



JRC SCIENCE FOR POLICY REPORT

# Factors influencing the potential of European Higher Education Institutions to contribute to innovation and regional development

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## Executive summary

Ensuring Higher Education Institutions (HEIs) contribute to innovation is one of four priorities for action established by the Renewed EU Agenda for Higher Education, which also calls for them to have a broader role in local and regional development (European Commission 2017). While these goals are widely accepted, increasing the regional impact of HEIs is challenging and more complex than policy makers may think, in particular within less developed innovation eco systems. This report analyses the factors that influence the potential of European HEIs to contribute to place based innovation. These factors can be grouped into two main types, although there is interaction between them:

- The supply side – This relates to the outputs of HEIs from teaching, research and other knowledge services. The quality and quantity of these outputs are determined by how HEIs are organised, governed and regulated, which shapes their behaviour as institutions and that of the people who work there. While some of the factors may be local, such as managerial leadership, HEIs are influenced strongly by national regulation and wider trends in the higher education landscape.
- The demand side – This concerns the ability of firms and other institutions to absorb knowledge and human capital generated by HEIs. The greater the level of this absorptive capacity in regions, the higher the potential for HEIs to have an impact on innovation and growth. Increasing this capacity relies much less on higher education policy and more on industrial, enterprise and cohesion policies.

The report has four main parts:

The first frames the subject through a brief review of the policy and academic literature that shows how HEIs have the potential to drive innovation and regional development. This potential varies however not just by the type and mission of an HEI but more importantly by the type of region in which it is located. Consequently, policy interventions also need to be place sensitive.

The second part illustrates the factors by drawing on two sets of case studies conducted in recent years by the JRC, and where relevant draws on data from U-Multirank to expand on the findings. The analysis is structured around four different geographical/institutional levels, namely:

- (i) the individual HEI, analysing how their different missions can have an impact on their host regions;
- (ii) Regional partnerships, whereby university and regional strategies are aligned to better match supply and demand for knowledge and skills, especially in the context of smart specialisation;
- (iii) Internationalisation and interregional cooperation discusses the conflicts and complementarities between the trend towards internationalisation of HE activities and demands to contribute more to regional priorities; and
- (iv) Public policies, incentives and regulations which provide the structures and conditions for HEIs to operate and have an impact regionally.

The third part reports on a recent econometric study on how HEIs impact on local and regional development by comparing the flows of human capital and knowledge from HEIs with firm location. The study shows that universities do positively impact on the economic performance of firms in their regions, but that this impact is dependent on university specialisation.

Finally, part four offers some tentative policy recommendations for higher education systems, multi-level governance, funding instruments, especially the European Structural and Investment Funds, and the need for monitoring at EU level.

# **1 Higher Education Institutions, Innovation and regional development**

## **1.1 Main messages from the academic literature**

There is already a large body of evidence on the role of Higher Education Institutions (HEIs) in local and regional development (Arbo and Benneworth 2006; OECD 2007; Garnsey and Heffernan 2010; Goddard and Kempton 2011). Several interesting observations emerge that deserve consideration from a policy perspective, with some being more related to the supply side and others to regional demand.

Firstly, contributing to regional development is widely considered to be part of the 'third mission' of HEIs; and almost by definition less important than their main missions of teaching and research. This is a major shortcoming: instead of separating their regional role, HEIs would have a greater impact if they more systematically took account of the regional dimension in their research portfolios, educational curricula and external engagement activities more broadly. Furthermore, the impact of their different missions would be greater if they are integrated, in line with the concept of the Knowledge Triangle (OECD 2016). For example, there is evidence that the contribution of research conducted by universities on the innovative potential of firms is strongly mediated through education (Leten et al, 2014).

Secondly, when considering less developed regions and countries in particular, the contribution of HEIs to the development of human and social capital through education and training is likely to have a much greater impact than the production of scientific knowledge alone (Pinto et al 2013). For example, investment in tertiary education is considered a key factor in the growth of the 'Asian Tigers' (Sen 2001). The use of knowledge adds more economic value than its production, and less developed regions are highly disadvantaged because of small populations with higher level skills and few firms able to absorb the knowledge generated by HEIs. Furthermore, scientific knowledge is even more footloose than human capital and is likely to be used by knowledge intensive firms located in other places, providing little added value to the region in which it was produced. Firms tend to take into account scientific impact in their selection of academic partners (Van Looy et al, 2011) and in their search for academic knowledge, firms are less concerned with geographical proximity than with research quality and fit (Fitjar & Rodriguez-Pose, 2011). Therefore, an indiscriminate attempt to increase research 'excellence' in all HEIs is unlikely to benefit Europe's less developed regions, even if it may have positive impacts for certain research intensive universities located in them. On the other hand, when all activities are taken into account, not only research, there is evidence that HEIs do have a positive impact on their host regions, such as the study reported on in section three of this report.

A third observation that flows from these first two is that not all HEIs and their contribution to regional development can be considered and treated in the same way. The functions, objectives and strategies of research universities, technical universities and teaching universities differ (Hewitt-Dundas 2012; Kitagawa et al 2016), and can be influenced by regional demand (Boucher 2003; Sánchez-Barrioluengo 2014). Therefore a more place based approach to higher education is needed. As with innovation policy overall, there is a tendency to imitate successful examples that are often not appropriate in all cases (Tödtling and Trippl 2005; Benneworth, Pinheiro et al. 2016). In relation to HEIs, a prototype is pursued based on academic spin offs from research intensive universities, but this has only shown results in a limited number of advanced regions and universities. Teaching universities and universities in less advantaged regions would benefit from learning from other models.

Finally, while HEIs are being asked to contribute more to local and regional development, they are also trying to internationalise their activities. The trend during recent decades

towards a more globalised world and challenges associated with migration, ageing and increased connectivity through new technologies, has put internationalisation of higher education at the forefront of their concerns. Internationalisation is no longer an option, but at the core of HEIs activities. However, the internationalisation of HE initially understood from collaborative spirit between HEIs has shifted towards competition in an increasingly globalised market and understood as well as the relations between the global and the local spheres (de Wit 2016). A key question that emerges in such a debate is whether internationalisation and regional impact can be reconciled and what are the trade-offs? HEIs confront a number of challenges associated to this dichotomy, especially research intensive universities. Researchers' performance is generally measured by their scientific productivity: publishing in internationally peer reviewed journals, participation in research projects and networks, and the overall institutional performance by their position in international rankings (ARWU, THE, QS, etc). Similarly, in a globalised world HEIs are asked to educate students from abroad or locals to become mobile citizens, able to adapt to different cultural and working contexts. However, brain drain is an increasing concern for EU member states, particularly in EU 13 countries that are investing important resources in educating students but encounter challenges to retain talent (Cavallini et al. 2018).

## **1.2 Policy context**

The European Structural and Investment Funds (ESIF) is the main tool at EU level to increase regional demand for knowledge and skills generated by HEIs. However, in practice many Member States have used the large proportions of the ESIF to fund applied and even basic research at universities and neglected the role of building absorptive capacity in the region. The concept that underpins innovation spending by the ESIF is Smart Specialisation, which is also integrated into elements of centrally managed programmes such as Horizon 2020. Smart specialisation is an approach to knowledge based development that challenges policy makers to identify a limited number of investment priorities. Critically, this process of prioritisation should take place in partnership with stakeholders in the innovation system, especially the entrepreneurial community, since policy makers alone cannot be sure about which 'domains' of knowledge based activities have the most chance of success.

