ROs which are deeply involved in this process can better serve the regional and national development through RIS3 design and implementation.

Open Innovation accelerates the exchange of knowledge and technology transfer not only between HEIs, ROs and companies, but also among the regions. For instance, the ultimate goal of the inter-regional cooperation programme EURIS²² was to help regions to embrace Open Innovation, to provide specific regional recommendations for the improvement of RIS3 and to draw general policy recommendations dedicated to regional, national and EU policy makers.

Open Innovation is a core concept embedded in a number of current innovation infrastructures, such as: Living Labs, Smart Cities, Clusters, Technology/Science Parks. As an example, Living Labs²³ provide an open innovation infrastructure embracing all innovation stakeholders (end-users, companies, HEIs, ROs, community, developers, local and regional authorities) that are involved in the whole innovation chain for development of innovative products and services. Within the new networked economy, communities and local innovation infrastructures are supposed to play a substantial role.

HEIs and ROs enable advanced knowledge creation and dissemination through their scientific interactions and networking activities. The exploitation of newly created and often advanced knowledge enhances the probability of innovation and may have strong economic impact at its intersection with selected growth axes (e.g. agrofood, tourism and culture, energy, etc.) of regional economies. Furthermore, this knowledge may itself produce new axes for regional development. This is part of the design of the “entrepreneurial discovery process” for RIS3 as well as its successful implementation.

In conclusion, the transformational impact of RIS3 on regional economies relies to a large extent on the central role of HEIs and ROs, supported by ICTs, in the full range of the innovation chain.

3.2. The Innovation Chain and ‘Death Valley’

Evidence indicates that at the early stages of the innovation chain, as shown for example by scientific publications and their impact (Van Noorden 2012), European HEIs and ROs are globally competitive. It is worth noting also that there are internationally competitive HEIs and ROs forming pockets of excellence even in less advanced European Regions. However, exploiting an idea or invention to bring it to market and the creation of wealth requires crossing of the so-called ‘death valley’, which also involves other stakeholders and instruments. These include: financial instruments, such as venture capital (VC) and public seed funding; multiple other public and private funding schemes; incentives such as tax-relief; loan warranties and low cost of money; appropriate legislative and agency support; intellectual property (IP) policies; facilitation of partnerships, such as Competence Centres and Public-Private or Private-Private Partnerships (PPP) of thematic clusters and technology platforms; and most important an enabling academic and business entrepreneurial culture. The time parameter is critical for crossing the ‘death valley’, and as such a fast track achieved by minimising the bureaucracy around each of the supportive components is also needed. This is particularly critical in Member States where over-regulation is a major burden. Added to that, failure to realise the full innovation potential may be the outcome of competing interests in maintaining the existing academic or corporate status quo.

As indicated in the European Innovation Scoreboard²⁴, many European regions are seriously lagging behind in the provision and/or effectiveness of the above components and instruments for crossing the ‘death valley’. Therefore, for successful place-based exploitation of the knowledge created by HEIs and ROs and to enable the implementation of RIS3 in European regions, the entire spectrum of issues critical to crossing the ‘death valley’ need to be addressed. This is also recognised in the commitments of the Innovation Union Flagship Initiative. Along these lines the roles of EU financial instruments, such as the Risk-Sharing Finance Facility (RSFF), are crucial and need to be expanded. The European added-value of public support is to overcome market gaps for the financing of European R&D with a high level of risk. Other possibilities, such as those provided by the European Investment Fund (EIF), may also serve this goal by reducing the cost of borrowing money. For instance, the seed funds (accelerators) Eleven²⁵ and

²¹ Open Innovation <http://ec.europa.eu/digital-agenda/en/about-open-innovation>

²² European Collaborative and Open Regional Innovation Strategies, <http://www.euris-programme.eu/>

²³ Open Living Labs – www.openlivinglabs.eu

²⁴ <http://ec.europa.eu/enterprise/policies/innovation/facts-analysis/Innovation-scoreboard/>

²⁵ <http://eleven.bg/>

LAUNCHub²⁶ established under the EIF JEREMIE initiative²⁷ support entrepreneurs and digital start-ups in South and Eastern Europe. Relevant initiatives developed within Horizon 2020 may also be useful.

Overall, to realise the role of HEIs and ROs in RIS3 requires attractive environments for researchers and entrepreneurs and effective measures for meeting all stages of the innovation chain.

3.3. Technology Readiness Levels & Innovation Indicators

In order to cross the 'Death Valley', technology monitoring is essential to get a quick ramp-up in terms of technology maturity within the triple helix system. Such a process is often addressed by ROs (but not exclusively) as they have usually more facilities that allow a scaling up of a given technology.

When a new technology is first invented or conceptualised, it is not suitable for immediate application. Instead, new technologies are usually subjected to experimentation, refinement, and increasingly realistic testing. Once the technology is sufficiently proven, it can be incorporated into a system/subsystem. Commonly used **Technology Readiness Levels** (TRL) (Department of Defense 2011) are scaled technology assessments, with the number of sub-levels and assessment criteria varying according to the application sector (e.g. for TRLs NASA / ESA). TRLs are used to assess the maturity of evolving technologies (devices, materials, components, software, work processes, etc.) during its development and in some cases during early operations.

A new innovation indicator developed by the EC (European Commission 2013) to benchmark national innovation policies indicates that the EU as a whole performs well in an international comparison, even though it remains behind some of the most innovative economies worldwide. However, it also highlights the significant innovation divide between European Member States, as shown in Figure 2.

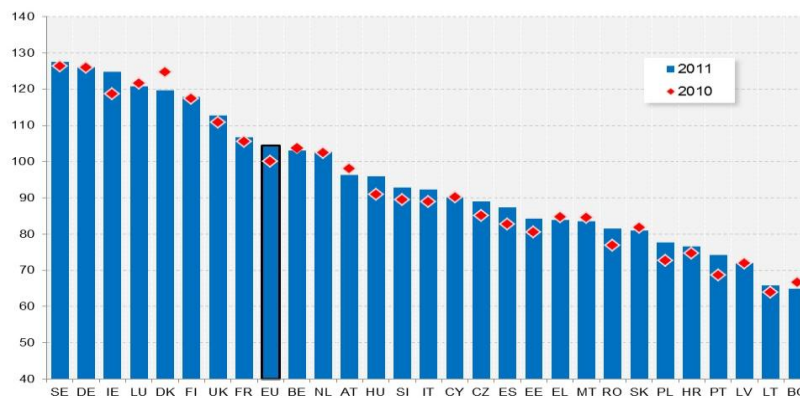


Figure 2: Member States Innovation Output in the years 2010 and 2011

This new indicator focuses on innovation outputs which are wide-ranging and differ from sector to sector. It measures the extent to which ideas from innovative sectors are able to reach the market on the basis of four components, chosen for their policy relevance²⁸:

- Technological innovation as measured by patents.
- Employment in knowledge-intensive activities as a percentage of total employment.
- Competitiveness of knowledge-intensive goods and services. This is based on both the contribution of the trade balance of high-tech and medium-tech products to the total trade balance, and knowledge-intensive services as a share of the total services exports.
- Employment in fast-growing firms of innovative sectors.

A challenge for RIS3 is to narrow the divide demonstrated by this indicator. Existing EU initiatives may provide a base for HEIs and ROs in RIS3 to meet these challenges

3.4. Synergies with other EU Initiatives

There are several EU initiatives which may have synergistic effects through providing levers for HEI and RO involvement in RIS3, aiming to develop a level playing field for knowledge-based growth. These include the European Research Infrastructures action and other EU programme initiatives such as

²⁶ <http://launchub.com/>

²⁷ www.eif.org/what_we_do/jeremie/

²⁸ http://europa.eu/rapid/press-release_IP-13-831_en.htm

Research Potential, the Regions of Knowledge, ERA Chairs, INTERREG, and the more recently discussed Teaming and Twinning actions.

3.5. European Research Infrastructures (RIs) in RIS3

RIs are well placed to play an enabling role in the context of RIS3, either as hubs of distributed RIs of the European Strategy Forum on Research Infrastructures (ESFRI) Roadmap, or as Regional Partner Facilities (RPF) associated with a major RI located elsewhere. They can be strong components of RIS3 provided that their role is well understood and promoted. To this effect their support to local business communities and their contribution to the overall regional and national economic capabilities have to be clear within the RIS strategy.

Initiatives for establishing European Research Infrastructures (RIs) have their origin in FP2 and have received increasing support in subsequent Framework Programmes. A core concept introduced early on was the support for trans-national access (TA) to excellent – and in some cases unique – national RIs by European researchers to enable them to stay at the forefront of developments in all scientific and technological fields, including e-infrastructures (Fotakis 2010). In FP6 alone, approximately 26.000 TA users originating primarily from less research-intensive Member States were supported through this action. About 90% of these users declared that they would have been unable to carry out their work at the RI without EC support. Under FP6 and FP7, in addition to TA, other actions were introduced such as Networking, and Joint Research Actions (JRA), forming the Integrated Infrastructure Initiative (I3) with the aim of improving the quality of access offered.

An important change in FP7 over previous FPs was that, in addition to the optimal performance and use of existing RIs, FP7 facilitated the process for the development of new RIs of pan-European interest through a strategy-led approach defined by the ESFRI procedures. To exploit cross-border synergies, the Commission is committed to mechanisms for linking Member States' RI roadmaps to the ESFRI Roadmap and RIS3. Along these lines Structural Funds may be used for co-financing research and innovation programmes, 'reinforcing the capacity of less favoured regions to host and participate in RIs of pan-European and international interest' (CoPoRI 2013)

In this context European RIs which form environments based on processes of prioritisation, similar to those envisaged for RIS3, and having in their nucleus Universities and/or ROs, may form an efficient mix of research, human resources and cohesion. The challenge is for this to be done with equilibrium between scientific excellences on the one hand and social and economic considerations on the other.

The regional as well as European socio-economic benefits achieved through the development and operations of European RIs have been documented²⁹. The impact of RIs for fostering smart growth and jobs may be summarised as follows:

- creating new markets and promoting high-tech enterprises
- developing skilled human capital
- linking regional and European R&I resources

In terms of fostering high-tech enterprises and creating new markets, the European research market amounts to 8-9 billion euros annually (Fotakis 2010), half of which is estimated to be the annual budget for instrumentation procurement. Implementation of the ESFRI Roadmap is expected to lead to an increase in this market by about 20%. There is an additional collateral effect: considering that RIs are front-runners of the research market, requiring challenging and novel approaches, new prototype products and services may be developed that improve those commercially available, thus enhancing the market base and value. Almost two out of three companies report being able to move into new markets due to their activities as product-suppliers to RIs. Along these lines many companies have reported that contracts with RIs, apart from being economically beneficial, are also prestigious supporting sales in other segments of the market (ESFRI 2009).

Experience has shown that scientific research, even when it is not directly translated into services and products, influences indirectly and long term the economy of a country/region by enriching its human potential. The scope for developing top-level science relies on the attraction and training of talented young scientists and skilled personnel. Indications are that industrial research managers view this as the principal contribution to industry rather than the specific knowledge generated by research. A more coherent strategy for distribution of RIs among the Member States would play a crucial role for narrowing the innovation gap observed in the Innovation Union Scoreboard results.

RIs enable advance knowledge and innovation creation and dissemination through the scientific interactions and networking activities they involve. To this effect, they may form environments which act

²⁹Synergies between FP7 and structural funds for research infrastructures. Available from: http://ec.europa.eu/research/infrastructures/index_en.cfm?pg=structural_funds

as incubators for the development of entrepreneurial cultures. Furthermore, the prospect of further beneficial spill-overs may induce newcomers to locate near such RIs. Overall, RIs can be hotspots which may facilitate the formation of regional hubs, where good science, technology, talent and entrepreneurship may cluster and have a significant socio-economic regional impact (CoPoRI 2013)

HEIs and ROs could better benefit from effective use of GÉANT³⁰ and e-infrastructures³¹. GÉANT is the communication infrastructure backbone that interconnects the National Research and Education Networks (NRENs) in Europe and provides a seamless service to the European research and education community in the 'digital ERA'³². It is the most advanced research network in the world and has made it possible for more than 50 million researchers and students and over 10 000 institutions to work together in real time. An e-infrastructure (cyber infrastructure) is a combination of hardware, software, services, personnel and organisation, which provides a wide range of services for the global research communities, such as: high performance computation services; data, information and knowledge management services; observation, management and fabrication services; interfaces and visualisation services; and collaboration service (Atkins 2003). E-infrastructures enable research communities and projects to build and exploit interactive and interoperable knowledge environments for research and education. New types of scientific organisations and research environments are emerging, e.g. "laboratories without walls", a co-laboratory, e-science community. The establishment of virtual organisations is a fast-growing phenomenon, a virtual organisation is defined as "a group of individuals whose members and resources may be dispersed geographically and institutionally, yet who function as a coherent unit through the use of e-infrastructure" (Cummings, Finholt et al. 2008). A virtual organisation typically provides shared and real-time access to centralised or distributed resources, such as community specific tools, applications, data, sensors and experimental facilities (see for instance, EGI³³ and nanoHUB.org³⁴). Today no country or region can be competitive in R&I without an advanced e-infrastructure³⁵.

