Policy dialogue input paper: Poland

March 2014

This input paper provides a profile of statistical indicators which benchmark the performance of Poland against other member states in relation to participation in FP7. It also provides wider context around innovation in Poland and facilitators of, and barriers to, innovation.

The paper presents an Overview, summarising key findings, an Executive Summary, and an Evidence Base.

This input paper has been drafted by Coventry University and Aalborg University, under the MIRRIS (Mobilising Institutional Reforms in Research and Innovation Systems) project. MIRRIS aims to encourage greater participation in the European Research Area by the EU13 countries through a process of analysis, dialogue and mutual learning among national research and innovation stakeholders and institutional actors.

This project has received funding from the European Union's Seventh Framework Programme for research; technological development and demonstration under grant agreement n°320209

Executive Summary – Key Points

Within the EUs flagship R&D&I Framework Research Funding programme (FP7), EU15 member countries have tended to significantly out-perform newer member states (EU13) both in terms of absolute numbers of participations, participations per head of population and the success rate of applications. This report provides details specific to Poland's participation in FP7, and presents a range of wider indicators of research and innovation which provide context and also, in part, help to explain patterns of participation.

Participation in research and innovation

- Poland is underperforming for the size of its research and development employment sector (but much less than would be the case based on a simple population estimate). The difference is still sizeable (over 1,100 participations) and suggests that mechanisms which improve the quality and capacity of research and development staff and institutions are likely to improve performance.

- Poland's success rate in applying for FP7 monies is very close to the overall EU13 average. However because Poland has submitted relatively few applications (for its size) it has one of the smallest numbers of FP7 beneficiaries per head of population and one of the smallest gains of FP7 monies per inhabitant, standing at just €8.90

- If FP7 funding for countries is adjusted for Purchasing Power Parity (using prices for 2012), Poland's situation improves somewhat, although the broad trends in FP7 funding receipts are unchanged

- Poland's participation in the European Research Area is relatively strong in several thematic areas, particularly: "ICT" (230 beneficiaries), "Nanotechnologies, Materials and New Production Technologies" (164), and "Transport" (149) (Eurada, 2013).

Barriers and enablers of participation in FP7

- There are important differences in the experience of Poland with regard to FP7 and ERDF monies earmarked for R&D in the period 2007-2013. The ratio of FP7/ERDF funding in Poland is 0.03. This compares to 3.8 in Denmark and 3.5 in Belgium where FP7 funding is more significant than ERDF. There are then, quite different incentives operating across EU member states. The extent to which this may influence FP7 performance is an important potential topic for discussion with national stakeholders.

- The "Shanghai 500" includes two Polish universities, the Jagiellonian University and University of Warsaw (both in the 300th to 400th place bracket). Perhaps unsurprisingly therefore, Poland, in common with most of the 2004 accession states does not have a large institutional presence from a major university in FP7 – No Polish university features amongst the 50 most active HES organisations taking part in FP7 (Sixth Monitoring Report; page 93).

- Poland scores towards the bottom of the European Union's innovation scorecard index. Particular weaknesses are: 'linkages and entrepreneurship' (measures of SME innovation and collaborative activities); and 'innovators' (innovative activity among SMEs).

- The emphasis placed on research, development and innovation career pathways at all levels in a national education system will affect the progression of students through to research careers. Data show that public expenditure on education as a percentage of gross domestic product is significantly higher across the EU15 than the EU13. The position of Poland is broadly consistent with this overall picture.

- National business systems are crucial when assessing innovation in its broadest sense. In this respect, the European Council and Commission continue to recommend that Poland improve its business climate; nevertheless, it should be noted that in the prestigious worldwide 'Ease of Doing Business' (2013), Poland is ranked 45th. This is well above the EU13 average and even above several EU15 member states: Spain (52nd), Luxemburg (60th) and Italy (65th).