One of the largest sources of knowledge, especially in less developed regions, can be found in HEIs. Smart specialisation provides an opportunity for an alignment of regional strategies with those of local HEIs. This does not mean the specialisation of HEIs along narrow disciplinary lines, but rather the consideration of how their different missions can contribute to the vision and priorities emerging from Smart Specialisation Strategies (S3). Education, research and external engagement can all contribute but depend on close partnerships with regional authorities and inclusion of HEIs in regional governance systems. A JRC survey of regions shows that 80% of respondents think that HEIs were very closely involved in the design of S3 (Vallance et al 2017). However, while this may be the case, a JRC review of all the S3 has shown that the contribution of HEIs has not been considered in depth (Edwards et al 2017). In particular, their role in developing human capital to implement the strategies is rare. They often focus on hi-tech research potential, but this will have little impact without the capabilities to translate it into economic and social value – an argument that is now increasingly being made, including by a group of experts commissioned by DG Research and Innovation to review the S3 (European Commission 2015).

This observation can also be made when analysing the Operational Programmes of the European Structural and Investment Funds (ESIF). Spending under Thematic Objective (TO) 1 on research and innovation is linked to a national or regional S3, which concentrates investments on a limited number of innovation priorities. Whereas the regulations are rather brief in defining an S3, a guide published by the JRC and DG REGIO describes them as 'economic transformation strategies' that integrate a variety of

funding and policy instruments. However, in reality the JRC has observed that implementation of S3 takes place almost exclusively through TO1 in the European Regional Development Fund. While the scope of activities under TO1 can be broad, the S3 and associated investments focus too much on technology, ignoring other factors of innovation related to human capital development that would consider universities in a more comprehensive manner. For example, there is not much evidence that TO 8 on Employment and Labour Mobility or TO 10 on Education and Training are used to implement the strategies. Furthermore, while the Commission has promoted the use of synergies between EU funds, in particular combining the ESIF with Horizon2020, there are only a small number of cases where this has been successful in practice (Özbolat and Harrap 2018). Experience so far points to the need to integrate the ESIF much more systematically, especially those targeted at education, training and skills development. Furthermore, while there has been an effort to find synergies between the ESIF and Horizon2020, albeit with limited results, there is also a large potential to use both the ESIF and Erasmus programme in synergy. For example, alliances formed as part of the European universities initiative<sup>1</sup> are encouraged to become permanent structures supported by both the different institutions of the alliance and through other funding sources.

### **1.3 Inputs from HEIs into the local economy**

HEIs can affect local development through several distinct channels. The recent literature has made a remarkable effort in identifying specific ways in which HEIs can impact the economy. These include:

#### **1.3.1 Higher education and the creation of human capital**

HEIs increase the level of education of the region in which they are located and in this way contribute greatly to the creation of human capital. In other words, HEIs contribute to the increase of the average educational attainment of a population. Although this variable is not synonymous of skills, it is crucial for the process of economic growth. A large and consistent literature has shown a strong positive relation between the level of human capital and the absolute performance and rate of growth of countries, regions, and cities (Glaeser & Sainz, 2004; Rodriguez-Pose & Vilalta-Budi, 2005; Sianesi & Van Reenen, 2003). This impact of higher education on human capital and, through this channel, on productivity and growth, takes place mainly via the educational activities of universities. It is education (that is, teaching and associated activities) that increases the level of knowledge of a large number of people, so that they have a higher productivity when entering the job market and produce positive externalities via learning effects. This suggests that to be effective, regional development strategies and funding need to incorporate education and skills much more closely, for example by extending the scope of TO10 of the ESIF.

What are the specific mechanisms at work? First, workers with higher educational qualifications are able to perform activities with greater complexity, which is an established fact in labour economics. Data on this is therefore systematically collected in official statistics. Graduates occupy positions with the highest levels of autonomy, self-direction and ability to manage complexity. Second, by hiring graduates firms gain access to knowledge that would not be available via other means (e.g. by investing in equipment developed by other companies). In some industries this is simply a precondition for operations. Hiring engineers or science graduates means getting access to entire branches of knowledge that contribute to the creation of value. In other words, there is a strong linkage between human capital and innovation. Third, by hiring graduate staff companies generate internal knowledge spill-overs. Graduate staff

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<sup>1</sup> For more information on the initiative please consult: <https://ec.europa.eu/education/education-in-the-eu/european-education-area/european-universities-initiative>



increases the productivity of non-graduate staff by organizing the work and pushing production towards higher value added activities. Fourth, by hiring graduate staff companies can gain access to knowledge from universities. This is a highly informal process, but effective in many cases. After graduation, students work in companies but keep informal relations with their former professors; very often professors themselves are keen to maintain such contacts with their former students.

### **1.3.2 University research and economic performance**

The linkage between university research and economic performance is well established in the literature (Solarin & Sen, 2016; Karlsson, Warda & Gråsjö, 2013). Universities produce publicly available new knowledge, which advances the frontier of knowledge and open opportunities for technological advancements. University-based research is therefore a source of large positive externalities to the overall economy. Knowledge from university-based research may reach the economy following a variety of pathways that are different from the channels of education of students. A large and consistent literature has stressed the somewhat counterintuitive fact that the impact of (university) research on the economic system has a strong spatial dimension, that is, is localized (Rosenthal, 2008; Boschma, 2005).

### **1.3.3 Academic entrepreneurship**

Among the various pathways through which HEI can affect the local economic performance, a special place is that of entrepreneurship. There are two main pathways: academic entrepreneurship, or the direct creation of new firms by academic staff, and startup creation, or the indirect contribution of universities to the generation of entrepreneurial ideas and opportunities. More recently, a new category has been added, i.e. student entrepreneurship.

### **1.3.4 Cultural and social externalities**

Universities also create a social and cultural climate in which valuable non-university activities find a favourable environment. The presence of a population of young and educated people brings with itself favourable conditions for cultural activities, as well as for entertainment and leisure. This makes the ecosystem more attractive for other highly skilled individuals and generates a dynamic that is conducive to innovation. This effect is at the core of the literature that has been developed around the popular notion of creative class.

### **1.3.5 University Expenditures**

Universities trigger additional demand effects upon the local economy, due to the additional expenditure of the student population in the territory, in terms of accommodation, food, transport, sport and leisure activities. To this student-based effect it should be added the expenditure of the national or regional government that is channelled to the university, for example for the payroll of academic and non-academic staff.

## **1.4 Demand conditioning the impact of HEI inputs**

Analysts of economics and innovation policy have shown that the impact of knowledge and skills including those provided by HEIs is largely determined by the scale of their demand within the economy, a theme that is taken up specifically by those analysing regional development.