In conclusion, RIs and RPFs may be effective tools for enhancing scientific and technological excellence in Europe, while simultaneously countering societal, cultural and economic challenges at regional level, thus promoting the goals of RIS3. Those HEIs or ROs which form the nuclei of RIs therefore have key roles in RIS3.

3.6. EU Initiatives for Capacity Building

The main aim of the FP7 Capacities programme (2007-2013) was 'to enhance research and innovation capacities throughout Europe and to ensure their optimal use'³⁶. As part of the programme, the EC launched two complementary initiatives that are closely related to the development of RIS3:

- Research Potential (REGPOT) programme³⁷
- Regions of Knowledge (RoK) programme³⁸

Research Potential aimed to upgrading the research capacity of HEIs and ROs in the convergence and outermost regions of the EU that demonstrated excellent R&I potential (Atanasova 2013). The programme promoted close cooperation with outstanding European research organisations, Intellectual Property management and protection, and innovation capacity building. Synergies with the national/regional cohesion policy programmes had to be demonstrated in order to achieve institutional sustainable development. The main expected outcomes were: brain gain (recruitment of experienced researchers), upgrading the research infrastructure, contribution to local and European sustainable socio-economic development, and greater visibility and dissemination.

The Interim Evaluation report of Research Potential (European Commission 2010), based on an assessment of 86 projects, reported the following achievements:

- Upgraded research capacity and capabilities (recruitment of excellent researchers, updated technical equipment);
- Increased quality and recognition of research output (scientific publications, presentations at major scientific and industry events);
- Better integration in ERA – stronger networking with leading research organisations in Europe, increased participation in FP7 and other funding programmes;

³⁰ www.geant.net/

³¹ <http://cordis.europa.eu/fp7/ict/e-infrastructure/>

³² <http://cordis.europa.eu/fp7/ict/e-infrastructure/docs/geg-report.pdf>

³³ <http://www.egi.eu/>

³⁴ www.nanohub.org

³⁵ Digital Agenda Toolbox for RIS3, <http://s3platform.jrc.ec.europa.eu/digital-agenda>

³⁶ <http://cordis.europa.eu/fp7/capacities/>

³⁷ http://cordis.europa.eu/search/index.cfm?fuseaction=prog_document&PG_RCN=10908064

³⁸ http://cordis.europa.eu/fp7/capacities/regions-knowledge_en.html

- Increased cooperation with end-users, including SMEs, improved innovation potential;
- Effective contribution to regional and national **socio-economic development**.

Regions of Knowledge aimed to integrate R&D into regional innovation strategies in order to boost science and technology-based economic development³⁹. It is based on the Triple-helix model for cooperation between HEIs, ROs, public authorities and business and promotes the emergence of world class clusters in Europe. In addition, RoK provides input for the development of smart specialisation strategies by supporting:

- Trans-national co-operation between high potential research-driven clusters in sectors of common interest;
- Better links between HEIs/ROs, regional authorities and the local business community for the development of regional RTD policies;
- Development of Joint Action Plans at regional level to increase economic competitiveness and explore opportunities for mobilising financial and other forms of support offered by various sources;
- Competitiveness of the regional research-driven clusters via dedicated internationalisation measures.
- Provision of mentoring for regions with a less developed research profile in setting up and developing regional research-driven clusters.

ERA Chairs is an instrument to be applied under Horizon 2020 in order to help close the research and innovation divide in Europe⁴⁰. By establishing ERA Chairs, HEIs and ROs in low performing RDI Member States and regions with evident potential for research and innovation excellence are supposed to attract outstanding researchers in order to unlock this potential in the frames of ERA⁴¹. The measure aims at “creating a competitive research environment and the framework conditions necessary for attracting, retaining and developing top research talent within these institutions”. The beneficiaries are supposed to demonstrate their involvement in designing and implementing RIS3. The expected outcomes are (Kroll 2013):

- Promoting excellence: increased excellent research outputs, highly cited publications in international journals, more international collaborations, scouting top talent, highly trained doctoral candidates with the right skills;
- Increasing the critical mass of excellent researchers at the host institution;
- Widening participation: significant improvement of the performance of institutions in competitive research funding under the leadership of the ERA Chair;
- Creating ERA 'culture' through open, transparent and merit-based recruitment for research positions, operational HR strategies in line with the Charter & Code of Researchers, gender equality measures in place, external peer assessments for careers;
- Mobilising support for facilities and infrastructures, creating synergies between cohesion and research funding;
- Clearly articulated contribution to RIS3.

Under the ERA Chairs pilot call 111 proposals were submitted. All successful HEIs and ROs were committed to designing and developing RIS3 in collaboration with regional authorities and other local or regional stakeholders. Two other new instruments – Teaming and Twinning– are also related to the ERA Chairs concept. They aim at investing in Triple Helix partnerships by “giving much importance to hybrid structures between advanced and emerging research institutions” (Corpakis 2013). The main characteristics of the three new instruments are the expected strong links to regional development through contributions to RIS3.

Teaming aims at creating new centres of excellence or modernising existing research institutions in low performing RDI Member States and regions by teaming activities with leading institutions in Europe in the context of RIS3. This measure will rely on already existing partnerships, aiming to develop them to a higher level of integration and excellence, and may provide the opportunity to leapfrog to the top of the research landscape by using the brand name of leading institutions. A strong commitment of the recipient region or Member State is expected, e.g. through the Operational Programs and Structural Funds. In case of enough proof of sustainability, institutional building seed funding will be provided. In addition, the instrument aims at building links with innovative clusters and supporting excellence in research and development through peer reviews and awarding labels of excellence (e.g. Seal of Excellence) to those institutions that meet international standards.

³⁹ http://cordis.europa.eu/fp7/capacities/regions-knowledge_en.html

⁴⁰ http://ec.europa.eu/research/era/era-chairs_en.html

⁴¹ <http://www.biginnovationcentre.com/Assets/Docs/Triple%20Helix/Presentations/Workshops/Corpakis.pdf>

Twining aims at identifying emerging institutions in low performing RDI Member States and regions that have strong capacity in certain research areas. The main aim is to strengthen this capacity through links with at least two internationally well recognised and leading institutions in this field. This measure facilitates partnerships between regional research entities which have a substantial potential for excellence and capacity to innovate and cooperate with international leading counterparts (MPG 2012). A variety of measures and activities are envisaged, e.g. mobility of researchers and experts, short-term on-site or virtual trainings, workshops; conference participation; organisation of joint summer schools; dissemination and exploitation of the research outcomes, etc.

In order to make the capacity building instruments more effective, the concrete measures and activities should be well tuned to the real needs of the prospective beneficiaries. A number of additional measures could be envisaged as well, such as:

- Support for stronger cooperation lines between the participating institutions, such as: joint advanced doctoral training, joint cross-border research and innovation activities, joint/dual BSc, MSc and lifelong learning education and training. The projects could include not only Support Actions, but also a layer of RTDI and RIS3 activities.
- Shared use and upgrading of the available research infrastructure and e-infrastructures, and gradual establishment of joint virtual organisations and services.
- measures to support Digital Science and Digital Learning and opening the HEIs and ROs to Digital Entrepreneurs, Open Innovation, and communities of practice;
- Measures for embedding HEIs and ROs into place-based innovation ecosystems and infrastructures, such as: Digital/Smart Cities, Living Labs, Digital Regions which could gradually turn into large test beds for innovative products/services.
- Measures to support virtual/flexible mobility schemes rather than physical mobility.
- Measures (at EU and national level) for ensuring equal remuneration rates of the researchers when they work on activities providing "European Added Value". These measures are recommended to be in the context of national strategies for RDI capacity building, retaining of talents and attracting new talents.

The latter measures could be the main instrument for reversing the brain-drain into brain circulation and brain-gain for researchers from EU-12 and other convergence and outermost regions of EU. "Paying equitably would let Eastern Europe use its competitive advantage of marginally lower living costs to retain and even attract top researchers, so that Principal Investigators can assimilate critical masses of young eager talent. Additionally, it encourages many more applications to EU projects and forces local funders to match those compensation rates. This is what EU science stimulation should be" (Galsworthy and McKee 2013). However, the main decisions in this direction should be taken at a Member States level⁴². There are reports according to which HEIs and ROs from EU-12 do not provide competitive remuneration packs for excellent researchers (e.g. ERC grantees) and they move to institutions in EU-15.

As most of the EU actions reviewed above are relatively new, their full potential in regional development has not been fully realised and assessed. However, since they are designed and directed to the benefit of convergence regions, there are strong arguments for embedding them in the planning of RIS3. Along these lines, practical measures for the optimal use of resources through EU funding synergies should also be established. For example, such synergies could include the use of structural funds for the support of selected projects which have received a positive evaluation in HORIZON 2020 but were not eventually funded due to budgetary limitations. To some extent this is already happening in several Member States for successful ERC proposals which could not be funded.

A key element for a successful synergy between the above initiatives with RIS3 is the impact of recent developments in ICTs and the emerging research and innovation environment.

3.7. ICTs and the New Digital Information Environment

The information environment in which HEIs and ROs operate is changing very fast due to the deployment of advanced ICTs and ICT-supported activities: broadband, e-infrastructures, social computing, mobile applications, cloud computing, open data, big data, simulation, augmented reality, serious gaming and virtual worlds, language technologies, semantic web, etc. ICTs are driving a global transformation of society and the way people communicate, work, learn, carry out research, do business and entertain in a new digital information environment. Organisations are also changing, including HEIs and ROs, public administrations and companies, adopting new organisational models.

⁴² Robert-Jan Smits, Director-General of DG Research and Innovation, at a discussion on Horizon2020, 5th European Innovation Summit, European Parliament, Brussels, 30.09-2.10.2013

The Europe 2020 strategy and the Digital Agenda for Europe identified ICTs as a powerful tool for delivering 'smart, sustainable and inclusive economic growth through the realisation of the digital single market and the exploitation of the potentials for innovation of fast and ultra-fast internet and interoperable services and applications'⁴³. Although the ICT industry generates only about 5% of GDP, ICTs drive about 20% of overall productivity growth and the ICT industry makes up one quarter of total business R&D⁴⁴. ICTs are considered as a "key enabler of competitiveness and innovation". By 2016, the digital economy is expected to reach EUR 3.2 trillion in the G-20 economies. ICTs are not only enablers of the new economy, but they are also horizontal enablers of development and growth for other sectors by bringing benefits for traditional industries. It was reported that more than three quarters of the value added created by the internet derive from enhanced productivity in traditional industries. SMEs grow two to three times faster and create new jobs if they utilise ICTs. Member States are stimulated to develop their national, local and regional 'digital agendas' and to use Structural Funds, including Rural Development Funds and the Connecting Europe Facility⁴⁵, to develop measures that aim at investing in broadband and enhancing access, use and quality of ICT based innovative products and services. In October 2013 the European Council identified some positive signs of economic recovery in Europe and focused on the digital economy, innovation and services as means for increasing growth potential, enhancing job creation and boosting European competitiveness⁴⁶.

By embracing ICTs, HEIs and RO improve the quality of their research and education (e.g. by applying Digital Science and Digital Education), empower their capacity building (e.g. through access to e-infrastructures and using flexible models of mobility) and get unprecedented opportunities to communicate and cooperate with all other stakeholders in designing and implementing RIS3. The latter could be achieved through adoption of policies and strategies for stimulating Digital entrepreneurship and Open Innovation, digital administration, Open Access and Open Data, and thus contributing to development of a European Digital Commons for the needs of ERA and RIS3. ICTs could support development of creative (place-based) innovation ecosystems evolving into environments of excellence, centred around HEIs and ROs and attracting global talent.

Digital Science

Recently, DG CONNECT adopted a vision for Digital Science in Horizon 2020: "transforming science through ICT tools, networks and media, to make research more open, global, collaborative, creative and closer to society" (European Commission 2013). Digital Science relies on wide use of e-infrastructures and ICT-based services and tools in virtual and collaborative environments. It opens up new opportunities for raising the interest and improving the knowledge of citizens in science and technology. Digital Science provides a platform and methodology for stimulating Open Innovation and commercial exploitation of scientific results by a large community of digital entrepreneurs. Such an approach fits very well with RIS3 since it would let policy makers collaborate with all stakeholders in developing solutions related to global challenges and in promoting the corresponding policy decisions.

The Digital Agenda for Europe clearly states the need for more effective knowledge transfer activities and emphasises the requirement for publicly funded research to be widely disseminated through Open Access publication of scientific data and papers (European Commission 2010). The Europe 2020 Flagship Initiative Innovation Union confirms that the Commission aims to make Open Access a general principle for projects funded by the future European framework programmes (European Commission 2010).

Digital Science could be a very important component in the context of involvement of the HEIs and ROs in RIS3. However, in order to make this happen, there is a need for change in the scientific culture and institutional practices in the HEIs and ROs, and in the way they collaborate with the outside world: industry, administration and citizens. By adopting Digital Science approaches less developed regions in Europe could improve their opportunities for narrowing the existing science, technology and innovation gaps between them and other regions. Social and economic cohesion will strongly depend on the extent of implementation of Digital Science approaches and instruments and on the opportunity for knowledge and information flow among the main regional stakeholders.

