

EURAXIND

Literature review of institutional practice in promoting the intersectoral mobility of researchers

September 2016

Work Package 2
Deliverable 2.1

EURAXIND project
Re-submission Date: 19.06.2017



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Introduction

This report summarises the findings of an integrated literature review on research performing organisations' engagement with business. It is carried on within European Union's Horizon 2020 funded project EURAXIND (EURAXESS for Industry), which focuses on enabling researchers, academic organisations, and the EURAXESS network more generally, to engage more with business, provide opportunities for collaborations and build strategic partnerships.

The literature review has mainly focused on recent policy documents and selected articles from specialised journals that discuss the approaches and effective practices in outreach activities to business. These practices included the building of strategic relations, research collaborations, and the recruitment of researchers. This report complements two other literature reviews which are focused employers' needs for enhancing intersectoral mobility (Deliverable 3.1), and researchers' views and experiences of intersectoral mobility (Deliverable 4.1).

Throughout the report, the term "academia" refers to research performing organisations (RPOs) or more specifically higher education institutions (HEIs) and research institutes; while the term "business" includes other organisations outside academia.

Specifically, through this literature review, we have attempted to have an overview of the state of the art of the collaboration between academic institutions and business by focusing in this strategic relationship from the point of view of the academia. In order to do this, we attempt to address the following questions:

- (1) What are the benefits for academia-business collaboration?
- (2) What are the main barriers to academia-business collaboration?

How do academia and business engage? The information compiled in the report does not aim at being exhaustive but illustrative to be used as the basis to enable EURAXESS Service Centres, and RPOs generally, to connect better to business, thereby encouraging more business employers to engage with the EURAXESS portal. Furthermore, the existing practices and barriers identified will inform the survey of institutional and EURAXESS practices, and will be key in the design of the EURAXIND Employer Engagement Toolkit.

What are the benefits for academia-business collaborations?

Research, education and innovation are three central and strongly interdependent drivers of the knowledge-based society. Together they are referred to as the "knowledge triangle", and specifically in the EU, the close collaboration between research, education and innovation is vital for the realisation of European Research Area (ERA) and for maintaining Europe's competitiveness vis-à-vis its main economic competitors (US, Japan and China).

Researchers, entrepreneurs and companies are considered Europe's main strengths, especially in comparison with other regions in the world. Nevertheless, many other regions have economies developing much faster than the European. Thus, although innovation lies at the heart of the Europe 2020 strategy (European Commission, 2010), there strong are



indications, however, that Europe might not be using this competitive advantage to the best and is not investing sufficiently, or not adequately, in research and innovation.

Currently, academic institutions are the major employers of researchers in most European countries, while the employment of doctorate holders in the business sector remains relatively low, leaving a great terrain of innovation potential outside academia unexplored.

Looking at the number, we find that although European Research Performing Organisations (RPOs), and more specifically higher education institutions (HEIs) and research institutes currently produce significant amounts of new knowledge, with the exception of a few high performing member states, Europe has a relatively low number of researchers employed in the business sector, compared for example with the US or Japan (Researchers' Report, 2014).

A way forward to bridge this gap would be by bringing academia and other sectors closer together (ERAC, 2014). Universities are organisations that perform a key role within contemporary societies by educating large proportions of the population and generating knowledge. Recently, on the initiative of policy-makers, many universities have been taking action to develop a 'third mission' by fostering links with knowledge users and facilitating technology transfer. A key element for this engagement between academic institutions and private employers is the intersectoral mobility of researchers.

Vandevelde (2014) defines "intersectoral mobility" in the broadest sense of the term and refers to all possible bridges between university, industry and other sectors of employment. However, other sources such as the MORE2 study define "intersectoral mobility" as researchers being physically mobile to sectors outside academia, in the researcher's own country or abroad (IDEA Consult, 2013). This not only relates to private business but also to the private not-for-profit sector as well as the public and government sectors.

But even in its more limited definition, the key issue is that intersectoral mobility allows researchers to operate as "knowledge brokers" between academia and other sectors of society, and thus, fosters new methods of researcher training and development, which should translate into making them better suited for the challenges of the current labour market, fosters research collaboration, continues to build sufficient critical mass, and intensifies R&D activity in particular areas. In this way, intersectoral mobility is expected to increase the impact of scientific research in society and contribute to researchers' career development, both of which are expected to enrich the European Research Area and to boost economic growth (European Commission, 2006).