### **1.4.1 Absorptive capacity of firms**

Firms vary in their ability to understand, process and use knowledge to innovate (Marques et al 2019). This ability can depend on their size, since larger firms have higher levels of financial and human resources, as well as the complexity, type and newness of knowledge. For instance, firms with higher levels of spending on R&D activities are also more likely to be interested and able to capitalise on knowledge produced by universities. The overall absorptive capacity in a region therefore depends on the number and type of firms. Those most able to absorb knowledge are usually based in more advanced core cities, making it more difficult for universities to have an impact on innovation in less developed regions (Bonaccorsi 2016).

### **1.4.2 Regional innovation systems**

The ability of individual actors to absorb knowledge and innovate is enhanced when there are high levels of cooperation between them as part of a 'regional innovation system'. HEIs and firms are not the only actors in such systems, which are also shaped by the role of development agencies, local regulations and planning bodies, intermediaries such as technology transfer offices, science parks, incubators and other 'Knowledge Intensive Business Services'. They are also shaped, crucially by levels of entrepreneurship, demographics, culture and the ability to attract and retain creative talents. In fact some of the 'softer' and less formal factors make the difference for knowledge transmission, especially when it is not codified, but of a more tacit nature.

### **1.4.3 Role of government and public procurement**

Governments have a role in strengthening regional innovation systems, and therefore indirectly building demand for knowledge. This can be through knowledge brokering services, investing in education and skills, or creating public spaces for interaction. They also have a role through financial schemes such as innovation vouchers that provide firms with the resources to use HEIs and other knowledge providers (although these schemes need to be monitored carefully to ensure that firms that need such support receive it). Finally, governments can directly increase demand through innovative public procurement that uses the knowledge developed at HEIs.

## 2 Case study analysis

This second part of the report analyses two sets of case studies undertaken by the JRC related to the regional role of HEIs. One set from the Regional Innovation Impact Assessment (RIIA) Framework project analyses the role of 25 individual HEIs across different missions of education, research, knowledge transfer and development of entrepreneurship; the other from the Higher Education for Smart Specialisation Project (HESS), analyses how regional authorities have engaged with HEIs, providing a picture of the regional context in which HEIs may have an impact. The four main themes that are covered are:

- The level of the individual HEI, analysing how their different missions can have an impact on their host regions
- Regional partnerships, whereby university and regional strategies are aligned to better match supply and demand for knowledge and skills, especially in the context of smart specialisation;
- Internationalisation and interregional cooperation discusses the conflicts and complementarities between the trend towards internationalisation of HE activities and demands to contribute more to regional priorities.
- Public policies, incentives and regulations which provide the structures and conditions for HEIs to operate and have an impact regionally.

**Figure 1 Mapping case studies: Business R&D investments and university-industry copublications**

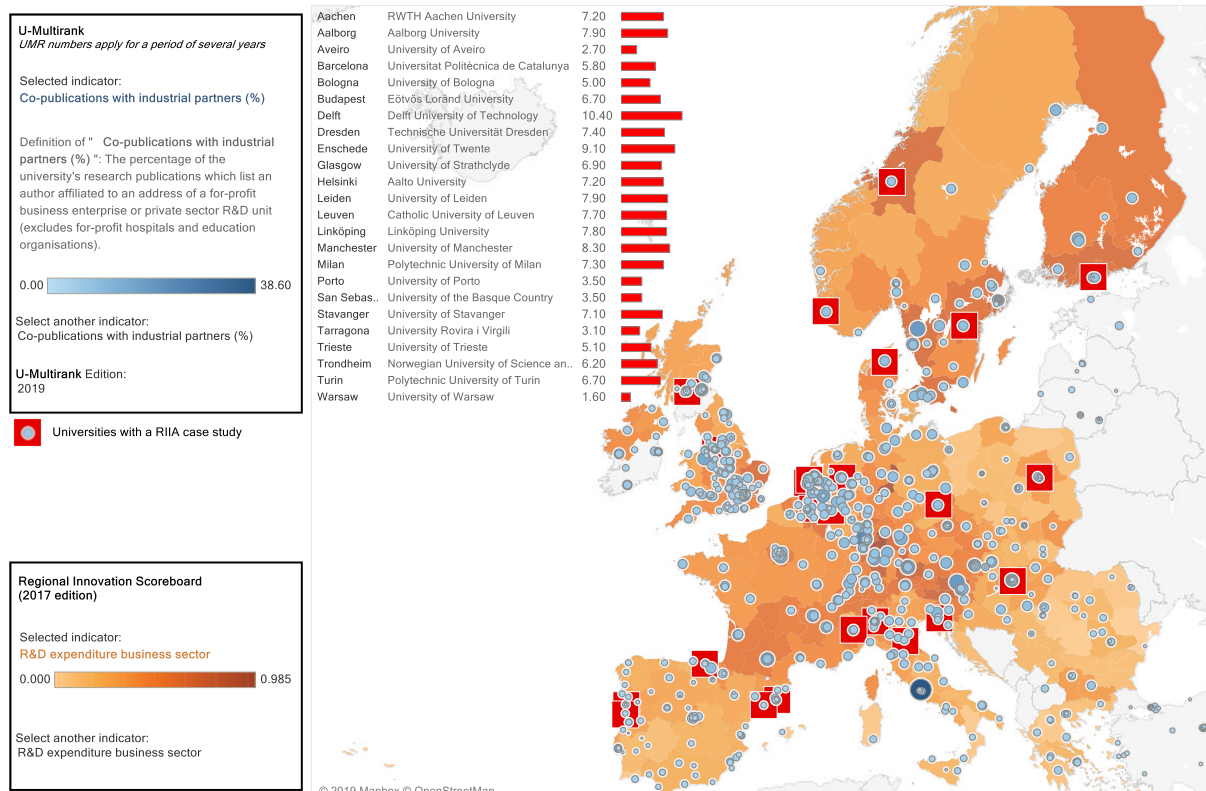


Figure 1 introduces the universities<sup>2</sup> studied showing their geographical spread in the European Union, capitalising on a few selected indicators from U-Multirank ([www.umultirank.org](http://www.umultirank.org)). The case studies have been selected to represent not only different higher education and regional innovation ecosystems, but also different types of

<sup>2</sup> Not all universities included in HESS case studies feature in U-Multirank.

universities – realising the aforementioned differences in the nature and mission of research universities, technical universities, teaching universities. The extent to which universities focus primarily at operating at a global, European, national or regional level is another distinctive dimension though some of Europe's leading universities manage to be active at all these geographical levels simultaneously. The results for these indicators are mapped in the figures below for the HEIs involved in the RIIA project and those located within the HESS case studies (although not all feature in UMR). We then discuss the ways in which the best performing HEIs have scored highly in these indicators.

## **2.1 Organisation and performance of individual HEIs**

This section focuses on the 25 HEIs involved in the RIIA project and reports on activities that contribute to regional impact. Some of these activities are associated with indicators found in U-Multirank (UMR), especially those related to regional engagement.

### **2.1.1 Attraction and retention of talent**

The attraction of talent is among the core objectives of HEIs: both students and researchers help reinforce and enrich their academic community, improve their visibility and position in the world, and improve their research and teaching networks with highly skilled individuals.