Digital Learning

The wide penetration of ICTs into society catalyses the drive for global educational reform which will gradually break the monopoly of the print and paper based educational system. The observed global educational reform leads to using new pedagogy models⁴⁷ in highly interactive virtual learning environments. ICTs have driven a large institutional change in the field of higher education and some

⁴³ Digital Agenda Toolbox for RIS3, <http://s3platform.jrc.ec.europa.eu/digital-agenda> Guide for Broadband Investment http://ec.europa.eu/regional_policy/sources/docgener/presenta/broadband2011/broadband2011_en.pdf

⁴⁴ Digital Competitiveness Report 2010, http://ec.europa.eu/information_society/digitalagenda/documents/edcr.pdf

⁴⁵ <https://ec.europa.eu/digital-agenda/en/connecting-europe-facility>

⁴⁶ http://www.consilium.europa.eu/uedocs/cms_data/docs/pressdata/en/ec/139197.pdf

⁴⁷ See for instance: <http://www.edusummit.nl/>

new university models have emerged, such as: Virtual University, e-University, Virtual Campus, Global Campus, University 2.0. For instance, the term Virtual Campus is defined as follows⁴⁸: "Cooperation between higher education institutions in the field of e-learning, regarding: design of joint curricula development by several universities, including agreements for the evaluation, validation and recognition of acquired competences, subject to national procedures; large-scale experiments of virtual mobility in addition to physical mobility and development of innovative dual mode curricula, based on both traditional and on-line learning methods".

ICTs offer unprecedented opportunities to improve quality, access and equity in education and training (European Commission 2012). There is ample scope in Europe for greater exploitation of the potential of Open Educational Resources that allow individuals to learn anywhere, at any time, following flexible and individualised pathways. HEIs will play an increasing role in life-long learning, producing media-rich multi-lingual courseware and other kinds of educational content that will shape new learning environments (European Commission 2011). For instance, Massive Online Open Courses⁴⁹ (MOOCs) is a fast growing phenomenon which integrates social networking, massive involvement of active and motivated learners, Open Educational Resources and engagement of well-known experts in the field of study. Open Courseware⁵⁰ and MOOCs are global undertakings which go beyond the regional reach of the traditional university courses. Máire Geoghegan-Quinn, European Commissioner for Research, Innovation and Science, in her speech "Research, Innovation and the Maastricht Generation", states: "Indeed, all kinds of developments are forcing universities to re-think the way they operate. MOOCs, for example, are revolutionising teaching and thinking. Big data is transforming scope and scale of research" (Geoghegan-Quinn 2013).

Digital Learning is expected to be among the main instruments for overcoming the enormous eSkills gap in Europe: by 2015 Europe is expected to face a shortage of approximately 900,000 ICT practitioners⁵¹. It is noted that life-long learning is a key demand in fast changing economies such as those expected to be promoted by regional RIS3. HEIs and ROs have to play a key role in the announced Grand Coalition for Digital Jobs. Such engagements could be integrated into RIS3.

Virtual Mobility

The mobility of researchers in Europe is mainly **one-way mobility** – from less-developed countries and regions in Europe towards the more developed ones (Inzelt 2013). Such phenomena are not in line with many official European policies and strategies.

Virtual Mobility is still often hindered by a lack of funds to establish true cross-border collaborations and the existence of heavy bureaucratic and political obstacles (European Commission 2012). Flexible forms of mobility should be fostered, considering individual factors such as age, gender and family needs, as well as health conditions. This requires the joint efforts of all stakeholders, including the Commission, Member States and the institutions (HEIs and ROs).

The benefits of Virtual Mobility of researchers in HEIs are widely recognised in the frames of the Lifelong Learning Programme in Europe, e.g. Virtual Mobility increases the opportunities of graduates for new jobs and self-employment. Members of Europe's institutional network for open and flexible higher education – EADTU – have widely embraced the model of Virtual Mobility and established a dedicated portal⁵². The Virtual Mobility model is explored in the frames of the EIT ICT Labs⁵³ as well.

Development of Digital Education and Digital Research capacity in parallel with Virtual Mobility models would be more beneficial for the less-developed European countries and regions. Virtual Mobility would be a very effective model in mobility schemes between academia and industry. Europe has long traditions in the area of eWork⁵⁴ and implemented many innovative Virtual Mobility models during the last two decades. In addition, by investing in Virtual Mobility Europe would become more competitive in the global educational and research market and would attract more talent from all over the world, including from the European R&I diaspora. Such initiatives could be deeply embedded in the Smart Specialisation undertakings and strategies.

⁴⁸ http://ec.europa.eu/education/programmes/llp/guide/glossary_en.html

⁴⁹ http://en.wikipedia.org/wiki/Massive_open_online_course

⁵⁰ www.ocw.mit.edu ; www.openlearn.open.ac.uk ; www.ocwconsortium.org

⁵¹ Grand Coalition for Digital Jobs, <http://ec.europa.eu/digital-agenda/en/grand-coalition-digital-jobs-0>

⁵² <http://www.eadtu.nl/virtualmobility-projects/87-epics.html>

⁵³ <http://www.eitictlabs.eu>

⁵⁴ AMI@Work Communities, http://www.ami-communities.eu/wiki/AMI%40Work_on-line_Communities

Digital Entrepreneurship and Digital European Commons

Digital Entrepreneurship “embraces all new ventures and the transformation of existing businesses that drive economic and/or social value by creating and using novel digital technologies”⁵⁵. The Commission is on its way to launching a European Strategy for Digital Entrepreneurship in order to promote the smart use of ICTs for completing the digital single market⁵⁶. This would allow information and data to be easily exchanged across borders and used by administrations, businesses, HEIs, ROs and citizens. The Commission considers open public data as a very important resource that might strengthen the innovation potential of EU (European Commission 2011). Such data consists of administrative data, statistics, weather data, data from publicly funded research projects, digital libraries, etc. Overall economic gains from opening up this resource for re-use in new products and services could amount to €40 billion a year in the EU. The cross-fertilisation between publicly funded research and the commercial sector in the “digital ERA” will increase the pace and impact of innovation. In June 2013, a new EU Directive dedicated to Open Data policies was adopted” (European Commission 2013). The EU Open Data Portal⁵⁷ contains thousands of datasets that could be explored and used by different stakeholders. The scope of the Open Data is extended to libraries, including university libraries, museums and archives. This will promote development of cross-border services and will create new jobs in sectors like education and tourism.

The emerging Linked Data standard is already widely used to represent data in many areas (JRC 2013). Access to Linked Data allows developers to integrate information from different sources in new innovative applications and services. However, the developments in the area of Open Data and Linked Data are still concentrated in only a few European countries⁵⁸.

The vision for “GÉANT 2020” is to turn GÉANT into a European communications commons in the “creative knowledge society of 2020”, where “talent anywhere is able to collaborate with peers around the world and to have instantaneous and unlimited access to any resource for knowledge creation, innovation, and learning, unconstrained by the barriers of the pre-digital world” (European Commission 2011). The main goal is to develop GÉANT 2020 as a common, enabling infrastructure for European Research and Education. The GÉANT Ecosystem is based on the National Research and Education Networks (NRENs) which serve not only academic users, but also high schools and libraries. Some NRENs are engaged in providing services to the public sector as well, e.g. JANET⁵⁹. Such partnerships enable closer cooperation inside the “knowledge triangle” and pave the way for further cooperation under the Smart Specialisation initiatives (RIS3). NRENs and the e-infrastructures could be embedded into some existing or emerging innovation infrastructures, such as: Living Labs, science and technology parks, Smart Cities, industry clusters, Future Internet Research and Experimentation⁶⁰ (FIRE) facilities, etc. For instance, a number of city-based experimental facilities have been launched in the frames of the FP7 Smart City projects⁶¹. The links between the Future Internet community, coming mostly from industry, and the research community based on GÉANT, are relatively weak. The two communities are complementary and if they are better integrated, a synergistic effect could be achieved: the research networks could provide robust and reliable environments for prototyping and validation of next-generation networks and applications, while the Future Internet communities (mostly companies) could work for successful development of innovative products and services based on open, user-driven innovation.

Integration of GÉANT, NRENs, e-infrastructures and the large variety of digital innovation infrastructures could turn regions and Europe into a large experimental facility for new and emerging innovative products and services. Member States and regions should be encouraged to provide support to digital entrepreneurs and start-ups, including by providing access to the Digital European Commons of the future which would be multi-ethnic, multi-cultural and multi-lingual. A variety of funding instruments could be used to support such initiatives, such as: Structural Funds, Horizon 2020, and the Risk Sharing Finance Facility (RSFF) of the European Investment Bank (EIB).

⁵⁵ <http://ec.europa.eu/enterprise/sectors/ict/digital-entrepreneurship>

⁵⁶ <http://www.europarl.europa.eu/sides/getDoc.do?pubRef=-//EP//TEXT+TA+P7-TA-2012-0468+0+DOC+XML+V0//EN>

⁵⁷ <http://open-data.europa.eu>

⁵⁸ www.data.gov.uk ; www.opendata.paris.fr ; www.dati.piemonte.it ; www.data.overheid.nl

⁵⁹ <https://www.ja.net/>

⁶⁰ <http://www.ict-fire.eu>

⁶¹ <http://www.ict-fire.eu/home/success-stories/openlab.html> ; <http://www.ict-fire.eu/home/success-stories/experimedia.htm> ; <http://www.ict-fire.eu/home/success-stories/smartsantander.html>

Summary

In this section key parameters concerning the role of HEIs and ROs in the innovation chain have been addressed, together with synergistic effects of relevant EU actions in terms of capacity building. It is concluded that all aspects involved in the innovation chain including financial and regulatory measures should be brought into sharp focus if the knowledge and innovation potential of HEIs and ROs is to be realized. Successful implementation of RIS3 thus relies to a large extent on identifying and closing gaps in the innovation chain (bridging the 'death valley') i.e. on the existence of an innovation-friendly environment, with the cultivation or establishment of high-quality academic and research environments as a central element.

Existing EU initiatives for R&I capacity building offer significant bridgeheads for HEIs and ROs in RIS3 as well as synergies between cohesion and research funding. Notable among these are (European) Research Infrastructures (RIs) and RPFs, which can be hotspots facilitating the formation of regional hubs where good science, technology, talent and entrepreneurship may cluster and have a significant socio-economic regional impact, thus promoting the goals of RIS3 as well as linking regional and European R&I resources. Those HEIs or ROs which form the nuclei of RIs therefore have key roles in RIS3. Other capacity building initiatives which may provide bridgeheads for HEIs and ROs in RIS3 are the Research Potential (REGPOT) and Regions of Knowledge programmes under FP7, which dovetail with new initiatives under Horizon 2020 aimed at upgrading existing or creating new high quality research institutions in low performing RDI Member States and regions: ERA Chairs, Teaming and Twinning. A critical element for successful synergy between the above initiatives with RIS3 is the impact of recent developments in ICTs and the emerging digital research and innovation environment. HEIs and ROs are well placed to act as enablers in utilising ICT tools and the associated transformational potential of knowledge and information flows from and to the region.

4. Opportunities & Challenges for Universities & ROs in RIS3.

This section examines opportunities and challenges for HEIs and ROs in RIS3. It considers opportunities provided by clusters and technology platforms, issues of complementary specialisation and the mechanisms involved in up-scaling from regional and European partnership to a global dimension. It then gives a detailed analysis of the constraints and opportunities for optimizing HEI and RO involvement in RIS3.

4.1. Clusters & Technology Platforms

Grouping HEIs and ROs with companies in 'clusters' can be an effective means of promoting interactions and translating intellectual and scientific potential into commercially successful new products and services. Such clusters may help in overcoming the obstacles involved in the innovation chain and may therefore contribute to the success of RIS3. Particular features of innovation clusters are their thematic focussing and geographic proximity.

Clusters are defined by the co-location of producers, service providers, educational and research institutions, financial institutions and other private and government institutions related through linkages of different types (European Commission 2007). There is huge diversity among clusters: they differ in terms of their stage of development along the cluster life cycle; some are networks of SMEs, some are organized around key anchor firms, and yet others have developed around HEIs or ROs.

Several innovation clusters are the first entities to have been organized on a regional basis. Their members operate in partnership under a common development strategy focusing on generating synergies on R&I for entering potential markets. The underlying element is the achievement of critical mass and adequate innovation capacity for facing global competition. This dovetails with the objectives of RIS3 and simultaneously bridges gaps in the innovation chain. An interesting example of how a national cluster policy can develop is the emergence of Poles de Compétitivité in France, described in section 4.3.

Regional or national clusters may operate at a national level as technology platforms, and may be linked at a European level forming transnational technology platforms.