Likewise, university-business cooperation in research is an important vector of innovation and growth, being one of the avenues to foster a dynamic research sector while strengthening the so-called third mission of universities (Allinson et al, 2015). Working closely with higher education and intermediaries, companies can ensure that students develop the transferable skills needed in business, as well as the right technical competences. European policymakers can further support this through increased support for internships and improving understanding of what constitutes transferable and horizontal skills. Actually, by taking the competences that characterise researchers and introducing them to the public, private and not-for-profit sectors, the production of new ideas in these sectors of employment can be increased. It therefore constitutes an increasingly important part, explicitly or not, of the national research organisations' mission to facilitate greater impact from the high levels of investment in public research made by governments.



Furthermore, University-business cooperation has also a key role to play in horizon scanning through analysis of how emerging trends and developments might potentially affect current policy and practice). There are many areas where horizon scanning is necessary: in skills forecasting, in technological developments and in predicting innovations of the future. Higher education institutions and companies working together can help to reduce forecasting risks and contribute to economic growth by combining their collective knowledge and skills. But for this to work, permanent and stable mechanisms have to be in place to facilitate such institutional dialogue, research and action.

The project “Promoting Collaborative Doctoral Education for Enhanced Career Opportunities” (DOC-CAREERS II) looked at how universities work with their business and other non-university partners in establishing and taking forward research projects in the framework of doctoral education. It aimed at reflecting on good practices in university-business relations, with particular emphasis on regional dimensions, as well as exploring the employment prospects of doctorate holders and how collaborative schemes can enhance their career prospects.

The key report of the project (Borrell-Damian, 2015) points to the existence of a variety of collaborative models, shaped by the characteristics of the research project, the profile of the university and the company, and the regional context. The potential importance of collaborative doctoral education for regional development is highlighted. It demonstrates that the establishment of university-business partnerships is based upon proximity among the different partners (e.g. geographical proximity, shared language), a common understanding of the regional context, and the presence of appropriate policies and legal frameworks which are all important elements in developing and sustaining successful partnerships.

As to why collaborate, enhancing their competitive advantage and fostering innovation were the main incentives for both universities and companies in strengthening their cooperative relations. Specifically, for universities, this was related to furthering their relative position in the higher education landscape, as their mission and core activities in teaching and research were increasingly related to innovation. Indeed, research and innovation activities were perceived by universities as essential pillars of their development, allowing them to better tackle societal challenges and to contribute to regional and national development. Interacting with industry partners, namely via the establishment of collaborative doctoral schemes, was therefore considered as an important strategic activity for universities, as it pushed forward the development of interdisciplinary training, provided innovative solutions for complex problems responding to industry needs and supplied a highly skilled workforce for companies. Advancing research, namely through cooperation with the business sector, also gave universities more visibility, nationally and internationally, and allowed them access to a wider pool of funding sources, e.g. business partners, international competitive funding. Cooperation with the business sector also supported universities in strengthening the perceived value of research, namely to companies and other external partners.

We have failed to obtain standardized research results and data on the impact over academic institutions of these intersectoral collaborations, but this is not surprising as a recent EC’s Joint Research Centre (JRC) Policy Report (2016) acknowledged that although policies to foster intersectoral mobility are in place in almost all Member States - many of which have been implemented for several years now - readily available evaluations are scarce due to a limited evaluation culture that limits the information available. Nevertheless, the few existing evaluations provide proof of positive impact of those measures on



researchers' skills and employability, and to a lesser extent, impact data can be extrapolated from patent and publications propensity and R&D intensity of companies. Also, the strongest evidence is provided in the industrial PhD programme evaluations where the impact on skills and employability of PhD researchers can be clearly attested. A similar trend is observed in this study when analyzing the impact of policies supporting spin-offs, which provide some evidence about the increase of the entrepreneurial capacity of research organizations, promoting the translation of research results into economic value.

More recently, Science Europe (2016) launched a survey among its member organizations confirming this difficulty of obtaining quantifiable impact data arising from intersectoral mobility measures, there were however more intangible impacts declared by the respondents such as:

- promoting innovation and knowledge transfer among researchers;
- increasing communication with non-academic
- audiences and establishing external links;
- enhancing the development of start-ups; and
- encouraging clinical research and training clinicians to engage in academic research.