Regions compete to retain and attract talent, being increasingly aware of the importance of human capital to create growth. There is clear evidence of the influence of the socio-economic conditions of a region and its brain drain/gain dynamic, with dynamic regions being the ones with structural migration inflows of talented young people (Cavallini et al. 2018). This can be seen in the UMR data for graduate retention rates (bachelor level) of the RIIA case studies located in more and less developed regions: HEIs in comparatively less developed regions have lower retention rates such as the University of Warsaw at 29% and the University of Aveiro at 31%, compared to those in comparatively more developed regions such as the University of the Basque Country at 86% or University Rovira i Virgili at 88%.

Equally, attracting international students is beneficial for a region. Those universities such as Aalto that has more than doubled the share of international students over the last seven years (from 8.1 % in 2010 to 14.6 % in 2017 according UMR 2017 data) help regional firms to source talent with recognised qualifications that are already located nearby. Some could also remain and start running a business as for instance Sheen Xi Hu, a former student of EIT from China who after graduation co-founded and runs MatchX.io in Germany. The absorptive capacity of a region is a key factor in retaining students e.g. Eindhoven University and the high tech Brainport region in the south of the Netherlands. However, adequate immigration policies allowing foreign students to take up employment during studies or more importantly after graduation is a precondition for success of this strategy. Some countries as e.g. the Netherlands introduced favourable tax treatments to attract skilled foreign students (Napierala et al., forthcoming).

Some regions are developing initiatives to connect the international talent to the regional fabric, ensuring that the R&I system benefits from the knowledge and networks they can bring. Le Studium in Centre-Val de Loire (FR) is attracting international researchers to the region connecting them to the S3 priority areas and the “ARD 2020 – Ambition Research Development 2020” regional R&D clusters (Arregui-Pabollet et al, 2018).

Alliances between universities in the same region are not common however, since they usually perceive each other as competitors. We can observe that student mobility involves only a very small proportion of the overall student population, ranging from 0.05 to 0.16 (UMR 2019), therefore showing that still only a privileged minority is able to benefit from the internationalisation of higher education institutions. But at many HEIs an increasing trend in internationalisation is observed e.g. at Aalto University in 2010 only 6

% of the University's professors were of foreign nationality, whereas in 2017 this proportion had increased to 22% (Napierala et al., forthcoming). According to the data there seems to be a correlation between those HEIs having international doctorate degrees and higher international mobility of students, probably meaning that more international institutions are able to attract more international students.

### **2.1.2 Education and human capital**

The contribution of HEIs to human capital within the region they are located varies considerably depending on the type of institution: Traditional universities generally perceive their role as producing highly educated, rounded graduates that may be employed anywhere in the world, whereas Universities of Applied Sciences and other technically based HEIs may have a stronger relationship with local firms and design courses specifically to match their human resource requirements. However, the situation is not as clear as this, with an increasing blurring of boundaries between levels of education and types of institutions (Hazelkorn and Edwards 2019). Furthermore, compared with research and innovation activities, the contribution of HEIs to regional development through provision of human capital is harder to measure (Bonaccorsi 2016).

In the HESS case study of Navarra businesses reported the need for advanced horizontal competences (e.g. entrepreneurship education) rather than specific knowledge (Campillo et al 2017), suggesting that modifying curricula according to regional specialisation is not necessary or even counter-productive. However, at the same time employers welcomed the decision to fund industrial doctorates related to Navarra's smart specialisation priorities, which seems to show that for higher level qualifications specialisation is best introduced at postgraduate level. Yet experience of working in regionally based firms and institutions does not necessarily involve a change in the academic part of curricula. According to UMR, Navarra has one of the highest levels of student internships in the region (especially at the public university) and the HESS case study confirms the strategy of the region to boost 'Dual degrees' that combine higher education and vocational training.

The University of Trieste, one of the RIIA case studies shows a similar approach to Navarra. On the one hand the University is investing heavily in entrepreneurship education, having recently launched a co-working space with local entrepreneurs while using innovative methods to develop entrepreneurial skills among students. On the other hand, courses have been specifically designed to respond to needs of the local economy, including the S3 priorities of Naval Engineering and the Bioeconomy, with input from local firms. Further specialisation however comes at postgraduate level, with the University funding 10-12 PhD programmes where students undertake an internship within the region, and for the first time in 2016 it selected 22 post-docs related to the region's S3 priorities, funded by the regional governments' "HEaD (Higher Education and Development)" programme.

### **2.1.3 Regional cooperation in research and innovation**

Spatial proximity and agglomeration are important factors for knowledge diffusion (Sabel 1989; Porter 1998) even in the context of a globalised economy. Personal interactions are the main sources for knowledge spillovers in local economies, which are channelled through the education of students, contract research, innovation related services or joint R&I projects (Fritsch and Schwirt 1999).

Higher education institutions are key players in the regional innovation system, therefore they are an important policy instrument to stimulate regional development (Fritsch and Schwirten, 1999), through the cooperation they establish both within and outside the region. However, research has shown the preference of public research institutions to cooperate interregionally and internationally, and yet SMEs which drive economic growth are more dependent on the regional environment and relevant knowledge sources (Koschatzky and Sternberg 2000).

The case study from Navarra has shown that universities can respond to global endeavours through stronger local engagement, being one of the most decisive assets of the region, contributing to provide and enhance the human capital of the territory and being a research and knowledge reference for companies in the region (Campillo et al. 2017). In the region, the Public University of Navarra is clearly more regionally oriented, having developed strong ties with industry with 49,9% of strategic research partnerships in the region (16.2% University of Navarra). The University of Navarra on the contrary is more internationally oriented university with 34.11% and 6.81% international academic staff (12.43% and 0.89% of the Public University of Navarra) (UMR 2018).

Other case studies constitute important showcases on the capacity of HEIs to connect the region to global players and networks or joining EU alliances and networks to help strengthen their innovation capacities in three HEIs missions, such as Aalto and Aalborg universities. In this regard, both show good performance in international joint publications with 62.7% and 57.7% respectively (UMR 2019). The participation in the EIT Health and Food hubs by Kaunas University of Technology has opened important opportunities for start-ups, with considerable numbers of spin offs (12.91) and an important number of students placed in internships within the region (93.3%) (UMR 2019).

#### **2.1.4 Entrepreneurship**

HEIs have been encouraged to become more entrepreneurial, although what this means can be interpreted in many ways. Overall, HEIs have been forced to be more entrepreneurial in terms of income generation, since public funding for teaching and research have declined, partly due to increasing student numbers and partly due to budget constraints brought upon by the great recession of 2008-2011. Therefore if we compare UMR data in 2018 and 2019 we can observe that from the 18 RIIA case studies where data is available for both years, income from private sources has increased in 15 (often substantially) and decreased in just three, as shown in the table 1 below.