- Empirical evidence indicates that Discretionary Learning (DL) forms of work are more conducive to innovation. In this respect, Poland exhibits higher levels of DL work organisation than across the EU13 as a whole, but lower than the average level for EU15 countries

- The principal language of the international research community, including that of the Framework Programme itself, is English. With the exception of the former British colonies Cyprus and Malta, significantly lower proportions of the populations of EU13 countries are fluent in English than is the case for the EU15. In the case of Poland, the level of English language competence amongst the population is below even the average of the EU13

Wider science and technology context

- Although the overall budget spend on R&D by the Polish Government is relatively small, it is of disproportionate importance compared to the EU27 average. In Poland, some 44.9 per cent of funds come from the Government sector, making it the same size as the business enterprise sector. Across the EU27 the business enterprise sector provides a clearer majority of funding for R&D

- For the EU27 the average EURO spend per head on R&D from the business enterprise sector is 318, from the government sector it is 65. For Poland the respective figures are 22 and 25. These are some of the lowest figures in the EU

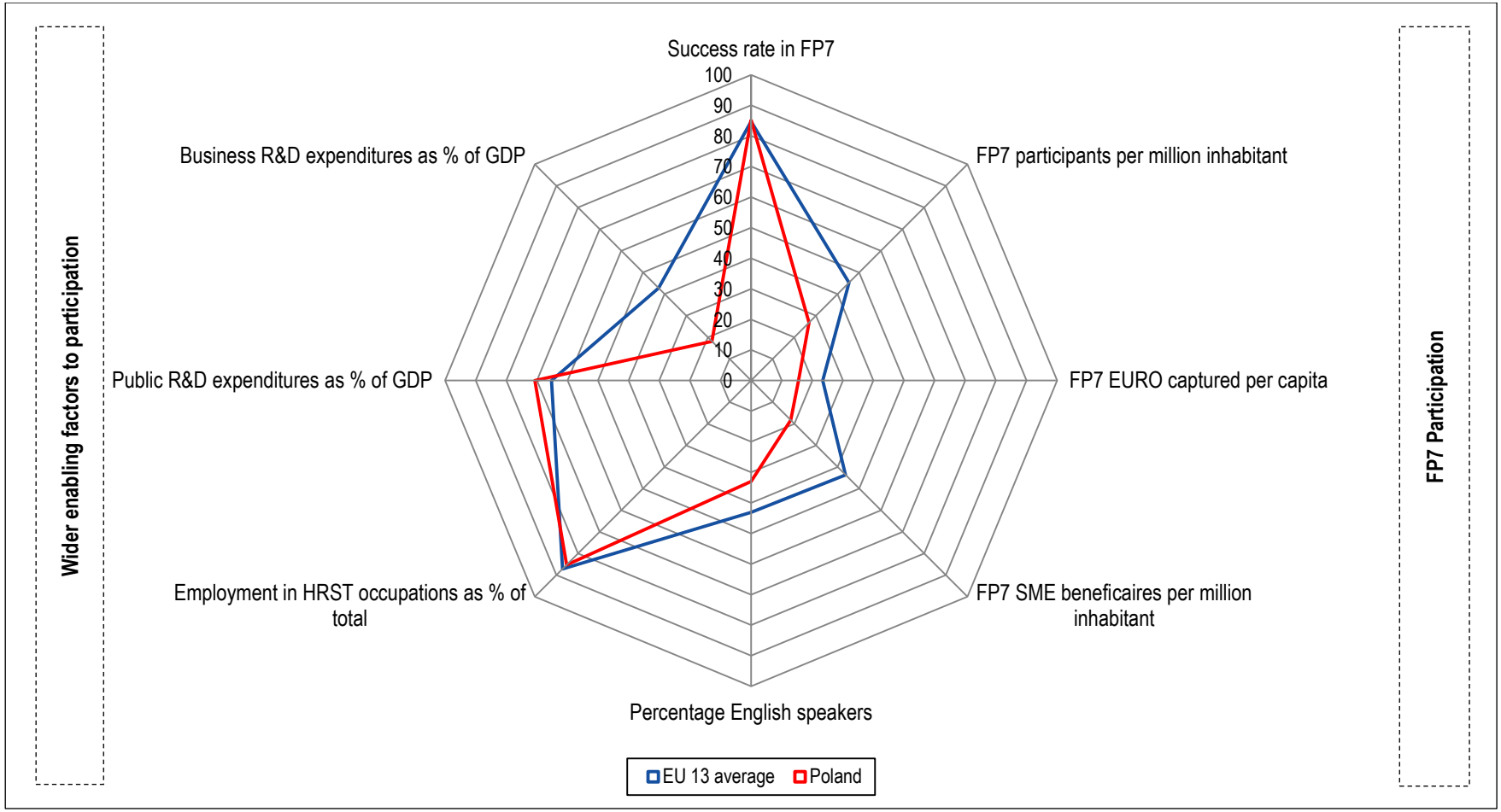
- Poland has some 4.5 million employees working in a science and technology occupation. Although the proportion of the workforce employed in these occupations is relatively low compared to many other European countries, standing at 28.9 per cent compared to an EU average of 33.9