Finally, it is also possible to find additional cases of the positive impact of academia-business collaborations in specific frameworks. Herrera, L. et al. (2010) analysed the mobility effects of personnel coming from the public R&D system on a firms' innovative processes, and concluded that these human resources facilitate the transfer of knowledge previously developed and accumulated in the public R&D system to firms. This type of mobility study makes a contribution to understanding how scientific knowledge flows, in this case from academia to business, but which ultimately foster a more efficient innovation system.

Another specific case is described by in Lai & Lu (2016), where within the framework of university and animation industry collaboration, it is concluded that financial supports and education are the major reasons for academia to participate in the university-business collaboration, while reducing costs and obtaining human training are the reasons for animation firms to join in.

In conclusion, both the recent policy developments across the EU, as well as the conclusions of a good number of reports and surveys strongly support and foster the need for academia-business engagement. Also, although systematic data on the impacts for academic institutions is still somewhat lacking, all existing outputs and perceptions are positive, specially within the framework of developing researcher skills and competences.

In the following sections we will address which are the main obstacles for academic institutions to engage with businesses, and we summarize a number of recommendations, and when possible, specific examples of how to tackle these barriers.

What are the main barriers to academia-business collaboration?

Although the last Researchers' Report (European Commission 2014) compiles how the EU, Member States and/or institutions have introduced a range of measures, programmes,



strategies and legislative acts to address the barriers and train researchers to meet their national R&D targets, including the improvement of academia-business collaboration, there are still barriers to overcome.

The same message is confirmed by the JRC Policy Report of 2016 on intersectoral mobility and knowledge transfer, and it can be generally agreed that the barriers for academia to engage with businesses are relatively well known. Nevertheless, Kitigawa (2011) explains that although there are a number of perceived “barriers” between university and academia and that in general it is assumed that these barriers “hinder effective knowledge exchange”, there is no evidence on “how the perceived barriers shape subsequent collaborations” or how individuals may overcome such barriers. Furthermore, it is not known how these perceived barriers affect individual career strategies and decision making processes.

The ERA Steering Group on Human Resources and Mobility (SGHRM) organized a working group on 2016 focusing in intersectoral mobility. The working group launched a survey through the SGHRM members to identify the most important barriers, as well as to identify existing practices aimed at overcoming them. The survey received replies from 20 countries and identified the following barriers as most important by most of the respondents:

- Overall lack of R&D development in certain countries/regions
- Researchers consider academia the best place to work
- Difficult to ‘return’ to academia after substantial career in business
- Regulations / legal framework / administrative barriers
- Few opportunities for transferable skills development through practice (learning by doing) (for students and researchers)
- Academic staff are not equipped to help/stimulate mobility and transferable skills development

Nevertheless, there were differences between countries and other barriers also ranked high depending on the reply, so bringing all the information compiled together, the working group agreed on the following categories of barriers:

Rules & Regulations: The organisations that are involved in intersectoral mobility - higher education institutions, research performing organisations, and business - are in many countries subject to different regulations, which severely hamper the mobility of researchers between them. Examples might be labour laws, including wages, social security and pension rights.

Funding & Support: In most countries, ministries of higher education and research tend to support research in higher education institutions and the public sector. In many countries, other ministries are also engaged, such as ministries of economic affairs, ministries of health and ministries of trade & industry. Joining forces and stimulating a holistic approach, taking into account other aspects than funding, is important to increase the impact of funding on innovation and economic growth, and as a part of this, also on the exchange of knowledge and mobility of researchers between sectors.

Training & Development: One of the most important barriers to intersectoral mobility is that there are few opportunities for transferable skills practice, which is closely related to the barrier noting a lack of preparation for non-academic careers. 'Learning by doing' is a practical and active way to gain knowledge, which simultaneously applies acquired skills in



the setting for which they were designed and makes researchers aware of the skills that they have required.

Most higher education institutes and public research institutes today have networks linking them with local and international businesses, non-profit agencies, and other organisations – not in the least through BA, MA and PhD graduates developing their further career in these organisations. The key question, however, is the extent to which universities and organisations use this network effectively in order to encourage effective research collaboration and intersectoral mobility. If there is little intersectoral collaboration, the “physical” mobility of researchers will also be also limited.