**Table 1 University income from private sources, spin offs and patents awarded**

Institution Name	Income from private sources			Spin offs			Patents awarded (size-normalised)		
	2018	2019	Trend	2018	2019	Trend	2018	2019	Trend
Aalborg University	1.03	0			0.8		0.64	0.63	-
Aalto University	4.6	13.87	+	0.02	0		1.06	1.07	+
Angel Kanchev University of Ruse	8.15	1.75	-	1.68	9.74	+	0	0	
Catholic University of Leuven		0			0		5.95	5.97	+
Delft University of Technology	14.03	0			15.78		3.46	3.37	-
Eötvös Loránd University	0.52	3.18	+	3.85	0.69	-	0	0	
Kaunas University of Technology	15.95	7.35	-	8.58	12.59	+	0	0.2	
Linköping University		28.87			0		0	0	
Norwegian University of Science and Technology	2.83	13.58	+	14.77	2.25	-	0.54	0.53	-
Polytechnic University of Milan	4.17	28.23	+	32.31	4.76	-	2.4	2.3	-
Polytechnic University of Turin	1.73	25.12	+	23.89	1.5	-	1.26	1.23	-
RWTH Aachen University	27.53	96.23	+	105.6	29.49	-	1.47	1.46	-
Technische Universität Dresden		0			0		2.66	2.67	+
Universitat Politècnica de Catalunya	2.31	18.05	+	20.93	2.07	-	1.08	1.21	+
University of Aveiro	13.39	8.53	-	9.68	11.22	+	0.29	0.29	0
University of Bologna	0.49	0		19.82	0		0.4	0.45	+
University of Manchester	1.86	56.35	+	74.28	0.41	-	1.29	1.27	-
University of Porto	0.95	0	+	20.96	0		0.55	0.67	+
University of Stavanger	2.67	3.07	+	3.94	1.5	-	0.47	0.53	+
University of Strathclyde	3.55	63.11	+	15.86	2.7	-	1.6	1.58	-
University of the Basque Country	2.81	4.75	+	5.07	4.32	-	0.57	0.61	+
University of Trieste	3.01	8.41	+	10.85	2.53	-	1.02	1.03	+
University of Twente	7.13	35.39	+	43.83	5.57	-	3.33	3.23	-
University of Warsaw	1.95	0		3.52	1.11	-	0.25	0.25	0
University Rovira i Virgili	1.39	11.36	+	11.05	3.51	-	0.14	0.15	+

Entrepreneurial universities have often been considered as those that promote spin off companies or work with industry to earn money through patenting research results. However, it has been noted that the benefits of these activities for HEI budgets are relatively small in most cases, with only a handful of institutions making large commercial profits (Marques et al 2019). It is interesting to note that for the RIIA case studies with data available in 2018 and 2019 only three have increased the number of spin offs while 13 saw a reduction, in many cases substantially. For patents awarded the picture is more balanced, with 10 recording an increase and nine a reduction.

We can only speculate on the sources of private income which has been increasing, but it is unlikely to be spin offs and patenting, with HEIs having to be more entrepreneurial in attracting funding and students, including professional development. Furthermore, commercial activities pursued in the original concept of the entrepreneurial university are likely to have little positive impact for the wider region (Goddard et al. 2016). Therefore while entrepreneurship is an overall positive attribute for HEIs, in terms of regional development a wider definition is more appropriate, such as the one offered by Gibb et al (2014):

"Entrepreneurial higher education institutions are designed to empower staff and students to demonstrate enterprise, innovation and creativity in research, teaching and pursuit and use of knowledge across boundaries. They contribute effectively to the enhancement of learning in a societal environment characterised by high levels of uncertainty and complexity and they are dedicated to creating public value via a process of open engagement, mutual learning, discovery and exchange with all stakeholders in society - local, national and international."

Other concepts for HEIs include the 'Engaged' and 'Civic' university (Goddard et al. 2016), which are more similar to the above definition of an entrepreneurial university,

and importantly are more focused on the regional dimension. However, it is more difficult to capture the activities through indicators that could be used in the UMR.

## **2.2 Regional institutions and partnerships**

The analysis above shows examples of how individual HEIs have modified their core missions to have a greater impact in their regions. However, the impact can be much greater if their actions are coordinated according to an overall innovation strategy, including other actors within regional ecosystem – often referred to as the quadruple helix to refer to partnerships between public authorities, firms, civil society and HEIs. While these partnerships are not easy to build due to difference in working methods and culture between the different actors, our two sets of case studies have shown examples of where good progress has been made.

### **2.2.1 Design and implementation of regional strategies**

HEIs have been widely involved in the design and implementation of Smart Specialisation Strategies (S3), which are the latest generation of regional innovation strategies in Europe and which are supported largely by the Cohesion Policy. What distinguishes S3 from other types of RIS is that specific priorities are established and monitored to develop 'critical mass' and thus competitiveness. This has been done through two main methods, in both of which HEIs have played a role, namely analysis and consultation. A first step has typically been to analyse the regional economy and its potential for innovation in different sectors using indicators such as the intensity of R&I activities. In many cases economics and business schools have been involved in this exercise, which was the case in the Algarve (Portugal) and North East Romania, whereas other regions such as Navarra (Spain) involved researchers from universities in neighbouring Basque Country. More important has been the consultation of HEIs by regional authorities on their strengths and capabilities to contribute to the strategy. For example in Lubelskie (Poland) an Innovation Council was established in 2012 to update its previous RIS and introduce the elements of S3. All the region's HEIs were active members of this council. It is important to note however that the most coherent S3 priorities are those that have been developed with input from firms and other users of innovation. In fact, in some cases the self-interest of HEIs in terms of their own existing specialisation has dominated to the detriment of the wider economic system.

According to the S3 method the best form of consultation is an ongoing 'Entrepreneurial Process of Discovery' (EDP) whereby innovation actors send messages to the public authorities about which areas should be prioritised. These areas may not be traditional sectors but emerging areas of innovation that cross sectoral boundaries, or the process may highlight specific niche activities within sectors in which the region can become more competitive through innovation. This process can happen naturally in more advanced innovation eco system, which can be observed in the Navarra case study. Here the university strengths naturally fit into regional priorities because of decades of cooperation with business which has been competitive in areas such as bio-medicine and mechatronics. However, in other regions such as North East Romania where the regional innovation system is very weak, interaction between universities, public authorities and industry has been built from scratch. The first step was the establishment of a Regional Development Agency which developed an S3 voluntarily (formerly it was the responsibility of the central state to develop a national strategy). The RDA became one of the most active in Romania and organised focus groups with business and local HEIs to develop priority areas. Similar 'hubs' or 'platforms' involve HEIs in the different Portuguese regions in the HESS case study.

The process of implementing S3 should be monitored to make sure the balance between knowledge generation and knowledge demand is maintained and that different actors from the quadruple helix are involved – and if necessary the weaker element of the EDP



should be strengthened. An example of this can be seen in the Lubelskie HESS case study which contrasted two regional strengths: bioeconomy and photonics. Bioeconomy was chosen as a priority when the S3 was designed because of the capacities in all the region's HEIs. However, cooperation with local industry has been weak because of the low level of entrepreneurial activity in the private sector; where cooperation has occurred it is with firms from other parts of Poland. Not all cooperation has to be local, but if bioeconomy is to become an economic strength the entrepreneurial fabric has to be developed and leadership taken (perhaps by the regional authority to begin with) to bring together the local firms that are active in this area to incentivise cooperation with the HEIs. In contrast, photonics was not specifically targeted by the S3, but has become an emerging specialisation because of the success of several SMEs which later led to cooperation with one of the region's universities. However, greater involvement of HEIs to produce knowledge and human capital would strengthen this emerging specialisation, as would their role in creating international links.