The 'Spider diagram' (Figure 1) below summarises some of the evidence presented in this report and highlights how Poland compares with the EU13 overall in FP7 outcomes as well as some of the enablers and barriers which influence this performance. The performance of Poland, and of the EU13 combined, is benchmarked against the performance of the EU27 **which is equal to 100 per cent in each of the categories**.

Poland's success rate in FP7 is almost identical to the average of the EU13 but is below that of the EU27. The number of FP7 participations for Poland is much smaller than would be expected for a country of Poland's size. The number of FP7 participations per million inhabitants is around a quarter of the EU27 average, and significantly below the average of the EU13. Relatedly, Poland also performs below the average for the EU13 on indicators of Euros captured and SME participations.

The diagram sets-out a number of factors which are supportive of wider research and development. Public expenditure on R & D in Poland is comparable with the EU13 average but below that of the EU27. As is the availability of skills and employment in science and technology occupations. In contrast, private firm expenditure on R & D is very significantly below the EU13 average. Poland also has comparably low rates of English speaking which might influence the ability to successfully apply for FP7 funding.

Figure 1: FP7 performance and wider innovation indicators for Poland benchmarked to EU27 average



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1.0 Evidence Base - introduction

1.1 In this evidence base report we present the data from which the core findings in the Executive Summary are derived. The Evidence Base is divided into four sections, these cover:

- Participation in research and innovation under FP7
- Barriers and enablers of participation in FP7
- Wider science and technology context
- Qualitative information on research and innovation

1.2 In each section we provide a short overview and some commentary on the data presented. Section 2 provides details specific to participation in European Union's Seventh Framework Programme for Research (FP7).The following sections present a range of wider indicators of research and innovation which provide context and which also, in part, explain patterns of participation in FP7. For ease of reading we omit full data tables from the report narrative but these are provided in Annex 1.

1.3 The report reproduces official data on FP7 participation as well as Eurostat data on wider factors which influence research and innovation. **Where Eurostat data is used the most recent data available for each country at the time of analysis is reported**. Eurostat data provides an evidence base which is consistent across countries and which allows for cross-country benchmarking. It is for this reason that Eurostat data is preferred to use of nationally produced statistics which may not be directly comparable across countries.

2.0 Participation in research and innovation under FP7

2.1 In this section we present details of Poland's participation in research and innovation under FP7 and describe how this compares to other European countries.

2.2 There is a distinct pattern in FP7 participation, in that EU15 member states have tended to significantly out-perform newer member states both in terms of absolute numbers of participations, participations per head of population and the success rate of applications (European Commission, 2013a). Belgium, Germany, Denmark, France, the Netherlands, Sweden and the UK all have success rates in excess of 23 per cent (Table 1). The average of post-2004 members is 18 per cent, while Poland's success rate over the period 2007-2012 is 18.5 per cent. With the exception of Ireland, Luxembourg and Portugal, all the EU15 member states have greater absolute participations in FP7 than Poland. The top three thematic areas in which Poland has participated are: "ICT" (230 participations), "Nanotechnologies, Materials and new Production Technologies" (164), and "Transport" (149) (Eurada, 2014).

2.3 These differences in performance raise two important and inter-related questions: how can the number of submissions from newer member states to research and development programmes be increased? And, how can the success rate of these be improved? In both cases, developing the national innovation system of the country is likely to be a critical influence (Schuch, 2013).

2.4 There are a number of ways in which Poland's participation rate can be contrasted against what we might have expected or "its optimum participation rate". Here we provide four estimates (see Table 2). The first is what a population weighted distribution of participation of the monies

currently allocated to FP7 participants would look like (i.e., all other factors being equal and monies were won or accrued based solely on population size). The second estimate provides the distribution if monies were won or accrued on the basis of employment in research and development (i.e., all other factors being equal and monies were won or accrued based solely on the size of this workforce).