The most highly ranked barriers in this area were related to the fact that researchers consider academia the best place to work, and that it is perceived to be difficult to return to academia after a substantial career in business. Furthermore, at its most extreme, research in academia is perceived to be slow, thorough, and dedicated to push the boundaries of research in the long term. At the other end of the scale, research in the private sector needs to be fast, useful, and commercially viable in the short term.

The outcomes of this SGHRM working group, are much in line with those of the Sixth University-Business Forum, which provided an opportunity for representatives from higher education institutions, companies, government, youth associations and other organisations to come together to discuss how partnerships can stimulate new jobs and growth (Allinson et al, 2015). One of the highlights of this event was that, despite advances, there remain many barriers to university-business collaboration, often caused by competing priorities.

The lack of mutual understanding between the worlds of higher education and business was discussed in the forum, and several options to improve this situation were proposed:

- better involving alumni, intermediary organisations and better engagement of students as active partners in all parts of the collaborative process are key to better collaboration.
- urgent changes need to be made to the academic community’s incentive and reward structures if university-business collaboration is to be accorded the same value as teaching and research.
- measuring the different types of activities undertaken by HEIs is crucial, but assessing the outputs of university-business collaboration is really difficult.
- case studies showcasing good practice in how such measurements are made and making examples readily available would be highly beneficial.

In regards to institutions’ suggestions for improving their engagement with business, included:

- Examples of successful cooperation activities and models should be made available to those HEIs, companies and other potential partners who are less convinced of the potential positive outcomes.
- Making university’s activities more visible and accessible to companies and other stakeholders is important if they are to engage in cooperation activities. There are many mechanisms for this including online databases, dedicated offices and marketing material.



- Changing the incentive and reward structures to promote university-business cooperation related activities for example through recognition in career progression, prizes and awards, or reduced teaching / research commitments.
- Supporting HEI staff to take risks. With the right kind of support in place HEI staff can be encouraged to take more risks, engage in innovative projects which then enhance their academic portfolio.
- Attaching funding to university-business cooperation, either in the form of base funding or as competitive funding. This would further encourage academic staff to pursue collaborative projects and programmes with business.
- Support the entrepreneurial and innovative potential of HEIs. HEIs are being judged by the ways in which they respond to the social and economic needs of society. This means that HEIs are having to change the way they work and their organisational models in order to adapt to the different demands of education, research, knowledge production, entrepreneurship and innovation.

How do academia and business engage?

The issue of academia-business collaboration has been a priority in the EU science policy for some time. In line with this, the EC published in 2006, the document “Mobility of Researchers between Academia and Industry: 12 Practical Recommendations” (European Commission, 2006) that was addressed to research organisations, universities, and private companies engaged in research, as well as to public authorities. The document was based on a thorough analysis of the perceived insufficient cooperation between public sector organisation and private companies in the field of research and presented coherent and powerful set of recommendations for improving intersectoral mobility of researchers between academia and business, as a means of enhancing a culture of longer-term, structured interaction and cooperation between both sectors in terms of knowledge transfer and development of cross-sector skills and competence. The recommendations can be summarised into the following key concepts:

1. Joint researcher training programmes
2. Developing key employment skills for all researchers
3. Joint doctoral supervision
4. Intersectoral mobility: internship, consultancy
5. Appreciation of mobility staff through evaluation criteria
6. Recruit more staff on permanent positions with intersectoral experience
7. Remove administrative barriers, esp. in recruitment
8. Align academia-business interests through framework conditions: co-location, grants, technology transfer offices
9. Appreciation of institutional collaboration activities through evaluation criteria/incentives
10. Informal networks between SMEs- - academia
11. Funding to professionalise academic staff
12. Raise awareness and provide legal instruments : social security, pensions, EU programmes.



Some years later, these concepts were further reviewed, and developed into an updated set of recommendations aimed at fostering intersectoral mobility (European Commission, 2011):