Along these lines, European Technology Platforms (ETPs) are industry-led stakeholders fora that develop short to long-term research and innovation agendas and roadmaps for action at EU and national level to be supported by both private and public funding (for a list see Annex I). ETPs span a wide range of technology areas and have to date played an important role by developing joint visions, setting Strategic Research and Innovation Agendas and contributing to the definition of the research priorities including those under the Research Framework Programmes. In ETPs, SMEs from different regions may come together with large corporations, HEIs and ROs forming part of the linking process

ETPs are key elements in the European innovation ecosystem. They develop strategies and provide coherent business-focused analysis of research and innovation bottlenecks and opportunities related to societal challenges and industrial leadership actions. They can mobilise industry and other stakeholders within the EU to work in partnership, share information, enable knowledge transfer and deliver on agreed priorities. ETPs are independent organisations, some of which form nowadays Public-Private Partnerships (PPPs). Furthermore, several Member States have established national technology platforms which mirror ETPs for building capacity and enabling their research communities to influence and participate in European activities, or to align their thematic activities with a shared strategic vision.

Due to their features, national and European technology platforms may have an important role in realizing the goals of RIS3 in scaling-up processes from regional to national and international levels.

4.2. Linking Regional, Inter-regional, National and Global Interactions

The knowledge creation process has a global character but in the context of RIS3 its application needs to be regional. There is a clear role for HEIs and ROs for satisfying this need. At the same time, in many cases the role of HEIs and ROs in RIS3 extends much beyond the regional or national boundaries. This is particularly so in regions which have research-intensive HEIs and ROs but limited absorptive capacity for R&D results in either their private or public sectors. Due to their competitive presence and international networks, such HEIs and ROs can act as conduits linking and scaling-up at inter-regional, national and global levels. This may have indirect, not immediately obvious benefits in feedback transformational processes which may facilitate the implementation of RIS3. For example, HEIs and ROs with an international visibility may act as poles of attraction for young talented researchers and eminent scholars and scientists and thereby contribute greatly to reversing brain drain from the region. Furthermore they may enrich the available human capital by producing well-trained researchers and highly skilled personnel (the educational and training issue). As noted previously, indications are that international corporate research managers view such high calibre human capital as a principal contribution to companies rather than the specific knowledge generated by research *per se* (Hallonsten and al 2004). For

these reasons, HEIs and ROs may have a significant role in the formation of the R&I ecosystem by attracting science-based companies or subsidiaries and/or creating spin-out companies, which may facilitate the economic transformation of the region, as aimed for by RIS3.

HEIs and ROs also have a role as links for effective technology transfer and adaptation of R&I activities, both that originating from other regions or being transferred to other regions. To achieve this effectively, the brand name of the regional HEI and RO matters. Also, the ability of HEIs and ROs to identify and respond rapidly to developments in the R&I open environment is important for making appropriate adjustments for the optimal implementation of RIS3. Similarly, if necessary, they can assist in identifying the best exit strategy.

Complementarity issues need also to be considered to capitalize on human and infrastructure capacities available in each region. This is particularly important for RIS3 realization in regions that do not have HEIs and ROs. The strengthening and expanding of relevant EU initiatives in the new programming period will help.

EU initiatives, as discussed in Section 3, may play a catalytic role for the linking-up processes of R&I by HEIs and ROs. A good example is the Research Infrastructures action, including both existing RIs which provide Transnational Access and the ESFRI infrastructures of pan-European interest envisioned for the next 10-20 years and the emerging Regional RIs. The early development of new, effective financing and operational mechanisms will be critical for the success of this endeavour. The Regions of Knowledge action, which has supported projects for transnational cooperation in clusters involving HEIs and ROs on the one hand and business and public authorities on the other, has also strong elements which, with appropriate adaptations, may support linking up processes within RIS3. The recently discussed concept of Teaming may also provide a positive impetus particularly for regions with limited R&I resources.

Several obstacles hinder the scaling up process. A major consideration is the management of funding of RIS3 initiatives only by the regional authorities, since the potential benefits of scaling-up may be diffused and not immediately visible within the region. Regulations for the use of Structural Funds for inter-regional actions may help resolve such issues. Another option for supporting such inter-regional or inter-MS spill-over effects would be the existence of a central funding 'pot' distinct from the funds allocated to regional authorities.

The concentration of the research community in HEIs and ROs on the global impact of their work, a usual prerequisite for promotion in academia, may be prohibitive for their engagement in regional issues. This is also related to the phenomenon whereby an invention created in a region is exploited elsewhere, especially if the absorptive power for R&D in the region is limited. This form of scaling-up is contrary to the objectives of RIS3. Facing this phenomenon and satisfying the place-based idea of RIS3 requires a range of financial and framework measures to overcome the 'death valley' as discussed in this report.

In conclusion, the interplay between the regional, national and global role of HEIs and ROs should be recognised as a positive element both at the design phase of RIS3, the 'entrepreneurial discovery process', and in its implementation.

4.3. Smart Schemes for RIS3

As a place-based strategy, and given the diversity of European regions in terms of the structure of their economies, their history, prevailing culture and traditions, and their social and ethnic fabric, there can be no one-size-fits-all approach to RIS3. There is also regional diversity in terms of the amount and diversity of the available HEIs and ROs provision. Moreover, as a bottom-up place-based strategy, notions of RIS3 prototypes may be misleading insofar as they may blur or lose the specificity issues of a region. Policy strategies may, however, provide interesting pointers. We consider here the examples of two national policy initiatives (France, Austria) and one local policy initiative (Southern Catalonia) as smart schemes for RIS3

France: The emergence of Poles de Compétitivité (Competitiveness' clusters)

France's competitiveness losses over the last decade warrants close scrutiny, and slackening economic growth has weighed on employment and public finances⁶². The country has also been identified as experiencing macroeconomic imbalances. Despite a noticeable evolution, the French institutional context is quite different from the American case because of the less pronounced links between universities and industry. In particular, the self-reinforcement effect between public and private research observed in the US is not found in France. A predominant "Paris-provinces" structure is also prevalent, which could explain a weaker diffusion of knowledge. Therefore, the differences between cultures, behaviours, etc. give rise to different patterns of knowledge diffusion. Based on best practices that have been successful in many countries, the French state launched a policy of establishing competitiveness clusters through a

⁶² http://ec.europa.eu/europe2020/europe-2020-in-your-country/france/country-specific-recommendations/index_en.htm

call for proposals mechanism⁶³. It encourages businesses and training centres and research associations in key sectors for economic development. In July 2005, 67 clusters were labelled by the Inter development and territorial competitiveness committee.

By 2010 there were 71 competitiveness clusters, following new waves of creation in 2007 and 2010, the appearance of new centres, the disappearance of others, and the re-structuring of some poles merged to succeed. Each Competitive cluster is a defined territory with the association of the business sector, research centres and training organisations, engaged in a partnership (joint development strategy) for synergies around innovative projects.

In the meantime, the French state promoted an overall favourable business and innovation environment and supported the efforts of research and development (R&D) deployed within clusters with newly created measures (Inter-Ministerial Fund (FUI) providing financial assistance to the best R&D Economic Development through calls for proposals; National Research Agency (ANR⁶⁴) for funding projects stimulating new ideas and partnerships targeting research efforts on economic and societal priorities, Public Investment Bank (BPI), Bpifrance or the Deposit, program on investments for future).

The clusters have contributed to the emergence of over 1000 R&D projects supported financially by the state, as well as local authorities (DATAR 2012). The first results of a selection of projects show technological, scientific or economic impacts:

- Most collaborative projects have led to license file patents.
- They are also at the origin of new or saved jobs.
- "Start -ups" and SMEs have also emerged.
- In some cases, increases in revenue could be precisely measured and in others there are indications for a stronger business growth.

As an example, since its creation the world competitive cluster Aerospace Valley has created employment in its regions in the aeronautics, space and embedded systems sectors. 11,000 new jobs have already been created in the last three years (INSEE figures^{65,66}). In the region, employment growth is largely contributing by the aerospace industry and research and development with the National Centre for Scientific research (CNRS), or the National Centre for Space Studies (CNES). Many non-market institutions are also among the largest employers: in healthcare, public services, the Regional Council, the General Council, in the railways and urban transport, and in teaching with the University Paul Sabatier.

Between 1999 and 2009, the number of jobs increased sharply in the Midi-Pyrenees region up to 12% against 7% in France. The region has a net of 129,800 additional jobs in ten years, despite the economic and financial crisis that began in mid-2008. Partly in response to the housing needs generated by the strong regional population growth, employment in construction increased much faster than in metropolitan France (31% against only 22%). In volume terms, market services are providing the most jobs, with 83,100 new jobs in ten years.

Austria: Using university performance contracts to mobilise universities for regional RIS3

The Austrian Federal Ministry of Science and Research is encouraging universities to take a proactive role in the knowledge triangle in order to mobilise and underpin universities' role as 'lead institutions' in regional smart specialisation strategies. As part of the universities' three year performance contracts the ministry has invited Austrian universities to position themselves in their region with the help of a 'location concept' (Standortkonzept) in order to integrate their regional role into the internationalization strategy for research. With the help of the location concept the university is able to highlight its position within a critical network of excellence with strategic partners in industry, business and academia in a self-selected area of close collaboration and will also be able to attract private and public funding including EU cohesion funding. The location concepts also help raise awareness among local authorities on the importance and impact of universities in regional development.

Altogether 15 out of 22 universities are participating in the process that involves self-assessment, identification of key partners/networks, target setting and monitoring by mid-2014. The ministry plays an active role in the process: it negotiates with the HEIs, monitors the implementation of the strategies, and provides feedback on the strategic outcomes and where necessary brokers between the players in higher

⁶³ http://www.insee.fr/fr/themes/document.asp?reg_id=3&ref_id=16709#def1

⁶⁴ <http://www.agence-nationale-recherche.fr/en/project-based-funding-to-advance-french-research/>

⁶⁵ www.aerospace-valley.com

⁶⁶ http://www.insee.fr/fr/themes/document.asp?reg_id=7&ref_id=19530&page=regards/pano_73_janv_2013/panopage2_73_janv_2013.htm#emplois

education and research sector at the regional and national level. No additional funding has been allocated for HEIs for the process, but the outcomes may impact on national funding allocation in future.

Southern Catalonia: The University Rovira i Virgili- a long-term commitment to the economic transformation and industry specialisation of the region

The University Rovira i Virgili (URV) is a comprehensive research intensive HEI in Southern Catalonia, created in 1991 by the Catalanian Government as part of the process of higher education decentralisation. URV's track record in knowledge exchange is based on its early decision in 1995 to build a robust research base and graduate/postgraduate training. For the past 15 years URV has benefited from consistent management and leadership that has systematically built the capacity for regional development. Following a strategic decision in 2001, URV has focused on areas of specialisation important to the region and aligned its education, R&D and service activities with the regional priority areas. URV's education and R&D are linked with the key industries of Tarragona and Southern Catalonia. It has an active agenda in "third mission" activities, such as entry points for SMEs to the university knowledge base as well as social and cultural programming in 22 cities in Southern Catalonia. URV's long-term co-operative relationship with the chemical industry incorporates both research and human capital development programmes that are relevant to the industry needs. Its industry-centred model is oriented toward increasing the productivity and competitiveness and innovative capacity of local industry firms, both large and small. URV emphasises the development of skills and human capital resources that can bring new ideas and business practices to local firms. Skills are developed at every level, from the technical operative workforce to executive management. There are strong alumni connections and students participate in internships and co-operative programmes within the local firms. Both advanced technical vocational skills and higher degree based skills such as in engineering are designed in co-operation with the local industry representatives.

During the economic crisis, URV has developed a stronger institutional specialisation and a leading role in Southern Catalonia's transition to a knowledge-based economy: In 2010, capitalising on the Spanish HE reform and the Campus of International Excellence call URV launched the Campus of International Excellence of Southern Catalonia (CEICS) as a tool for coordinating the knowledge and innovation ecosystem in Southern Catalonia. URV coordinates the CEICS knowledge triangle with 22 strategic partners (5 research centres, 6 technological centres, 5 research hospitals and 4 enterprise associations) in five strategic areas: chemistry and energy, nutrition and health, tourism, oenology, and culture and heritage. URV has played an important role in setting the CEICS agenda that operates through a broad range of transformative projects, renewal projects and incremental projects. The CEICS portfolio includes technology centres, networks of doctorates, joint doctorates, programmes of talent attraction, scholarships, cooperative strategic projects, Innovation Hub, Innovation Communities and enhanced VET collaboration.

An important element that supports URV's regional engagement and strategic goals are its HR policies and mechanisms that enhance, recognise, reward and evaluate regional engagement along with excellence in teaching, research and management. The university staff contracts recognise the importance of and give value to the staff participation in these outreach efforts. University staff members are allowed to spend time working in local firms during their leave periods and have on-going relationships with the firms. The university staff contract has been re-organised around a system with a ten-point base. All staff members are expected to do research and to teach, with the minimum contractual obligations constituting six of the expected ten points. To reach the expected ten points, university staff member can contribute in a variety of ways, according to their interests and expertise. For example, for some it may mean working with SMEs to implement technology transfer or technology commercialisation projects. For others, reaching the ten points may mean additional research and publication. The goal of this Human Resource strategy is to set a base expectation for the staff performance in core activities. This evaluation method creates the flexibility to allow all staff members to contribute to regional engagement activities. All criteria for performance constitute a unit contributing to the ten-point base. The results are available in the university intranet to all members of the department.