### **2.2.2 Institutions for knowledge management**

Studies have shown a link between the quantity and quality of institutions and regional development (Rodríguez-Pose 2013; Morgan 1997) or what has been described as 'institutional thickness' (Amin 1994). The importance of regional institutions for innovation and smart specialisation has been shown with regard to HEIs (Kempton et al. 2013; Bonnacorsi et al 2019), governments (Rodríguez-Pose and Di Cataldo 2015) and business clusters (Ketels 2012). In order to match knowledge and skills with demand, there is a need for 'boundary spanners' (Lundberg 2013), whether these are individuals in established institutions (such as knowledge transfer offices of HEIs) or separate institutions that can be called knowledge brokers. In our case studies we can identify examples of such boundary spanners that have the potential to increase the impact of HEIs in the regions where they are located. The contribution of HEIs to S3 would therefore be greater if HEIs had support staff able to bridge their own strategies with S3 and regional actors.

One type of institution to emerge is the association of different HEIs, to try and develop a regional higher education 'system'. This cooperation can be ad hoc or more formal. For example, in Centre Val de Loire there is now a higher education coordination body called COMUE (Community of Universities and Education Institutions) with its own governance mechanism. COMUE is a key partner for the regional government in its development of a Regional Plan for Higher Education, Research and Innovation, a recent requirement for all French regions. A recommendation from the HESS case study was to expand the governance of COMUE to include companies, which would allow great dialogue on future skills and knowledge needs (Arregui-Pabollet et al, 2018). In North East Romania there was no cooperation between the regional HEIs but this has started to be built with the HESS action research, following a leadership workshop with international experts in December 2015. However, cooperation can be difficult even in more developed regions such as Navarra where parallel structures for biomedicine have been built in the public university despite existing internationally recognised expertise in its private university.

In the case studies we can find institutions that aim to boost cooperation between HEIs and business. In terms of dialogue around regional human capital needs in Centre Val de Loire there are so called Campus de Metiers but there is no formal link to the region's smart specialisation strategy (a recommendation from the HESS action research). For knowledge transfer various structures exist, the most notable being Aditech Corporation in Navarra. Created in 2013, the Aditech governing board is composed of regional firms, the two universities, technological centres and the regional government. Initially created to group together the main research bodies its mission has been expanded to form a knowledge and innovation community that integrates actors in the knowledge triangle of education, science and business. It aims to generate value for society through new products based on the latest knowledge, whether through R&D or process innovation. Its activity is focused on four areas that are also priorities for the region's S3: Energy, industry, agro-food and biomedicine. In other less developed regions such as North East

Romania there is a proposal to create a knowledge brokering service on behalf of all the region's universities that would engage with business and suggest the most appropriate academic partners. The institution would be funded by the European Regional Development Fund and be modelled on successful initiatives from other regions such as Knowledge House in the North East of England.

## **2.3 Internationalisation and Interregional cooperation**

### **2.3.1 Tension between international and local objectives**

The trend during recent decades towards a more globalised world, with challenges associated with migration, population ageing and increased connectivity through new technologies, has put internationalisation of higher education (IoHE) at the forefront of HEIs concerns. Internationalisation is no longer an option, but at the core of HEIs activities. However, a paradox between internationalisation as a collaborative endeavour and competition emerges (de Wit 2016), as the initial impetus towards cooperation has shifted towards competition in the global HEIs market, competing to excel in international rankings, attract international students or additional funding sources and donors.

The EU Erasmus programme initiated in the 80s has significantly supported the internationalisation of the higher education system and the creation of the EU higher education space, promoting mobility of students, researchers and staff, but also cooperation between HEIs in innovation in education. The programme has widely promoted cooperation between HEIs and businesses.

The concept of internationalisation is however evolving, being understood beyond relations between nations and covering as well interactions between global and local spheres (de Wit 2013). In addition, policy makers are asking HEIs to become more engaged in their closer community and contribute to local development and economic growth (European Commission 2017), in a context of funding pressures and stronger public accountability demands. A key question emerges in such a debate, can HEIs internationalisation and contribution to local growth be reconciled and which are the trade-offs?

HEIs confront a number of challenges associated to this dichotomy. Researchers performance is generally measured by their scientific productivity publishing in internationally peer reviewed journals, participation in research projects and networks, and the overall institutional performance by their position in international rankings. In addition, in a globalised world context HE are asked to educate students either coming from abroad or locals to become mobile citizens, able to adapt to different cultural and working contexts.

IoHE is usually associated with the positive effects of collaboration in transnational research and the benefits for students being exposed to different education contexts. However, the challenges associated with internationalisation of HEIs are sometimes neglected.

### **2.3.2 Dichotomy of internationalisation versus regional engagement**

Internationalisation remains an increasing focus for HEIs, since it is becoming more important to have a high international ranking, top publications with leading co-authors and compete for international sources of funding. However, the HESS case studies underline that regional engagement is often perceived as coming at the cost of internationalisation. We may think that those HEIs which are more dependent on regional funding would have stronger incentives to contribute to regional priorities. Yet the UMR data shows that the amount of public funding from the regional level is not necessarily correlated with higher performance in regional engagement indicators. For example, the

Public University of Navarra receives 51.33% of its funding from regional sources, compared to 28.92% for the University of Trieste. Yet Navarra has a low score for regional joint publications (8.8), compared to 47.9 for Trieste. On the other hand, Navarra is among the universities with the highest number of student internships with the region (UMR 2016). Yet the perceived trade-off between internationalisation and regional engagement is not clearly found in the U-Multirank data; on the contrary many HEIs cases show salient performance in international indicators and at the same time they score high in regional engagement indicators. As an example, some excellent research HEIs with very good international joint publications indicators are performing equally well in regional joint publications or industry co-patents, as shown in the table 2 below.

**Table 2 University: regional engagement and internationalisation**

Institution name	REGIONAL ENGAGEMENT		INTERNATIONALISATION	
	Regional joint publications	Industry co-patents	International doctorate degrees	International joint publications
Universitat Politècnica de Catalunya	31.2	9.7	47.06	53.1
University of Trieste	47.6	5.9	14.32	59.7
Polytechnic University of Turin	25.4	53.7	32.95	47.3
Technische Universität Dresden	24.5	21.7	18.88	55
Catholic University of Leuven	26.8	16.7	39.92	67.3
University of Navarra	22.9	12.5	32.7	47
Public University of Navarre	13.1	16.7	14.57	43.1

Source: Own elaboration with data from UMultirank, 2019

Even though such a trade-off can be contested, the differences in HEIs types and incentives moving institutions to engage regionally should be carefully considered when encouraging stronger HEIs involvement in regional development and S3 (European Commission 2018).