- Many countries need to train more researchers at R1 and R2¹ level in order to meet their R&D targets, and in order to support intersectoral mobility. More graduates can be attracted into doctoral research by treating them as professionals, by providing them with adequate scholarships, and by presenting them with interesting career opportunities.
- R1 and R2 researchers are the target group most easily reached when promoting intersectoral mobility.
- Employers, who already have doctorate holders amongst their staff, tend to judge their added value more favourably than those who do not. Highlighting good experiences in this area and developing a joint vocabulary between academia and other sectors of society related to “research-based skills” may contribute to changing the perception of the value of research experience.
- Employers in other sectors of the labour market and academics need to learn to speak the same language and appreciate each other’s focus and strengths. This is a process in which taking small steps can be very effective.
- By maintaining a limited set of research performance criteria when hiring R3 and R4 stage researchers, universities miss out on great opportunities to take on board researchers with experience in other sectors of employment. Better recognition of activities related to the universities’ “third mission” (service to society, including the societal and economic impact of research) will help to bridge the gap between university and other sectors of employment.
- The principles of innovative doctoral training continue to deserve attention (European Commission, 2011). These principles, developed by the ERA Steering Group for Human Resources and Mobility for the European Commission, can play a significant role in focusing the attention on intersectoral mobility. Due to this, Member States must be prepared to invest time and funding in the implementation of these principles.
- During the doctoral training programme, doctoral researchers need more exposure to other sectors of the labour market. This can be achieved through e.g. joint supervision, collaboration with the public/private sector, or internships. This generates benefits for the doctoral researchers (employability skills) as well for the employer/organisation (appreciation of research experience) as for the academic environment (networking, collaboration).
- The impact of broader research training on intersectoral mobility and on a more intensive circulation of knowledge are not easy to measure as the outcomes are long-term. Adequate monitoring systems need to be developed.
- In most countries, legal and administrative measures are in place to facilitate the intersectoral mobility of researchers. Governments should consult regularly with the research community whether any such barriers may need to be addressed further.
- Governments should be able to trigger large impacts with small-scale initiatives, such as establishing partnerships with SME clusters, focusing on niche areas of strengths, and adopting European Structural Funds and European Social Funds in order to support intersectoral mobility.

¹ R1 – R4 as defined in the European Framework for Research Careers, European Commission 2011 http://ec.europa.eu/euraxess/pdf/research_policies/Towards_a_European_Framework_for_Research_Careers_final.pdf



- Internships for researchers, i.e. a limited period of time spent in other sectors in order to gain sector-specific experience and share research experience, are inexpensive, bottom-up initiatives that potentially have long-lasting effects on researchers' employability, employers' perception and long-term collaborative initiatives. Governments can play a role in facilitating, promoting and funding such internships.
- Government initiatives to support co-location of university and business, or to develop competency clusters fostering collaboration between university and other sectors on a particular topic, provide a more integrated approach to advancing knowledge exchange.
- Intersectoral mobility provides a highly relevant focus to recognise weak elements in a country's knowledge transfer system and identify appropriate measures for improvement.
- As many countries experience similar concerns in supporting intersectoral mobility, further opportunities to exchange experiences and good practices will help to accelerate the introduction of effective measures towards better knowledge exchange
- Not all good practices would operate as effective enablers in every country. In countries with limited R&D budgets and limited R&D performance levels – modest and moderate innovators– activities addressing the intersectoral mobility of researchers tend to be project-based rather than structural, to be reliant on external funding rather than national funding, and to focus on one particular layer of the knowledge transfer pyramid rather than encompass multiple layers in an integrated approach.

The barriers identified by the SGHRM Working Group of 2016, which are described in the previous section, are much in line with previous recommendations on intersectoral mobility in 2006 and 2014, which highlight a recurring need for improving and providing adequate training and development for researchers, particularly early stage researchers, with a focus on the non-academic labour market. Using the barrier categories defined in the report as framework, the SGHRM also developed their own recommendations to overcome them at EU level and at national level, and collected existing practices and programmes addressing each of the categories. All this information is available in the report, but here we highlight those recommendations which could be taken onboard by EURAXESS and illustrate when possible with good practices:

Rules & Regulations:

Recommendations:

- Disseminate good practices to support intersectoral mobility and good practices
- Consult research community regarding barriers experienced, and collaborate with the different ministries and national actors involved.

Example of practice:

- The National IP Protocol developed by the Irish Department of Jobs, Enterprise and Innovation (DJEI), working with other Government departments and drew on the knowledge of a dedicated group of experts from business, the venture capital community, technology transfer offices, research performing organisations, the Irish Universities Association and State research funders. The Protocol was developed with the aim of providing 'an exemplary innovation ecosystem that creates economic and societal benefits, especially sustainable jobs.



www.knowledgetransferireland.com/About_KTI/Knowledge-Transfer-Framework/#sthash.Rwjvdpvt.dpuf

Funding & Support:

Recommendations:

- Support the creation of platforms for university-business funded instruments to increase their visibility
- Foster that peer review evaluation panels value intersectoral mobility in assessing projects and researchers' CVs

Example of practice:

- Christian Doppler Research Association, CDG (<https://www.cdg.ac.at/en/about-us/>)
The CDG is considered a pioneer in Austria for successful cooperations between science and the private sector. The form of the cooperation funded by the CDG usually has the following appearance: a research group elaborates fundamental knowledge that flows into the development of new products and processes at commercial partners. This generates a brisk exchange of knowledge, experience and questions between the partners.