4.4. Constraints and Opportunities for HEIs and RO in RIS3

Mobilising HEIs and ROs for regional smart specialisation process is a challenge for many EU regions because of a number of constraints at national, regional and institutional level. At the same time, active participation in RIS3 may bring substantial benefits for HEIs and ROs. This section identifies some of the challenges and constraints as well as the opportunities and benefits.

Constraints at the national level National HE and Research policy: a limited and weakening regional agenda?

In most EU countries HE policy does not include an explicit regional agenda in which the regional smart specialisation process would easily fit. The national ministries of education encourage the role of higher education and research in meeting national and international levels of scientific excellence and advanced

education. The EU policy instruments incentivise HEIs and ROS either to pursue research excellence which has led to concentration of research funds in the most prosperous regions (Framework Programme research grants are awarded through open competition to individual researchers or teams) or to enhance regional growth in cohesion regions (European Structural Funds). International comparative and competitive league tables rank universities on integrated scales with focus on research performance based on a limited number of internationally recognised journals. As a result of tightening budgets and the global HE reputation race, governments concentrate their investments to develop world class centres of excellence, while regional engagement may be increasingly seen as a distraction and competition for resources.

Where the HE legislation has an explicit requirement for regional engagement or engagement with business and the community, it has been seen as a “third task”, but not necessarily linked to the core functions of research and teaching. The task of applied research and development and meeting skill needs in the local labour market is often given to newer institutions such as polytechnics or universities of applied science. These institutions may have a specific remit to serve particular regions but because of a lack of a long-established tradition in research and/or the infrastructure to support it, their ability to contribute to the development of a new economic base or renew old and declining industries may be limited. In the past decades many EU countries have experienced continuous political pressures to create new HEIs in areas not previously “served” locally by universities in parallel with a concentration of research resources in elite institutions in the main cities. Due to budget cuts, demographic changes and pursuit of critical mass, countries are now facing pressures to reduce the number of HEIs through mergers. This development may also endanger balanced development of regions.

National HE policies may directly reduce the interest and capacity of universities and/or other HEIs to engage in smart specialisation strategies or in regional development in general. While governments in many EU countries have legislated to reform institutional governance and management to replace collegial forms of governance and management (i.e. elected rectors, deans and heads of departments) with more overt managerial roles by appointed vice chancellors or rectors and the heads of the faculty, they have not always ceded full autonomy to institutions. Institutions can be subject to a regulatory burden or limitations on institutional autonomy and flexibility. They may have limited scope to respond to local skills needs because the HE curricula and consequently their programme offer is determined nationally. There may also be limitations on the use of the HEIs’ human, financial and physical resources, leaving little room for action and responsiveness. Universities may be subject to strict procurement regulations for relatively small purchases.

HEIs may face challenges in engaging in the Smart Specialisation Strategy process due to national steering/management of the structural funds that can pose a problem in inhibiting the advancement by universities of inter-regional research and innovation activities (both within one country and for cross-border cooperation). Synergy between innovation policy and regional policy initiatives/investments is often lacking or under-used.

Another constraining factor for HEIs’ participation in the regional smart specialisation processes and regional development in general is the lack of appropriate metrics to illustrate and evaluate and measure HEIs’ contributions to regional development. Most indicators in regional development are retrospective, rewarding past performance rather than development work that may lead to future income and services in the public interest. While the benefits of the regional service role of HEIs are more likely to emerge in the performance indicators of local authorities, for example, in terms of job generation, these are not benchmarks against which higher education institutions would expect to be judged.

Overregulation of higher education institutions is common in mature higher education systems and may discourage participation in regional smart specialisation processes. Overregulation usually arises from the increasing expectations on HEIs and multiple stakeholders including national and regional governments, all of whom have accountability requirements, which can generate a significant burden on HEIs.

Funding constraints

Attitudes of HEIs towards regional engagement and smart specialisation are sensitive to the way they are funded. HEIs’ regional engagement is characteristically not directly funded by national governments, as core funding of public HEIs is based on criteria that do not reward regional engagement. In the absence of incentives, HEIs, particularly research-intensive universities, are more inclined to prioritise their national and international role. The lack of full economic costing of HE research also works against long term R&D capability because institutions are not able to reinvest in the research infrastructure or create financial headroom to invest in capacity for translational research.

While emphasis on regional engagement is more likely when the funding of HE is regionalised or responsibilities transferred to regional government with related taxation power, the decentralisation of HE funding has brought mixed results.

Some countries have made efforts to reinforce the HE system in relation to firms and regional economies as well as their willingness to engage in the region. In most cases, temporary incentives under the form

of grants, calls for projects or joint programmes facilitate collaborative research at regional level. Some countries have developed large regional projects with a range of stakeholders to lay the foundations of regional innovation systems (Sweden's Regional Growth Programme VINNVÄXT). The Higher Education Innovation Fund for England (HEIF) includes funding and monitoring mechanisms that support university industry and community engagement. While HEIF funds are a small component of the budgets of English universities their cumulative impact (since 2001) on the behaviour of English universities has been significant. In 2011 HEIF became performance-based.

The decrease or slow increase in public R&D funding encourages HEIs to look to external sources to maintain or expand activities also regionally, but in practice this is challenging because industry contracts usually involve larger firms which collaborate with HEIs with a particular specialisation, regardless of their region. HEIs in the EU area have taken advantage of the European Structural Funds to initiate projects that have supported knowledge transfer and skills development in less favoured regions, but the nature of project funding has placed constraints on greater engagement. In some countries funding agencies only finance direct project costs or marginal cost. If core funding is linked to teaching via graduate output numbers there is not enough leeway to invest in translational research facilities and knowledge transfer. Activities funded by projects risk closure when the project ends if care has not been taken to mainstream them in research and teaching programmes.

A key objective of smart specialisation is to increase synergy between different funding streams and policies from a broad range of ministries and agencies sometimes with conflicting agendas. In practice, however, many countries feature a lack of joined-up government and competing agendas of the ministries of finance, higher education, science and technology and industry among others. In the smart specialisation agenda the regional innovation strategies will need to be aligned with national strategies for research and innovation. This is challenging as in most EU countries, including those with devolved governments, research and education is an exclusive competence of the nation state. These programmes also align with other non-regional EU policies and programmes (e.g. Horizon 2020). When developing smart specialisation strategies, EU countries and regions will need to take account and be involved in discussion of what types of operational programmes will be presented in the partnership contract.

A specific funding constraint for HEIs is the perceived lack of coordination of schedules of calls for applications for European and national competitive funding schemes for R&I activities, and schedules for use of regional funds through RIS3. Greater coordination is necessary particularly for universities to provide the required matching funds. In most cases HEIs have to raise the substantial proportion of their R&I funding from external sources.

Constraints at regional level

The European Commission and many regions across the EU area are looking to HEIs to contribute to smart specialisation strategies and more generally to regional economic, social and cultural development, but the capacity of the regions and HEIs to collaborate is often constrained by a wide range of factors.

Universities and other HEIs have often been absent from or had a minimal role in national or regional innovation strategies. A technology push model has dominated while the potential contribution of the Arts, Humanities and Social Sciences to social innovation has been generally ignored. The principles underlying why universities can be important agents in territorial development in the round have not been well understood by public authorities. To produce the maximum impact at regional level, there is a need for understanding and addressing a range of barriers and challenges, both internal to the universities and in the wider enabling environment.

Local and regional governments are responsible for administratively defined areas usually linked to unambiguous political mandates. By contrast research-intensive universities cannot have a mandatory geographical sphere of influence: they operate at the local, regional, national and international scales.

Some vocationally/professionally oriented HEIs have a specific regional mandate but it is increasingly less likely to be enforced by national, regional and local governments as the institutions compete for students and contracts wherever these can be obtained. Where devolution of powers in HE has been carried out, regional governments have been able to contribute to the establishment of HEIs and, in principle, also facilitated greater university engagement with the local community. In many member states, HE is not in the domain of responsibility of local and regional authorities.

Other constraints at regional level relate to the fragmented local governments, lack of political leadership, competition within and between the sub-regions. These factors may result in lack of coherence between national and regional/local policies, lack of a shared voice and vision at the regional level, and an exclusion of higher education institutions from the design and implementation of regional strategies.

The role of HEIs and ROs in regional smart specialisation processes is closely linked to their role in regional governance structures and decision making processes. In some public programmes and countries, the participation of HEIs is mandatory on the boards or in partnerships that manage economic development. Regions which lack the tradition of dialogue and partnerships between HEIs/ROs and regional stakeholders or more specifically inclusion of HEIs/ROs in supervisory and advisory boards may

face difficulties in drafting effective smart specialisation strategies. Research intensive universities do not necessarily see themselves accountable for regional outcomes such as job generation or business competitiveness.

There is anecdotal evidence of mutual exclusion processes where HEIs do not include regional stakeholders in their strategy development and the regional agencies exclude HEIs from the design and implementation of regional strategies. While some communities and regional agencies may be reluctant to draw on the expertise of HEIs/ROs in policy formulation and/or implementation or may engage only with a part of the higher education system, university leaders may also advise against closer regional engagement in fear of provincial and narrow image. Even when there is a specific regional administrative structure in place, HEIs face challenges of intraregional competition for their attention, particularly in cases of multi-campus solutions which raise questions of dilution of resources and can be very demanding in terms of staff and student mobility and management time.

Synergy between policy initiatives is often lacking or under-used. The experience of the use of structural funds for R&D activities varies greatly across the regions. Clear governance rules between EU and national/regional authorities are needed if the RIS3 goals of the structural funds are to be achieved. Local managing authorities of the structural funds (ERDF and ERF) do not see themselves as partners in the funded regional activities, but rather as simply the regulators for setting and monitoring the rules (EUA-JRC 2012)³

The private sector: Lack of absorptive capacity and articulation of demand

HEIs and firms, particularly SMEs, experience significant gaps in their collaborative relations. Well documented barriers relate to differences in corporate and academic culture and time horizons as well as lack of 'boundary spanners' who are able to bridge the gaps. Firms may be seen as driven by narrow self-interest and short term goals leading to a lack of a shared understanding about the challenges, ineffective or non-existent partnerships or a focus on supply side, transactional interventions from HEIs.

A key concept of the regional smart specialisation process is the 'entrepreneurial discovery processes'. A well-functioning smart specialisation process requires on-going relationship between industry and HE to determine what innovations have the best opportunities for adoption and commercialisation, creating an industry-university learning environment. It supports the human capital development required to adopt and apply process and product innovations and works with SMEs and large corporations. It measures success in terms of the sustainability and transformation of regional industry and employment growth.

Regional economies are often dominated by SMEs and often feature a high number of firms with low demand or absorptive capacity for new knowledge and innovation due to an underinvestment in R&D. There is often lack of co-ordination or representative voice with which to engage. While strong and dynamic regions may have well developed private sector networks that are plugged into higher education and articulated through Chambers of Commerce, industry and/or cluster associations, the less-developed regions have inchoate SME sectors, with under-developed industrial clusters and difficulties to articulate the demand for the higher education offer. Universities that are plugged into national/international networks are well placed to make judgements on the relative strength of regional activities. While HEIs and ROs in peripheral regions are well placed to shape the regional agenda, the low absorption capacity of local and regional firms further limits the development of research for local needs.

There may also be a lack of localised supply networks through which new innovation can transform and upgrade existing industries.

One constraint for developing successful RIS3 is the underdeveloped system of information gathering about the regional environment and needs, as well as about the successes and failures of respective activities of HEIs and ROs. There is a lack of information and robust data, e.g. on innovation performance in the private sector, student employability, graduate destinations and work-based learning activities which make it difficult to evaluate the outcomes of local policies and institutional practices.

Information and action on the part of the public agencies, HEIs, HE departments and external stakeholders is often poorly co-ordinated.

The regional smart specialisation process exercise may run the risk of being captured by public sector lobbies or by HE research interests that are not necessarily linked to regional potential. The lack of match between the university's scientific strengths and regional competitive advantages may also constrain its ability to play an objective role in the entrepreneurial discovery process. As a result entrepreneurs may even be 'locked out' of regional planning and the smart specialisation process. This is a concern in the less developed regions where enterprise associations and other demand-side bodies tend to be weaker. These regions may have strong universities that can generate pockets of world class knowledge which may be important in long term economic transformation, but these universities should also build capacity in SMEs to absorb and apply this knowledge. Unlike research organisations, universities can also through teaching build capacity on the demand side establishing the social relations which underpin the regional innovation system. These mechanisms include start-ups and spin-offs, student enterprise, graduate placements etc.

The environment for HE to engage in smart specialisation strategies across the EU countries is highly variable. Where the governance and industrial structure is weakly developed and where there is no strong regional leadership, HEIs can take a lead in the regional smart specialisation process, not only responding to regional needs but also actively helping to set the agenda. Whether the HEIs are able to do this depends on their own governance, leadership and management.