2.5 The third estimate is based on the number of participants that Poland might have expected if participations were proportionate to the number of scholarly international publications authored by Polish academics relative to their EU counterparts. Finally, the fourth estimate provides a simple calculation of the additional number of participants that Poland would have received funding for if the success rate was raised to that of the EU27 (21.7 per cent). These examples are presented only to serve as illustrations. It is clear that while both size and employment base will matter, so will other quality and experience factors which are not measured here.

2.6 The first scenario presented in the Table 2 shows that for its size Poland is very significantly underperforming. However this scenario is clearly unrealistic as research and development capacity and wider innovation systems have considerable importance. The second scenario also suggests Poland is underperforming for the size of its research and development employment sector (but by much less than the simple population size estimates). The difference is still sizeable (over 1,100 participants) and suggests that mechanisms which improve the quality and capacity of research and development staff and institutions are likely to improve performance. Under the third estimate patterns of publication in scientific journals are used to benchmark performance. Again Poland underperforms in relation to scientific journal publications. Finally, if Poland's success rate was lifted to the EU27 average there would be a non-trivial uplift to the number of participants by in excess of 300.

2.7 Taken together, these data suggest that measures of research and innovation quality and capacity, which are less easily measured through published metrics, are an important part of the explanation. They may also suggest that formal and informal institutional knowledge and networks are less well developed in Poland vis-à-vis other member states. *These are important issues to be discussed in the roundtables.*

Table 2: Estimates of optimal vs. actual performance for Poland, number of participants in FP7

ACTUAL PARTICIPATIONS	**1,834**
ESTIMATE 1: If FP7 participations distributed by population	6,942
Difference	*-5,108*
ESTIMATE 2: If FP7 participations distributed by research and development staff[1]	2,953
Difference	*-1,119*
ESTIMATE 3: If FP7 participations followed patterns of scholarly international publications	3,321
Difference	-1,487
ESTIMATE 4: If success rate of 21.7 per cent	2,151
Difference	*-317*

[Sources: Authors' estimates using Sixth FP7 Monitoring Report and EUROSTAT]

2.8 Table 3 (in the Appendix) compares Poland's performance to other post-2004 accession states. Poland's success rate in applying for FP7 monies is very close to the average. However because Poland has submitted relatively few applications (for its size) it has one of the smallest numbers

[1] Based on FTE of workers in Research and Development staff in 2011. Figures for Greece from 2010

of FP7 beneficiaries per head of population and one of the smallest gains of FP7 monies per inhabitant, standing at just €8.90. This compares to an average of €13.5 and to returns of €19.0 in the Czech Republic and €22.2 in Hungary; and with much higher rates found in some of the smaller states. The average number of Euros per beneficiary is however higher than average for Poland, standing at €187, 500. Poland's proportion of SME beneficiaries is comparatively low, perhaps reflecting the structure of the Polish economy.

2.9 If FP7 funding for countries is adjusted for Purchasing Power Parity (using prices for 2012), Poland's situation improves somewhat, although the broad trends in FP7 funding receipts are unchanged. Poland's adjusted EUROs per inhabitant values are 15.77 (the second lowest adjusted value), while the total receipts are equivalent to EURO 607 million and EUROs per beneficiary are equivalent to 303,808 (Table 4).

2.10 The juste retour represents the return that countries receive comparative to their contribution to the EU budget. The juste retour on FP7 programmes ranges from more than 80 per cent in the Netherlands to less than 3 per cent in a number of countries (see Table 5 in the Appendix). Poland has among the lowest rates of juste retour through FP7, at 2 per cent.

3.0 Barriers and enablers of participation in FP7

3.1 In this section we provide details of barriers and enablers of participation in FP7. We begin by focusing on the relative importance of FP7, compared to ERDF, which may influence the emphasis attached to bidding for projects. We then discuss the role of supportive institutions before examining barriers associated with the wider national system of innovation. Finally, the section looks at a range of national level factors which may facilitate or hinder participation in the European Research Area.