The CDG realises its objectives through:

- Christian Doppler Laboratories (CD Labs) established at universities and non-university research institutions (<https://www.cdg.ac.at/en/funding-models/the-cd-model/>)
- Josef Ressel Centres (JR Centres) established in universities of applied sciences (<https://www.cdg.ac.at/en/funding-models/the-jr-model/>)
- "Partnership in Research" (PiR) Programme (<https://www.cdg.ac.at/en/funding-models/partnership-in-research/>): The CDG, in cooperation with the Austrian Science Fund (FWF) has also launched a one-off programme with 1 million euro budget for research designed to encourage new partnerships between science/research and the business world. These may lead to the establishment of CD Labs or JR Centres, or other cooperation projects.

Training & Development:

Recommendations:

- Train and further professionalise academic staff in skills and career development with an emphasis on the transition to non-academic labour market
- Support national and institutional projects on transferable skills and career development for researchers and academic staff

Example of practice:

- Ghent University has several programmes and initiatives designed to foster intersectoral mobility:
 - Industry Liaison Network (<http://www.ugent.be/techtransfer/en/support-for-academics/industrialiaisonnetwork.htm>)
 - Mentoring Programme for postdocs by PhD-graduates from outside the university (<http://www.ugent.be/doctoralschools/en/menta.htm>)



- Transferable skills programme as part of the doctoral training (<http://www.ugent.be/doctoralschools/en/doctoraltraining/programme/transferebleskills.htm>)
- Career Coaching programmes:
 - For PhD candidates as part of the doctoral training programme (<http://www.ugent.be/doctoralschools/en/careersupport>)
 - For postdocs (<http://www.ugent.be/en/work/career/postdoc-talent-management/phdcareercoaching.htm>)

Collaboration & Entrepreneurship:

Recommendations:

- Develop a national employer, students, and graduates survey in order to assess the effects of investments in entrepreneurship skills among the enterprise community.
- Promote entrepreneurship amongst early-career (R1/R2) researchers and provide entrepreneurship training in order to nurture a new category of researcher: the “entrepreneurial academic”.

Example of practice:

- The Norwegian FORNY StudENT entrepreneurship (<http://www.forskningsradet.no/no/Utlysning/FORNY2020/1049265096545>): This scheme aims at increasing the number of successful start-up companies based on ideas from students in HEIs and strengthen the culture of entrepreneurship among students. The target group is master students in the final phase of their study and candidates who have recently completed their degrees. The maximum amount is one mill NOK, for a period of until 12 months, and may cover salary as well as development costs.

Awareness & Recognition:

Recommendations:

- Promote the relevance/value of academic research to business networks, and from industry research to academia, through an effective communication strategy.
- Create a competency profile for PhD researchers, postdocs, and professors, which can help to make non-academic stakeholders appreciate these skills
- Involve non-academic stakeholders in defining skills required for research and entrepreneurship in various job sectors
- Involve alumni in the design of programmes and training activities at PhD level as well as investing in “storytelling”

Example of practice:

- Industrial Partnership Programme (IPP) of NWO/FOM/STW (http://www.fom.nl/live/english/research/research_grants/ipp/ipp.ppt): An IPP is a funding instrument to build a bridge between fundamental research and application-oriented research from business. Academic knowledge is then linked to industrial



ambitions by carrying out high-quality research in collaboration with companies. In an IPP, academic researchers come into close contact with company researchers in areas with good innovation potential and challenging scientific questions. This joint approach can lead to ground-breaking innovations and is a best practice of tailor-made innovative intersectoral research in the Netherlands.