Constraints at the Institution level

To what extent HEIs and ROs will engage in regional smart specialisation strategies depends on the role the institution chooses for itself and the leadership role it adopts. Smart specialisation and the regional agenda will be a challenging task to both research-intensive universities which have a stronger focus on national and international excellence than local utility, and to smaller institutions with limited human resources and research and capital infrastructure.

Research-intensive universities may ignore smart specialisation because it does not fit well with their mission and implies a shift away from science-driven policy making for many regions. While Smart Specialisation calls on concentrating scarce public resources and investment to support knowledge-based economic development in targeted priority areas, this means that regions developing Smart Specialisation Strategies are required to prioritise specific RDI strengths, identified through the "entrepreneurial discovery" process. This approach represents a challenge to universities whose role traditionally has been to build broader research capabilities that may represent significant scientific excellence but are not necessarily unique to the region where they are located. The more selective, "smarter" match with research capabilities does not necessarily correspond with the scientific strengths in universities. HEIs' transformative value in regional innovation systems lies in diverse scientific strengths and their ability to perform basic and experimental forms of research that cannot be undertaken by private sector R&D: they can improve the long-term adaptability of a regional economy, resist industrial path dependency and lock-in to ageing technologies.

There are numerous institutional barriers and constraints at the institutions:

- Limited institutional autonomy in terms of mission, academic profile, programme offer and management of human resources and infrastructure or strong institutional autonomy which is used to resist any shifting of profile in a direction that would underpin regional specialisation.
- Limited legitimacy and strategic anchoring of smart specialisation or the needs and priorities of regions in general within research-based universities and HE system in general. Regionally relevant action is not reflected in strategic development, curriculum development or budget allocation of HEIs. HEIs' funding arrangements do not support sufficient alignment of institutional mission with the regional and local needs and priorities. Smart specialisation or regionally and locally relevant activities are predominantly viewed by HEIs either as a diversion from internationally and nationally recognised research or "third mission" that is not linked to research or academic subjects, limiting the effort and resources invested in them.

Third task activities may be the responsibility of a member of the senior management team or passed on to parts of the central administration (tech transfer office or continuing education centre), but the integration of teaching and research within the disciplines to deliver regional impact is seldom recognised.

- Inadequate incentive structures at institutional and individual level. The system of institutionally steered incentives and support activities linking HE and research with the region are inadequate or non-existent. Existing incentives enable isolated initiatives, the impact of which is diminished by their non-coordinated character. There is resistance in the academic community to regional engagement because it is seen as a risk for national and international collaboration and reputation and individual career progress. Regional engagement is not recognised as one of the grounds for academic promotion which is characteristically based around research excellence as reflected in peer reviewed publications and to lesser extent to innovative teaching or academic management.
- Lack of legal and administrative competences to meet the requirements of administrative processes and rules by the national/supranational authorities.
- Limited management capacity and co-ordination deficit. HEIs are loosely coupled systems with many relatively independent units organised around disciplines along a supply-driven agenda and different goals and resources. The head of the institution could integrate regional engagement and disciplinary areas and represent the corporate view of the institution externally, but in practice there is little connection between the high level engagement of the senior management and the actions of individual academics. There is a lack of co-ordination, cross-cutting mechanisms while individual departments or entrepreneurial professors are each delivering their own range of activities and services with limited co-ordination, collaboration and sharing of good practice, leading to duplication of

efforts and difficulties in creating critical mass. A range of mechanisms are used with varying success, but they are not co-ordinated strategically to produce the maximum impact.

- Disconnect between university technology transfer models and regional and local development and growth. University technology transfer models focus on developing saleable intellectual property and start-ups, but seldom produce enterprises that grow in the region and contribute to regional economic development. There is a lack of availability of resources to support the development of ideas (proof of concept) into products or services or translational research facilities to build prototypes or test drugs etc. Intellectual property is a source of conflict between the academic and his/her institution even where the national legislative environment is favourable. Continuing professional development for small businesses and the community does not easily fit into conventional full time teaching programmes and can require evening and weekend teaching, eating into time for research and scholarship. Problem-solving R&D for local SMEs is time consuming and diversionary from what are regarded as HE core activities.

Opportunities for HEIs and ROs participation in regional smart specialisation strategies

The bottom-up “entrepreneurial discovery process” and a collective strategy formation in the RIS3 process requires collaboration and discussion within the region and offers an opportunity for HEIs and ROs to (re)assert their role in the regional innovation system. While market-based actors face incentive problems to engage in the process, HEIs and ROs can position themselves as lead organisations in RIS3.

Smart specialisation requires the universities to rethink their role in regional innovation beyond a source of scientific research and development capacity and offers an ability to mobilise expertise in other policy-relevant knowledge domains, such as economics, business and regional development.

Governments can help facilitate this process as has been the case in Austria where universities are encouraged in their annual performance contracts to develop place-based strategies “location concepts” (Standortkonzept) as part of their internationalisation strategy for research (see section 4.3).

HEIs’ participation as lead organisations in the RIS3 process can also enhance their transformational role in the RIS. While alignment of R&D and teaching with regional priorities is important for the success of RIS3, universities’ wider societal role requires also experimental research in order to avoid lock-in to ageing technologies and a failure to support innovation. There are significant economic drivers for HEIs to become active in the smart specialisation process.

Through active participation in RIS3 HEIs may gain substantial support for their global aspiration in research and talent attraction and additional income for activities or services provided to local business through consultancy and professional training. Structural funds can be used to build HEIs’ capabilities, such as consultancy services for the execution of projects, multi-disciplinary research and management skills. Smart specialisation can also boost the HEIs’ public service role through which it can demonstrate its public accountability and value to the society.

The financial rules for the next Research Framework Programme, Horizon 2020, and Cohesion Policy 2014-2020 allow co-funding of the same projects from the two sources. This will help regions and HEIs take advantage of the two policies, especially if there is rationalisation and alignment of the timelines and administrative rules and procedures. Regional strategies that create synergies between ERDF/ESF funding and EU Research Framework programme funding help build research excellence through e.g. research infrastructures and attracting leading researchers. The top research groups are more likely to be successful in the EU Research Framework Programme and then be subsequently rewarded with long-term institutional funding.

The different pathways for regional innovation and development offer opportunities for further diversification of missions among the HEIs within the region: while developing new economic activities through radical technological change and breakthrough innovations is the task of research-intensive universities, the other pathways can be taken up also by other institutions. These forms involve: rejuvenating traditional sectors through higher value-added activities and new market niches, modernising regional economy by adopting and disseminating new technologies, diversifying technologically from existing specialisations into related fields, and exploiting new forms of innovation such as open and user-led innovation, social innovation and service innovation. (EC, 2011, European Commission factsheet on Research and Innovation Strategies for Smart Specialisation)

4.5. Characteristics of potentially successful HEIs and ROs in RIS3

The present report identifies a set of institutional characteristics that would seem to be necessary for achieving good results in RIS3. HEIs and ROs engaging in RIS3:

- are aware of the policy framework with regard to smart specialisations; they know and understand how this framework applies at various levels: local, regional, national, European.

- explicitly and actively address regional development in their core institutional mission and include regional development aspects in their strategic development plans. They include regional stakeholders in the process of developing their overall institutional strategies.
- include regional engagement aspects in their institutional evaluation policies and processes, along with the evaluation of teaching/learning, research, and broad contribution to the society. They have adopted specific indicators, metrics, to assess success in regional engagement.
- develop effective partnerships: are able to select the right external partners for RIS3; develop appropriate infrastructures and processes to sustain effective communication and coordination with these partners.
- identify, in cooperation with other partners, distinct regional features that support smart specialisations initiatives.
- are not ancillary partners in RIS3, but play a key role, from the design to implementation and assessment.
- have internal organisational and governance structures specifically designed to promote regional engagement. Employ specialized staff with appropriate training and responsibilities inside the organisation. Have an internal, adapted system of incentives to promote engagement in regional development efforts.
- address matters of regional engagement/RIS3 based on a concern for sustainability, as opposed to an attitude driven by the availability of individual project funding.
- pay special attention to the use of ICT as part of their regional engagement strategies and activities.
- do not compromise on other institutional functions that are not relevant for RIS3.

Is it necessary to be an entrepreneurial university in order to be successful in RIS3? Is it sufficient? - A comparison between entrepreneurial universities and successful HEIs and ROs in RIS3.

Many of the typical characteristics of the entrepreneurial university may also be deemed necessary for success in RIS3. Such characteristics of HEIs are mentioned in the present report as well. The question may be asked therefore whether being an entrepreneurial university is a necessary, and perhaps sufficient, condition for successful involvement in RIS3. The answer appears to be negative.

The concept of entrepreneurial university has been frequently used in the last 10-15 years to inform the discussions about the role and mission of universities in face of new external pressures and expectations. The concept has rapidly evolved in time, acquiring multiple meanings and uses. At present there is no one single model of entrepreneurial university in the world. Rather, several models co-exist, with different, although at least partly overlapping, characteristics. The concept has also found its way into the higher education policy reflection of the EU Commission. For example, in 2012 the Commission published a document jointly with OECD (A Guiding Framework for Entrepreneurial Universities⁶⁷), which acknowledges that there should not be one single model of entrepreneurial university in the EU. At the same time, however, the document outlines a guiding (that is, normative) framework to help interested universities assess the extent to which they are "entrepreneurial universities". The framework is organized in seven areas, each operationalized into a small number of desirable institutional characteristics.

Some of the characteristics most frequently mentioned in the literature on entrepreneurial universities, and which are also of interest in the context of smart specialisation strategies, include:

- innovation through research, knowledge exchange, new attitude to teaching and learning, new governance models, new approaches to external relations (EU Commission, OECD, 2012);
- entrepreneurialism in research universities; productivity of knowledge transfer offices; new firm creation; new environmental context, including the development of networks of innovation (Rothaermel, Agung et al. 2007)⁶⁸.

Researchers and policy makers also mention economic development and sometimes regional economic development specifically, as a core function of the entrepreneurial university. This function is to be achieved by HEIs through technology transfer based on R&D in high technology, by assuming the role of a major source of knowledge for the industry. Entrepreneurial universities are also conceived as a key element in the transition from "close innovation" to "open innovation" (Rothaermel, Agung et al. 2007).

⁶⁷ <http://www.oecd.org/site/cfecpr/EC-OECD%20Entrepreneurial%20Universities%20Framework.pdf>

⁶⁸ Rothaermel 2007 - perhaps the most comprehensive literature review to date.

All these characteristics, in one form or another, are mentioned in the present report as applying to HEIs and ROs as well, if they are to engage successfully in RIS3. Still, as shown in Figure 3, there are significant differences between the concept of entrepreneurial university and the characteristics of “ideal” HEIs and ROs working in RIS3 as detailed above. These can be summarized as follows:

- The concept of entrepreneurial university does not presuppose regional specialisation (the identification and selection of a limited number of regional features to work on with other partners). It is possible for a university to be entrepreneurial (like in the commercialization of its research results through patents), without being involved in any regional efforts based on the idea of selective specialisation. This is the main difference, which in turn is the source of other differences, as illustrated in the radar graph below.)
- RIS3 are linked to a specific policy context in the EU, including the principle of smart specialisation strategies as an “ex-ante conditionality”. This policy context may favour entrepreneurialism in universities, but it is not a necessary condition for entrepreneurial universities in the EU.
- Individual HEIs and ROs can be successful in RIS3 without defining themselves as entrepreneurial universities. It is possible, for example, for a research university, which does not call itself entrepreneurial, to engage successfully in RIS3 initiatives.
- The concept of entrepreneurial university does not apply to ROs. As discussed in the present report, ROs are nevertheless also expected to play a key role in RIS3, together with HEIs.