### 2.3.3 HE local partnerships for internationalisation

While the role of HEIs in positioning regions internationally is clear, it is still not harnessed as much as it could be. As an example, Leiden University is characterised by its strong internationalisation, attracting academics and students from all over Europe, ranking among the world's 100 leading universities in several of the major university rankings (THES, Leiden Ranking, ARWU), and also has exceptionally high performance in selected fields like Law, Life Sciences and several arts and humanities disciplines. It is forming a strategic alliance with other leading research universities in the South Holland region: Delft University of Technology (TUD) and Erasmus University Rotterdam (EUR) which offer complementary profiles Delft University of Technology shows an impressive performance in international doctorate degrees (72.65) or patents awarded in absolute numbers (81), much higher than the results for other HEIs (UMR 2019). Like the universities in the table above it combines high levels of international collaboration with a strong regional engagement.

### 2.3.4 Participation in EU funding programmes

The participation in EU funding programmes in support of research and innovation, education or mobility of students and staff has been a central part of the internationalisation strategy of HEIs. The participation in such programmes helps HEIs expand their international networks, strengthen research and innovation excellence, innovation in education and stronger university-business collaboration to better respond to market needs.

There are significant disparities across Member States in the participation of EU funding programmes. The European Research Framework Programmes were created to promote research and innovation excellence and close the innovation gap in the EU. However, participation in the Horizon 2020 programme is highly geographically heterogeneous, especially between EU13 and EU15 member states (Özbolat and Harrap 2018). Even within the same country or region, we find large differences between HEI participation in EU programmes, some having more difficulties in successfully participating and leading projects.

Building on existing international networks and platforms, experience in past framework programmes and entering the sometimes perceived "closed clubs" of EU consortia seems to be important determinants in being successful in EU programme participation (Pontikakis et al, 2018; Protegerou et al, 2010; Lepori et al, 2015; Heller-Schuh et al., 2011; Harrap and Doussineau, 2017; Breschi and Malerba, 2009).

It is observed that some of the analysed HEIs in less developed regions are still relatively well positioned in terms of international publications, such as the University of Warsaw, University of Bari and Salento (UMR 2016), although these regions attract a very small proportion of funding in € per capita from the Horizon 2020 programme, Mazowieckie (6.43) and Puglia (2.75)<sup>3</sup>. Therefore, strengthening the engagement of HEIs in the internationalisation of the regional economy could strongly benefit from the international networks and research excellence of HEIs. However, for this to happen HEIs need more support to apply to programmes such as Horizon 2020, such as through support staff, international networking and capacity building, which could be funded by the ESIF.

### **2.3.5 Positive role of universities in using international knowledge for local development**

The international researchers' networks, projects and infrastructures in which HEIs position and collaborate are indisputably a major asset for regions to internationalise. However, the research collaboration dynamics and incentives are driven by logics and incentives that might be coincident or not with the internationalisation interests of the region.

HEIs research and innovation collaborations might act as leverage with other territorial stakeholders, such as SMEs, clusters or business organisations, which could partner within the same projects. The characteristics and dimensions of EU projects is a good opportunity for such leverage effects on other organisations in the region, which potentially can increase the impact and coherence of the EU research and innovation funds attracted to the region.

The coherence and more structured participation at the regional level could as well have an impact on implementation of Smart Specialisation Strategies, better integrating different parts of the value chain or facilitating closer access to market products. However, a well-connected, coherent, collaborative and mature R&I ecosystem is needed to move the existing capacities in the region to the international sphere.

More importantly, the internationalisation of HEIs can also play an extremely important role in strengthening the identity of EU citizenship, particularly through the mobility of students and staff that experience other cultures, languages and values. These gains become even more important in the current context of "nationalisation as a rising social phenomenon globally" (de Wit 2016) and the disconnection of part of the population with the EU project.

Brain drain is an increasing concern for EU member states, particularly in EU 13 countries that are investing important resources in educating students but encounter major challenges to retain talent (Cavallini et al. 2018). The skills and human capital element has not been sufficiently considered in the definition and implementation of S3 across EU

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<sup>3</sup> Stairway to Excellence R&I Viewer tool: <http://s3platform.jrc.ec.europa.eu/synergies-tool>

regions (Edwards et al. 2017), which could potentially hinder regional economic growth and development of the different S3 priority areas.

## **2.4 Public policies, regulations and incentives**

Governments have a crucial role in shaping the conditions in which HEIs can have a regional impact, including as regulators, funders and strategy developers. There are two main factors in respect of influencing the regional role of HEIs: One is the overall structure of the higher education system which is usually the responsibility of national governments, although in some countries such as Germany and Spain the regional or state level have competences; the other is innovation policy that has become more decentralised over time, especially with the advent of S3, since funding from regional operational programmes has created de facto competences in countries without a formal regional level, such as in Portugal. Another additional role is that of local and regional authorities that help create a physical and cultural environment favourable to innovation, such as improvements in quality of life that attract students and talent, or urban spaces that promote social interaction.

National higher education systems have been designed principally to manage the core missions of education and research, although recently the objective of social and economic impact has been added (the so called third mission). However, in all three cases regulations and policies rarely follow a place based approach. For education, accreditation is driven mainly by nationally defined subject provision which does not take into account regional labour market needs; and research funding is decided by (mostly national) research councils and may or may not fit with regional priorities. Where impact has been introduced, such as in the UK's Research Assessment Framework, the impacts are place neutral, meaning there are no extra points for impacts that have a local or regional dimension. One good example of a place based approach to national funding settlements is the 'Lead Institutions Initiative' in Austria's three year performance contracts with the government. Each HEI has to develop a strategy to increase its regional impact with targets that are monitored.

Our case studies have shown that one of the biggest obstacles to HEIs taking a more proactive role in regional development is the lack of incentives provided to academic staff. Despite an increasing intensity of university-business cooperation and an impact element in some national funding settlements described above, performance appraisals for individual staff members usually do not take into account external engagement. This was shown for example in the HESS case studies where awareness of the regional S3 was only at senior manager level. There are differences however across types of HEI, with universities of applied sciences more likely to reward staff for external engagement than traditional comprehensive universities. A recommendation would be that through the European semester, benchmarks for career and promotion paths are established, in order to learn from systems that incentivise academics to contribute more to regional development.

While national higher education systems may be slow to change, one trend that could encourage HEIs to be more place based is an increase in funding for regional innovation projects, especially by programmes that are managed at regional level. However, these programmes have to be well designed to get the most out of HEIs by understanding both their strengths and constraints. Importantly, a balance needs to be struck between supply and demand of knowledge. This can be shown by contrasting the approach to spending of the European Structural and Innovation Funds in the Lubelskie case study with that of other regions. Poland has decided to spend heavily on the demand side whereby a very high proportion of the innovation spending is on SMEs. HEIs can only be beneficiaries if subcontracted by firms. This works when demand is clearly articulated to HEIs but our case study has shown that this is often not the case and SMEs prefer to work with individual researchers that are not necessarily based in local HEIs. This does not create sustained cooperation at institutional level. Consequently HEIs in Lubelskie have lost interest in the regional operational programme, which they used to benefit from directly in the last programming period. On the other hand our case study in North Central Bulgaria has shown that a new operational programme for research and education will fund innovation projects managed by HEIs as sole beneficiaries without the

need of an industrial partner. The most appropriate solution that we have observed in Centre Val de Loire and Portugal are innovation projects that require consortia of firms and knowledge suppliers which are equal partners rather than subcontractors.