Finally, as explained in the first section of this review, there is a lack of quantitative data on the impact of measure supporting intersectoral collaboration between academia and businesses, which probably explains the difficulty to locate scientific papers showcasing and analysing specific industry-business engagement activities and programmes, including the results of their implementation. But nevertheless, some studies do have attempted to obtain data to quantitatively measure the level of this collaboration:

Based on budgetary data from the 6th EU R&D Framework Programme (FP6), in 2009 the JRC Institute for Prospective Technological Studies (JRC-IPTS), analysed the main patterns derived from budget allocation to university-business cooperation (UIC) projects versus other forms of collaboration (e.g. academic-only networks, intra-firms networks, etc). The main findings show that for the EU average, a university-business collaboration contract involves funding four times bigger than other forms of collaboration. The results also show that countries getting the majority of FP6 UIC projects and value are usually Western, Northern and, to a minor extent, Southern member states, while Eastern and most Southern countries tend to rank low in both the number and value of projects. When correlating the average value of FP6 UIC projects with gross domestic product (GDP), this pattern appeared to be even clearer. Considering that the FP allocates funds on the basis of the quality of the proposal, these findings could be attributed to the self-reinforcing nature of UIC, and open perspectives of possible ways of better involving the new member states in an increasingly important knowledge-oriented future for Europe. Nevertheless, this report still acknowledges that further analysis would be needed to suggest a causal relationship between geographical differences in UIC and per capita GDP. This could shed light on the variables that lay behind differences in GDP: a history of engagement with R&D (and perhaps the private and collaborative parts in particular), the number of years a country has been a member of the EU, the spatial concentration of industrial activity, institutional barriers to collaboration, the number of universities in each Member State, the size of the public sector research workforce, etc.

The previously mentioned MORE2 Study estimated that in the EU around one in four researchers (23%) were mobile to a sector outside of academia during their doctoral studies. This was made up of 4% of researchers who were active in private business, 9% in the private not-for-profit sector and 10% in the public or government sector. When looking into their motivation to take up employment in the private sector, the most important factors encouraging researchers to become mobile (>60%): career progression (70%), gaining first-hand experience in business (69%), increasing employability (67%), availability of research funding (61%) and bringing research to the market (61%). On the other hand, the least important motives for moving to the private sector (<40%) job security (38%), personal/family reasons (33%) and social security and pension systems (30%); aspects which are also not considered to be important motives for international mobility.

The Researchers' Report (European Commission 2014) looked further into this issue by analysing the public-private co-publications between different sectors and comparing the



results between 2003 and 2008. The number of public-private co-publications between different sectors per million population increased in the EU-27 from 31.7 to 36.2 (14%). The increase in the United States was from 67.1 to 70.2 (4.6%). In Japan, the number of public-private co-publications between different sectors per million population increased from 55.4 in 2003 to 56.3 in 2008 (approximately 1.6%). China reported a substantial increase in scientific public-private co-publications between two or more sectors per million population (200%) from 0.4 in 2003 to 1.2 in 2008. This report also states how many countries acknowledge the problem and are promoting partnerships between universities, research institutions and private companies, and measures to improve the skills of doctoral researchers in areas such as technology transfer and intellectual property. Other measures include the implementation of joint projects, exploitation programmes, research traineeships in companies, inter-sectoral mobility programmes, industrial Doctoral programmes, and the possibility to combine teaching and private sector research.

Key findings

The institutional engagement with business has been a key priority for the European Union for some time.

Although many analyses have been carried on by different stakeholders and the barriers (which can actually be somewhat interrelated) are generally well understood, there is still need for practical actions in fostering the engagement of research institutions with business.

Awareness & Recognition is the area that is considered most important, in the respect that two of the barriers defined are among the top six, and several others are ranked of medium importance. To overcome these barriers, there is a need for cooperation and interaction among researchers from different sectors, to learn about the opportunities, and to recognise competences of researchers from other sectors. The SGHRM Working Group 2016 survey on intersectoral mobility confirms the need of getting adapted to the country's specific innovation ecosystems and regulations, including the practice and recruitment of researchers through devoted programmes.

There seems to be a lack of quantitative data supporting the overall positive perception of intersectoral collaboration.

Related national initiatives could include cross-sector collaborative programmes, targeted funding to develop individuals, overarching services and networks that help or advise researchers or those who support them, financial incentives for companies to employ doctoral graduates and innovative or exemplary projects and programmes (DOCENT, 2010).

It would be necessary that RFOs and RPOs acknowledge somehow intersectoral professional experiences beyond the usual academic evaluation methods in order to trigger mobility, especially from business to academia.



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