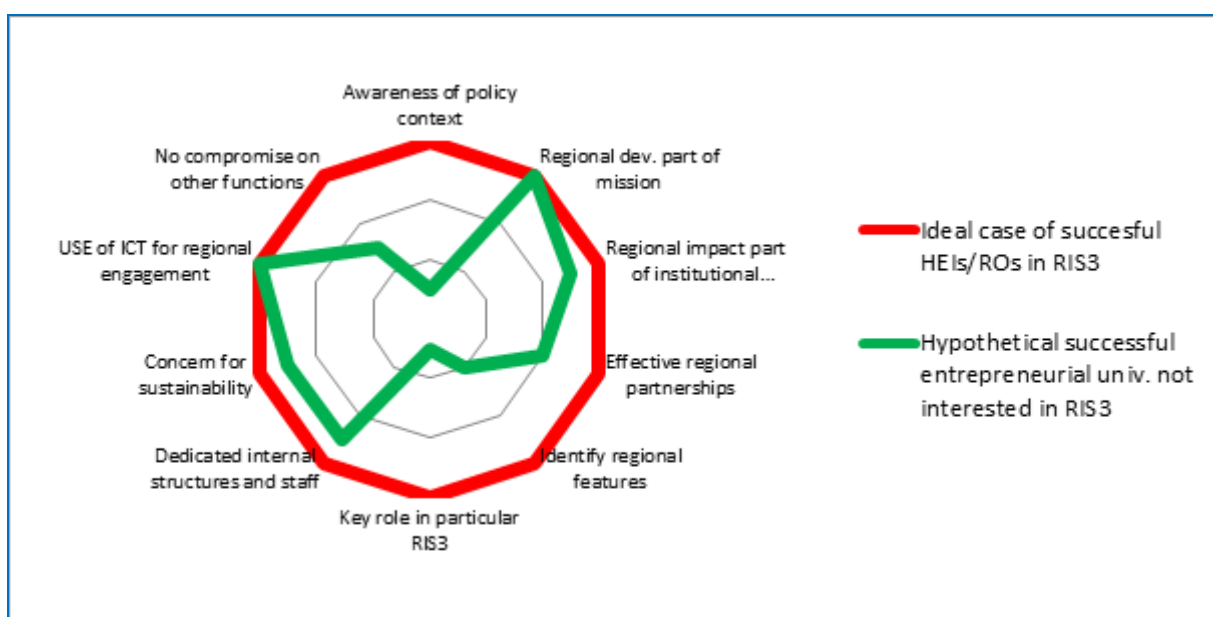


Figure 3: Comparison between an ideal case of successful HEIs or ROs in RIS3 and a hypothetical successful entrepreneurial university not interested in RIS3

Summary

The knowledge creation process has a global character but in the context of RIS3 its application needs to be regional. Clusters and technology platforms, characterized by thematic focussing and geographic proximity, can be effective means of promoting interactions between HEIs/ROs and companies and translating intellectual and scientific potential into commercially successful new products and services. These may also complement the role of HEIs and ROs which, due to their competitive presence and international networks, can act as conduits linking and scaling-up at inter-regional, national and global levels.

Mobilising HEIs and ROs for regional smart specialisation process is a challenge for many EU regions because of a number of constraints at national, regional and institutional level. At the institutional level, certain features of potentially successful HEIs and ROs in RIS3 are listed and compared with the characteristics of entrepreneurial universities. It is evident; however, that smart specialisation and the regional agenda will be a challenging task to both ROs and research-intensive universities which have a stronger focus on national and international excellence than local utility, and also to smaller institutions with limited human resources and research and capital infrastructure.

5. Conclusions, recommendations and pointers

5.1. Conclusions

RIS3 is a novel policy approach to economic and social development promoted by the EU. It is specifically designed to address issues of economic competitiveness, growth, and social cohesion as outlined in Europe 2020 strategy. This approach is based on the principle that the discovery of well-defined domains for specialisation in a region/ country, i.e. of R&I areas in which a region/country could excel and which are related to distinctive development opportunities, may play a crucial role in triggering economic advancement in that region/country.

RIS3 is essentially a place-based development policy building on knowledge assets, which aims at concentrating scarce public resources - regional, national, European - on a limited number of strong areas and activities. The realization of RIS3 involves the concentration (specialisation=concentration) of R+D efforts for achieving critical mass, thus facilitating economies of scale. This process of evidence-based decision-making and entrepreneurial selection of focus areas in order to minimize failures and increase efficiency is now an *ex-ante conditionality* for EU funding in the new programming period from 2014 to 2020; it relies on the mobilization of all actors involved in knowledge creation and dissemination.

Basic ingredients for innovation and capacity building - and hence for the success of RIS3- are high quality HEIs and ROs. These can occupy nodal positions in the global innovation chain. Whether R&I potential and associated economic and social outcomes are exploited in geographic proximity or elsewhere depends on whether a region has an innovation friendly environment, with support for innovative firms. Consequently, framework conditions for RIS3 are coordinated multi-level governance and policy commitment to actions or reforms which close gaps in the innovation chain. Specific challenges in the RIS3 process are, fundamentally, how to make the entrepreneurial discovery (prioritization) process operational and how to motivate stakeholder participation.

In particular, without HEIs and ROs, other relevant actors (governance authorities, representatives of the business sector and of civil society) will be handicapped in designing and implementing smart specialisation strategies. In turn, European HEIs and ROs are faced with the challenge of deciding how to engage in RIS3 initiatives. They need to consider both new responsibilities and new opportunities to develop their research, teaching, and outreach infrastructures, human resources, policies and practices. RIS3 can benefit not only the country/region but the participating HEIs and ROs as well, by promoting a new type of engagement, supported by new and significant financial resources. The pursuit of place-based excellence, utilizing a wise combination of both place-blind (Horizon 2020) and place-based (Structural Funds) funding for R&I could support or create HEIs and ROs of the highest quality.

The present report has examined the overall policy context regarding RIS3, its relevance for HEIs and ROs, as well as key conceptual and practical elements regarding their involvement in RIS3.

In particular, three major questions have been tackled.

What is the role of HEIs and ROs in RIS3?

- HEIs and ROs promote the goals of RIS3 by placing emphasis on the quality of research and capacity building. Research intensive establishments, by expanding their research capacities, may enable spatially relevant knowledge generation, absorption, and spill-overs.
- HEIs and ROs which have at least some pockets of excellence will influence in a positive manner the environment in which they operate, attracting and nurturing talent, including entrepreneurial talent. An average department or research group in an institution with a 'brand name' associated with excellence benefits from what can be called an "aura-effect". Simultaneously, the same effect attracts businesses and entrepreneurial activity, all of which contribute to RIS3.

The development of "locally-based" Technoparks, including thematic clusters and networks having in their centre high quality HEIs and ROs, as well as financial (private and/or public) and other supporting agencies may provide the most conducive environment for RIS3. Clusters are particularly successful for knowledge spill overs when HEIs, ROs and innovative companies are geographically concentrated.

- As sources for knowledge creation, dissemination and also as institutions of knowledge absorption, HEIs and ROs can be key actors in the entrepreneurial process of discovery/learning process for establishing RIS3 that reveals the strengths of a region's assets and knowledge base and associated potential for innovation-based growth.

- Through their research and international links they may provide and collate information about emerging technological opportunities, products, processes and standards, as well as assess the barriers for their adaptation in the local economy, as required by RIS3. By the same token they may act as channels for scaling-up from regional activities to national and international environments. They are also main contributors to the development of skilled human capital which is a key driver for realizing the objectives of RIS3. RIS3 requires prioritization of new initiatives and balanced considerations of what to leave intact. Its implementation takes place through proactive policies which exploit emerging promising tendencies, instead of responding to market failures. Interventions of HEIs and ROs in realizing such policies are also important considering the rapidly changing research environment, marked by the emergence of new disciplines and technologies, especially those of interdisciplinary nature which require shifting capacity.
- HEIs/ROs can contribute to the *design phase* of smart specialisation strategies by an evidence-based assessment of the region's knowledge capacity, competencies and potential, including those existing within their own institutions, as well as in local companies. They can help to identify research areas with significant competitive advantages at a national or regional level, and contribute to strategic prioritization and policy formulation. In the *implementation phase*, HEIs and ROs can focus on adaptations and developments contributing to the sustainability of RIS3 objectives as the growth strategy matures. HEIs and ROs can also build long term *capacity* within the region to effectively capitalize on the regional smart specialisation strategies through their education and training functions and interdisciplinary research capacity

High quality research environments are a precondition for high calibre knowledge creation, knowledge transfer and knowledge absorption. Such environments increase the probability for effective expansion of the existing academic base into spatially (regionally) relevant knowledge creation and spill overs for regional economic transformation. In this sense, Smart Specialisation is served by an expansion process of existing high quality environments. HEIs and ROs, through RIS3, favour a dynamic process of knowledge transfer and adaptation to the region and from the region to other regions.

What are the expected benefits and unwanted consequences?

- The involvement of HEIs and ROs in RIS3 is an effective pathway for increasing their regional engagement and in this way amplify their socio-economic contribution on a sustainable basis. As a result, their position in local societies is improved and their opportunities for a diversification of funding basis are enhanced.
- Considering that the effectiveness of HEIs' and ROs' role in RIS3 depends strongly on their overall research quality, with the appropriate policy mix the broader pursuit of academic excellence may be served through their involvement in RIS3. For example, resources from sub-critical areas may be freed through the concentration and strengthening of proximate scientific domains. Also, through linking up processes expected from HEIs and ROs in RIS3, their exposure to international competition is increased, thus potentially contributing to raising standards.
- Entrepreneurial talent existing in the academic community may discover new opportunities through RIS3 (e.g. by creating spin out companies). Simultaneously, the scientific talent in HEIs and ROs may benefit from positive feedbacks from RIS3. The concept of "excellence attracts excellence" may operate.
- HEIs and ROs need to avoid the risks that may result from a skewed understanding and implementation of RIS3. The idea of "concentration" of resources is inherent to the idea of critical mass building as required by smart specialisation. This may have the counter effect of uneven spatial division of scientific labour and resources in HEIs and ROs, with negative effects for the goals of RIS3.
- Overspecialisation may lead to lock-ups of skilled human potential and thus narrow the pool for talent and resources in HEIs and ROs, reducing their ability for flexible responses and undermining their potential for new innovation to emerge.

Overall,

Establishing a visionary policy mix, together with effective governance for the implementation of RIS3, can minimize the impact of such undesirable side effects.

A healthy entrepreneurial culture may be cultivated and augmented in high quality academic and research environments leading to effective initiatives and synergies for the benefit of a region/country through the involvement of HEIs and ROs in RIS3.

How to realize this role?

Regional smart specialisation strategies envisage a role for key knowledge producers – higher education institutions (HEIs) and research organisations (ROs) – in the strategy design, implementation and capacity building. While HEIs form an economic sub-system in their own right that builds the long term knowledge base in the regional, national and European economy, they can also play an important role in the RIS3. The same applies to ROs which often, by their organisation and structure, may have a direct role to play in RIS3.

The extent to which knowledge producers are engaged in regional RIS3 or more generally in regional development – human capital and skills development, knowledge transfer, innovation and enterprise formation and wider community development – depends on the policy context at the national, regional and institutional level. The key policies relate to financing, regulation and governance. Although RIS3s are **context-specific** there are common issues which have implications for policy development. This section concludes with pointers for policy development in the EC, national and regional governments and HEIs/ROs. Some of these pointers are of general significance for engaging HEIs and ROs in regional development (which is a prerequisite for RIS3) and others are more specific for establishing and realizing RIS3. The key pointers for future focus are:

- Strengthening collaborative mechanisms, e.g. between HEIs and ROs, industry, public sector and society.
- Integrating HEIs and ROs in the policy making process including the RIS3 strategy.
- Targeting incentives to HEIs and ROs to collaborate with industry.
- Stimulating private investment in R&I actions for RIS3
- Enhancing institutional autonomy of HEIs and ROs, including budgetary resources.
- Ensuring institutional flexibility of HEIs and ROs, e.g. provide incentives for regional HEIs/ROs to meet the regional long term and short term needs.
- Stimulating effective use of ICTs (Digital Science, Digital Education, Digital Administration, Open Innovation and Digital Entrepreneurship) at all levels: European, national, regional, institutional (HEIs and ROs) in the context of RIS3.

5.2. Recommendations and Pointers for the European Commission

- Enhance coordination within EC across the policy domains (Structural funds, research and innovation, higher education) and link the policy instruments for structural funds, research and innovation and education so as to ensure coherent decisions on priorities, resources and strategies. ICTs could play a crucial role in this process.
- Rationalise application, funding and reporting procedures and align the timelines of different programmes so as to seriously reduce the bureaucracy for the use of Structural Funds for R&I.
- Meet the aims of RIS3 by enabling HEIs and ROs to exploit funding instruments such as the RSFF, the EIF and relevant actions within Horizon 2020 for bridging regional gaps in the innovation chain and encouraging exploitation locally.
- Facilitate inter-regional links and scaling-up initiatives by establishing a central (EU or Government controlled) Fund to make an effective use of inter-regional spill-over effects.
- Expand the potential of Horizon 2020 actions for RIS3 implementation (eg ERA Chairs, Teaming). For example, use the relevance to RIS3 in the selection criteria. Special attention should be placed on the problems in the New Member States.

Given the current financial conditions and cutbacks for HEIs and ROs in many Member States, care should be taken to reduce potential risks such as the spatial division of scientific labour and resources which may entrench existing disparities.

In collaboration with Member States:

- Stimulate HEIs and ROs to implement Digital Science and Digital Learning models and to participate in digital economy development (e.g. Open Innovation, Digital Entrepreneurship).
- Support “virtual mobility” mechanisms and measures to be implemented in parallel to the “physical mobility” schemes embedded in Erasmus+ as an instrument to reverse the ‘brain-drain’ in New Member States.

- Support measures and instruments based on a model for equal remuneration of researchers in all European programs providing “European Added Value” as the main instrument for “brain-circulation” and “brain-gain” in less developed countries and regions.

5.3. Recommendations and Pointers for the Central Government level

Effective policies for HE require three things: clear targets, alignment of incentives to support the targets and monitoring that does not add to an accountability burden.