### **3 A quantitative analysis of the impact of Higher Education Institutions on the economic performance of firms in their region**

This part is based on a report that is the result of a collaboration between the JRC and external academics (Bonaccorsi et al 2019).<sup>4</sup> This summary consists of a description of the construction of an original dataset in which information from different sources is put together. This is used to measure the impact that HEIs have on the outcome of firms that are located close (less than 100 Km) to them.

#### **3.1 Enriching ETER to allow for analysis of regional impact of universities**

Most of the evidence on the relationship between HEI and local development are based on aggregate macroeconomic analyses at country and regional level. Here the impact of human capital formation and knowledge spill-overs is investigated by taking the individual HEI as the unit of analysis. The authors examine the extent to which HEIs generate, directly or indirectly, positive impacts on all firms located in their surroundings. To this end various datasets are integrated.

The first step is to measure how many graduates (from bachelor up to doctoral), and academic staff attend or are employed at each individual institution, by field of education, in the year 2015. For this we use a census of all HEIs in Europe, called ETER. This dataset is combined with scientific publications from the Scopus database in order to measure how many publications are produced at each institution and how many citations they receive, by scientific discipline, in the time interval 2011-2015.

The combination of these two sources yields a more complete picture of the sources of human capital at tertiary level and of research outputs. This data is geo-referenced at NUTS 2 and NUTS 3 level. This provides a rich representation of the flows that are generated by the higher education sector at local and regional level.

The objective of the analysis is to assess whether these flows have an impact on those firms that are located close to HEIs. For this all firms included in the ORBIS database across almost all European countries are geo-referenced. The next step is to calculate the geographic distance, using GIS coordinates, between firms and HEIs and define a radial structure, from 10km to 100km distance.

The model is completed with a large number of control variables from Eurostat, OECD and other sources. Various regression models have been used to analyse the impact of universities on the economic performance of firms in their vicinity.

#### **3.2 Universities are shown to impact the economic performance of firms in their regions, however this impact is dependent on university specialisation**

The covariation of firms' performance and activities carried out by higher education institutions on firms is confirmed beyond any reasonable doubt. After controlling for many structural factors (industry, size of the firm, legal form) and location factors (country, regions) it appears that HEIs produce outputs, in terms of human capital (graduates) and knowledge (publications), that in the large majority of cases positively influence firms located in the neighbourhood. This effect is even more remarkable since it comes from flows (yearly production of graduates and publications), that is, from relatively short term phenomena, not from established, and slowly created stocks.

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<sup>4</sup> This study is provided as a separate contribution to this deliverable.



At the same time, the impact is strongly dependent on specific disciplines, or bases of knowledge, with Engineering and Business showing the largest impact, Basic Sciences and Medicine mixed results, and Social Sciences and Humanities a positive impact only in joint models of human capital and research. This is another important result, which confirms the notion that knowledge is heterogeneous and follows different pathways to become productive in the economic system. At the same time, this finding sheds light on the necessity to consider a variety of impact models. Assuming an impact model for which the only dependent variables to be considered are those that refer to firms (whatever the dimension of performance) can be misleading.

## **4 Conclusions and policy implications**

As explained in the introduction, there are now numerous examples of good practice on how individual HEIs are making an impact in the regions where they are located, and a rich academic literature has emerged to analyse this. However, it is much more difficult to design policy instruments, especially at EU level in order to deliver on the Renewed Agenda for Higher Education and ensure that HEIs contribute to innovation and regional development. In order to try and break down the different and overlapping factors that influence how HEIs can have an impact, we have analysed both the supply and demand sides to the question. This leads to the following conclusions and policy implications:

### **4.1 Build demand and incentivise HEIs through the European Structural and Investment Funds**

A potential approach for EU, national or regional governmental actors for more directly incentivising HEIs to contribute more to their regional innovation ecosystems is outlined as part of the RIIA framework (Jonkers et al, 2018). This framework for ex post assessment could form a basis for tying additional institutional support to universities' innovation performance either through innovation performance based funding or through performance contracts between (regional) governments and a region's universities. The incentivising of HEIs would have a higher potential to be fruitful if it is in line with regional demand and absorptive capacity.

So far, from an EU perspective, there has been more scope in intervening on the demand side rather than attempts to directly change the behaviour of HEIs. This is partly because the organisation and regulation of higher education is a Member State competence, although benchmarking is possible through the European Semester. However, it is also because increasing supply will have little effect without strengthening the demand for the innovation role of HEIs, especially in Europe's less developed regions. Fortunately the EU does have scope to intervene, by using the Operational Programmes of the ESIF to help build more knowledge intensive firms in all types of sectors, which in turn will increase the demand for collaboration with local HEIs, whether on skills needs or knowledge transfer.

### **4.2 Multi-level governance of Smart Specialisation Strategies**

Channelling the ESIF to address specific policy challenges such as the one analysed in this paper is however notoriously difficult due to their co-managed nature and focus on spending allocations. The advent of Smart Specialisation Strategies is the best opportunity the EU has to ensure the ESIF are spent strategically to achieve policy objectives. This is because S3 are by nature multi-level, both in a vertical and horizontal sense. Firstly, S3 take into account EU, national and regional levels, all of which have different policy levers. The EU ensures that the S3 meet the criteria of the regulatory 'ex-ante conditionality', called 'enabling condition' in the proposals for 2021 - 2027. Member States and regions are currently reviewing their S3 framework which is an opportunity to position higher education institutions as key partners for public authorities. The focus of the new enabling condition is on good governance and monitoring which can help broaden the role of HEIs beyond their traditional missions of research and education, to include a regional dimension to all their activities through structured and permanent dialogue with public authorities. Secondly, in order to be effective S3 cut across government responsibilities, combining research, innovation, industrial and education policies. This type of integrated strategic approach is needed to reconcile supply and demand factors analysed in this paper.

## **5 Improve monitoring at EU level**

In this report we used UMR to analyse how the case study HEIs performed in terms of regional engagement. A broader regional level monitoring tool that is not necessarily comprehensive in comparing all European HEIs but creates proxies for the interaction of HEIs with their regional environments would have significant advantages. It could be used by Member States to compare their innovation eco-system and by the European Commission in its negotiations on ESIF spending (see also discussion RI2A framework above). It would rely on the cooperation of HEIs and public authorities and would be half way between the case study approach used so far by the JRC and the quantitative tool of UMR developed for DG EAC.

It may, for example, be possible to integrate some of the raw data used for constructing the university level indicators in UMR for such a regional level monitoring tool. For example if one takes the example of South Holland provided in the body text, it may be possible to combine the university level data from Leiden, Rotterdam and Delft University. In order to get a complete insight in the contribution of the regional level Higher Education System to its regional innovation ecosystem this would then need to be complemented with indicators on the eight universities of applied science that are not included in U-Multirank. A combination of university level data and data on the regional higher education system as a whole may also help to address some of the potential problems of attribution when assessing the impact of a university on its regional innovation ecosystem.

Such a data collection exercise would rely on the cooperation of HEIs and public authorities and could be half way between the case study approach used so far by the JRC and the quantitative tools of UMR.

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