3.2 FP7 funding and ERDF funding

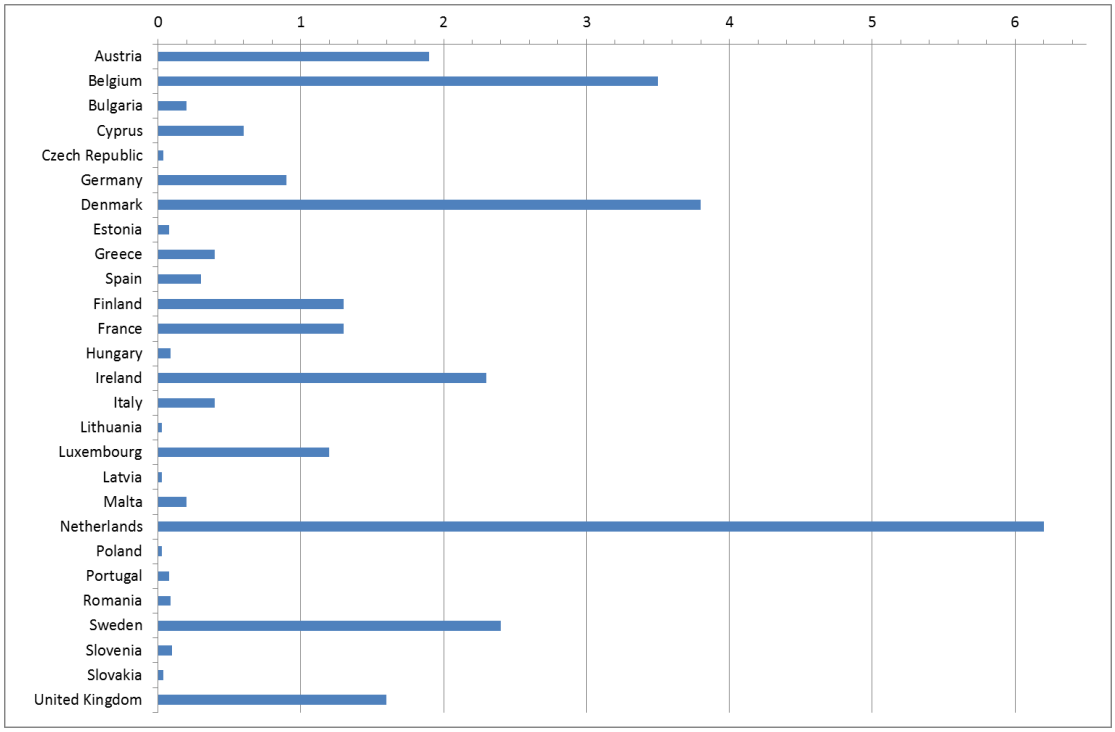
3.2.1 There are important differences in the experience of Poland with regard to FP7 and ERDF monies earmarked for R&D in the period 2007-2013. The ratio of FP7/ERDF funding in Poland is 0.03 (Figure 2 / Table 6)[2]. This compares to 3.8 in Denmark and 3.5 in Belgium where FP7 funding is more significant than ERDF. There are then, quite different incentives operating across different member states. *The extent to which this may influence FP7 performance is an important potential topic for discussion with national stakeholders*.

3.3 The presence of supportive institutions

3.3.1 Supportive institutions play an important role in influencing FP7 participation and universities are a particularly significant national actor in this respect. However, studies show significant inequality amongst universities in terms of their success in accessing funds from previous Framework programmes – with Europe's top research intensive universities accounting for the lion's share of higher education participants under FP6 and being more likely to act as project coordinators (Henriques et al., 2009). The importance of these types of institutions is highlighted by the fact that the top two ranked universities, Oxford (UK) and Cambridge (UK), have combined FP7participation figures similar to that of the whole of Poland.

2 Note that FP7 budget runs to 2011 in this data so the figures, though not the overall patterns will change.

Figure 2: Ratio of FP7 funding 2007-2011 to ERDF funding allocation for R & D 2007-2013



[Source: Source: DG RTD and DG Regio – Cohesion Policy 2007-2013: Research and Innovation reproduced in Eurada, 2014]

3.3.2 The Academic Ranking of World Universities, also known as Shanghai Top 500, shows that out of the top 500 ranked universities in the world there are 182 in the European Union. Out of these 182 universities there are only five in the EU13, with the reminder concentrated in EU15 countries. Other rankings such as those compiled by Times (2013), or the top 171 quoted by Henriques et al. show similar results.