Governments that seek to mobilise HEIs and ROs for regional RIS3 process and regional engagement in general could consider the following actions:

- Create coherent governance across the policy domains (finance; human capital and skills development; science, ICTs, KETs and innovation; industry development) at the national level to coordinate decisions on priorities, resources and strategies in regional and local development, including RIS3.
- Develop synergies between Structural Funds (ERDF, ESF) and EU research funding programmes to build long term capacity in regions. For example, to support positively evaluated ERC projects which could not be funded due to Horizon 2020 budget limitations.
- Develop policy and budget instruments for inter-regional cooperation in RIS3.
- Increase investment in R&D (the 3% of GDP target)
- Develop a National Strategy for capacity building, retaining and attracting talent that includes a strategic decision for equal remuneration of all researchers and experts in EU that are involved in European programs producing “European Added Value”.
- Simplify the rules and reduce the bureaucracy for the use of Structural Funds for R&I
- Encourage HEIs’ and ROs’ contribution to the preparation and implementation of regional and urban strategies, including RIS3 strategies, for example with the help of HEIs’ performance agreements, as is currently the case in Austria.
- Strengthen HEIs’ autonomy (human, financial and physical resources, responsibility over curriculum). Strengthen HEIs’ accountability without discouraging academic initiative. Promote the inclusion of external stakeholders in HEI governance and encourage the participation of HEIs and ROs in regional governance structures and RIS3 planning processes. Develop indicators and monitor outcomes to assess the impact of HEIs and ROs on regional performance, for example by including the contribution of HEIs and ROs to regional development in their performance evaluations.
- Support HEIs’ diversity and develop Vocational Educational Training (VET) and Digital Learning to widen access and provide diverse skills and competencies required for the knowledge-based economy and RIS3. Encourage collaboration between HEIs and the development of pathways for student progression. Support participation of HEIs and ROs in Grand Coalitions for overcoming the e-Skills gap in Europe
- Invest in broadband, e-infrastructures and support integration of academic and industrial RDI infrastructures.
- Encourage the role of HEIs and ROs in social innovation, social sciences and humanities for understanding and tackling socio-economic disparities and generating vibrant environments conducive to entrepreneurial culture.
- Provide incentives for HEIs and ROs to be part of the RIS3 process and regional engagement in general. International experience shows that this can be achieved through a diverse range of mechanisms for example long term core funding and/or additional strategic and competitive funding, such as: i) formulae for block grant funding against outcomes, with higher weights for enrolments in academic programmes related to regional labour market needs, ii) special funding contingent on evidence of regional engagement/focus and/or industry collaboration, iii) bonus points for HEIs and ROs collaborating in funding applications; iv) special funds that provide matching of funding obtained by HEIs and ROs from contracts with regional employers for education and training services; v) investment in the fundraising infrastructure (to boost voluntary giving) to support regional engagement.
- Encourage and support collaborative research among HEIs and ROs and between HEIs /ROs and industry at the sub-national level and across regions to exploit the complementarities between different HEIs and ROs, in order to reach a critical mass and enhance industry-academia interaction.

- Use RIS3 process to provide a more supportive environment for HEI and RO-industry collaboration, regulatory and tax environment and accountability regimes that do not place an undue burden on institutions or constraints on collaboration.
- Encourage collaboration between HEIs and ROs in the regions to improve the supply and demand of HE/research training provision through the development of joint programmes, RDI activities, and shared services and facilities, in order to make better use of resources and to achieve greater impact. Use RIS3 to incentivise also rationalisation of programme offers, RDI and services/facilities within individual HEIs and across HEIs & ROs in the same city/region.
- Improve schemes for supporting innovation and facing the 'death valley' between proof of concept and commercialization (e.g. loans, guarantees, tax relief, seed funding, venture capital, and legislation).

5.4. Recommendations and Pointers for the Regional Level

Policy makers at the regional level that seek to mobilise HEIs and ROs for regional RIS3 process and regional engagement in general could consider the following actions:

- Establish a partnership structure of government, HEIs and ROs and public and private stakeholders to develop a RIS3 strategy and a broader vision for the region or connected regions. Support the vision with a clearly articulated long-term strategy and milestones and funding to ensure that regional engagement is part of HEIs' and ROs' activities and reflected in their development plans. Map the current engagement activities within HEIs and ROs and carry out a gap analysis (needs assessment and activity audit).
- Consider establishing a regional public-private investment fund to build HE and research training capacity to contribute to RIS3 and regional engagement, using a variety of funding sources such as the European Investment Fund (EIF); Provide incentives to HEIs and ROs and individuals for regional initiatives, e.g. engaging faculty members and students in education and applied research projects related to RIS3 priorities. Use competitive funding to stimulate cross-institutional, multidisciplinary R&D and education programmes aligned with regional challenges and opportunities.
- Invest jointly with HEIs and ROs in programmes that support RIS3 strategies and bring wider benefits to regional businesses and community. Such measures may include: Translational research facilities aligned with the needs and opportunities of the region for example addressing the needs of the ageing population with the help of telemedicine and social innovations which can create new opportunities for enterprise; One-stop advisory services for SMEs that pool together the expertise of all HEIs and ROs in the region; Professional development programmes; People-based mobility between HE and industry that transfer knowledge and innovation to SMEs and other organisations (such as Knowledge Transfer Partnerships in England), and Graduate retention and talent attraction policies that are aligned with the regional priorities.
- Support the establishment of ambitious projects having as a nucleus HEIs and ROs, such as the RIs and Regional RIs, with the aim of fostering R&I environments, developing a knowledge-based entrepreneurial culture, supporting the local market and creating jobs.
- Promote the internationalisation of the region, its business sector, RIS3 and HEIs through attraction of talent and by tapping into HE and research global knowledge networks. Provide incentives for HEIs and ROs to increase their capacity as technology transfer agents to bring non-local knowledge to the region. Link RIS3 strategies with talent attraction policies and support these with employee tax incentives, repatriation schemes and improving the attractiveness of academic careers.
- Use RIS3 to encourage collaboration between HEIs and ROs through programmes, joint investments in R&D facilities and incentives. Encourage HEI specialisation and a collaborative way of referring enquiries from businesses and industry to HEIs and ROs for example through one stop shops that pool the expertise of HEIs and ROs in the region.
- Develop "Regional Digital Agenda" as part of RIS3.
- Promote integration of GÉANT (NRENs), e-infrastructures and the large variety of digital innovation infrastructures related to the Future Internet (e.g. FIRE), Living Labs, Smart Cities, EIT ICT Labs, etc. and thus turning the region into a large experimental facility for new and emerging innovative products and services.
- Stimulate Open Innovation and Digital Entrepreneurship.

5.5. Recommendations and Pointers for HEIs and ROs

- Seek an active role as a lead organisation or participant in the priority-setting and delivery of RIS3 strategy. Adopt a wide agenda of engagement that mobilises the institution to address the challenges and opportunities in the region, whether economic, social, cultural or environmental and identify key capabilities that can add value to the RIS3 process. Map the institution's regional/external links in teaching and learning, RDI and service. Conduct a self-evaluation of capacity to respond to regional and local needs and RIS3.
- Include regional engagement in the core missions of teaching, research and service and use RIS3 to achieve focus for actions. Monitor, evaluate and improve activities in this area to share good practice within the institution and benchmark with other institutions and regions.
- Review recruiting, hiring and reward systems to emphasise quality, relevance, impact and regional engagement. Make available appropriate career and financial incentives to encourage and reward staff engaged in local and regional development and RIS3. Develop their communication skills and build relationships and a culture of receptivity to ideas/initiatives emanating from external sources. Knowledge needs to flow in both directions.
- Stimulate institutional reform based on ICTs, i.e. implementing Digital Science and Digital Learning models and participating in digital economy development (e.g. Open Innovation, Digital Entrepreneurship, start-ups, clusters) at regional and global level. Investment in ICT infrastructures and virtual learning environments.
- Participate in the new Horizon 2020 instruments for building capacity, e.g. ERA Chairs, Teaming/Twinning.
- Develop institutional strategies (University, RO) for capacity building and retaining and attracting talents, including a strategic decision for equal remuneration of all researchers and experts in the EU area who are involved in European programmes producing "European Added Value".
- Support the implementation of "virtual mobility" at institutional level as a main instrument to reverse the 'brain-drain'.
- Participate in Grand Coalitions for overcoming the e-Skills gap in Europe.
- Develop senior management teams to deliver an institutional response expected by external stakeholders. Develop a management structure or capacity to support external engagement and RIS3. Invest in developing the skills of people that create and maintain links between the institution and other stakeholders.
- Provide education and training opportunities aligned to business growth to strengthen the absorptive capacity within the regional industry including SMEs and to develop general competencies to help people acquire LLL skills and adjust to rapid changes in the labour market.
- Engage in early stage interactions, for example by initiating collaborative R&D, and facilitating cluster development in the fields relevant to the region.
- Facilitate greater access to publicly funded innovation infrastructure, people and expertise, for example with the help of staff mobility schemes.
- Facilitate access to globalised knowledge networks and supply chains through collaborative networks and link them to RIS3 process.
- Invest in regional capacity building, for example by hosting or participating in joint seminars, conferences with business, local governments and civil society.

Annex I List of Recognised European Technology Platforms (ETPS)

ACARE	Advisory Council for Aviation Research and Innovation in Europe
ALICE	Logistics
ARTEMIS	Association for R&D actors in Embedded Systems
EATIP	European Aquaculture Technology and Innovation Platform
EBTP	European Biofuels Technology Platform
ECTP	European Construction Technology Platform
ENIAC	Nanoelectronics
EPoSS	Smart Systems Integration
EU PV TP	European Photovoltaic Technology Platform
ERRAC	European Rail Research Advisory Council
ERTRAC	European Road Transport Research Advisory Council
ESTEP	European Steel Technology Platform
ETP Nanomedicine	Nanomedicine
ETP4HPC	High Performance Computing
EuMaT	Advanced Engineering Materials
EUROP/euRobotics	European Robotics Technology Platform
FABRE	Sustainable Farm Animal Breeding and Reproduction Technology Platform
Food for Life	Knowledge transfer and stimulate competitiveness across the food chain.
Forest Based Sector	Define a vision for the future of the forest-based sector
Future of Textiles	Clothing expert's network of professionals
GAH	Global Animal Health
ISI	Integral Satcom Initiative
Manufuture	Assuring the future of a competitive and sustainable manufacturing in Europe
NEM	Networked and Electronic Media
NESSI	Networked European Software and Services Initiative
Net!Works	Communications networks and services
Photonics 21	Photonics
Plants for the Future	Plants of the future
RHC-Platform	Renewable Heating & Cooling
Smart Grids	European Technology Platform
SMR	Sustainable Mineral Resources
SNETP	Sustainable Nuclear Energy Technology Platform
SusChem	Sustainable Chemistry
TP Organics	Organic food and farming
TPWind	Wind Energy
WssTP	Water supply and sanitation Technology Platform
Waterborne	Together with Maritime Europe Strategic Action
ZEP	Zero Emissions Platform

Cross ETP initiatives

NANOfutures	Sustainable development by nanotechnologies
ETPIS	Industrial Safety

Annex II Abbreviations used

Abbreviations used in the text

CEA	Commissariat à l'énergie atomique et aux énergies alternatives Atomic Energy and Alternative Energies Commission
DAE	Digital Agenda for Europe
DG	Directorate General (European Commission)
EADTU	Europe's institutional network for open and flexible higher education
EARTO	European Association of Research and Technology Organisations
EC	European Commission
EIF	European Investment Fund
ERA	European Research Area
ESF	European Social Fund
ESFRI	European Strategy Forum on Research Infrastructures
ESMU	European Centre for Strategic Management of Universities
ETPS	European Technology Platforms
EU	European Union
EUA	European University Association
EUIMA	Sharing Innovative Practices in University Modernisation
FP7	Framework Programme 7
HEIs	Higher Education Institutions
I3	Integrated Infrastructure Initiative
ICT	Information Communication Technologies
IP	Intellectual Property
JRA	Joint Research Actions
JRC	Joint Research Centre (European Commission)
MOOC	Massive Online Open Courses
NRENS	National Research and Education Networks
PPP	Public-Private Partnerships
R&D	Research and Development
R&I	Research and Innovation
REGPOT	Research Potential (programme of DG Research)
RI	Research Infrastructure
RIS3	Research & Innovation Strategies for Smart Specialisation
RO	Research Organisation
RoK	Regions of Knowledge
RPF	Regional Partner Facility
RSFF	Risk-Sharing Finance Facility
SME	Small Medium Enterprise
TRL	Technology Readiness Levels
VC	Venture Capital

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The development and implementation of smart specialisation strategies involve a number of stakeholders, among which universities and research centres play a key role. Smart specialisation requires them to re-think their mission beyond scientific research with focus on national or international excellence and mobilise their expertise in innovation and regional development.

This report analyses the role of universities and research centres in the development and implementation of smart specialisation strategies and examines their strengths and weaknesses with a view to their contribution to a diversified local innovation and growth process.

While there are still challenges to be overcome, a number of success stories already demonstrate that universities and research centres can develop their capacity to successfully promote the approach of smart specialisation. Strengthening their interactions with companies and building up on their competitive presence and international networks, universities and research centres can position themselves as lead organisations in the process.

The report proposes a number of recommendations for policy makers at EU, national and regional level for facilitating the involvement of universities and research centres in the development and implementation of smart specialisation strategies.

Studies and reports