3.3.3 The Shanghai 500 includes two Polish universities, the Jagiellonian University (in joint 300th place) and University of Warsaw (in joint 400th place). Perhaps unsurprisingly therefore, Poland, in common with most of the 2004 accession states does not have a large institutional presence from a major university in FP7 – No Polish university features amongst the 50 most active HES organisations taking part in FP7 (Sixth Monitoring Report; page 93).

3.3.4 Table 7 ranks the top performing Polish universities for FP7 participation, also included are ranks 1, 10, 20, 30 and 40 of top performing universities anywhere in the EU27. This is provided to put the performance of Polish universities into context. Roughly speaking the highest performing Polish university would need to at least double its number of participations in order to rank among the top 50 Higher of Secondary Education institutions. However Poland's best performing university, Uniwersytet Waraszawski, is the sixth best performing HES in the EU13.

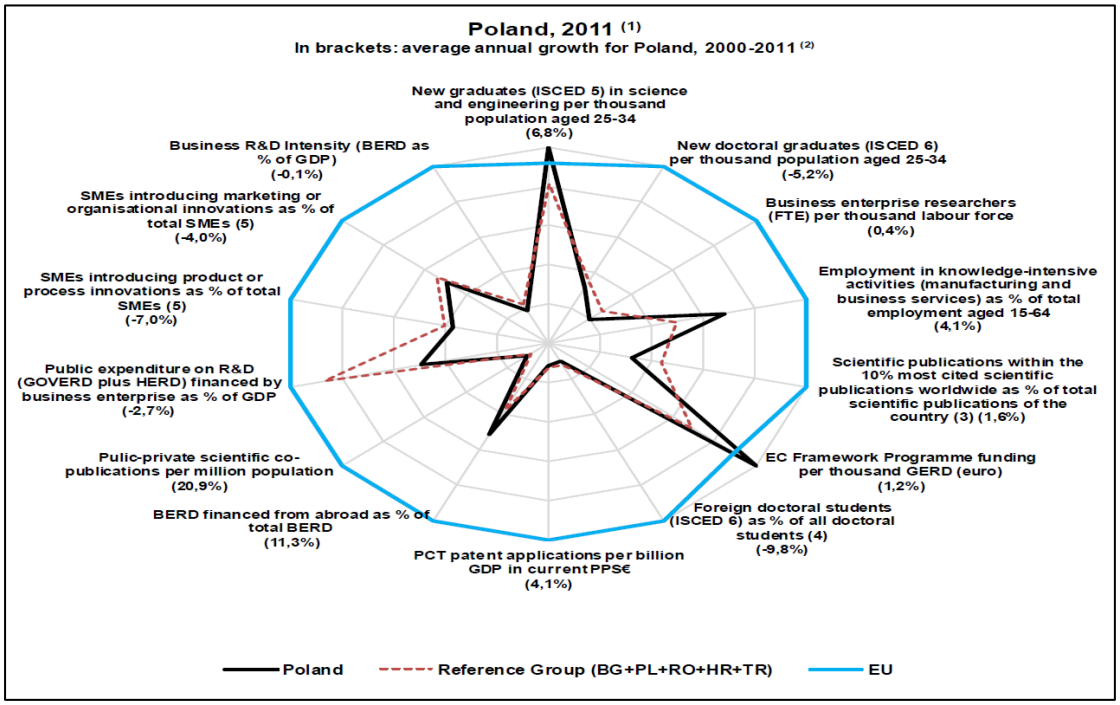
3.3.5 Significant gaps in university performance can also be seen in data on journal publications, and it is reasonable to assume that there is a direct relationship between the expertise and profile demonstrated through publication of research outputs and ability to access to research funding including EU funds. Table 8 shows that even though the EU15 countries produced a far higher number of scholarly international publications (51,200) when compared to their EU13 counterparts (7,600), Poland is close to the EU28 average.

Table 7: Higher or Secondary Education Organisations FP7 participations – EU15 and EU13 leaders compared to Polish HES

Rank	Institution	no. participations	Country
1	The University of Cambridge	570	UK
10	The University of Edinburgh	296	UK
20	University of Leeds	219	UK
30	University of Newcastle Upon Tyne	197	UK
40	Politecnico di Milano	178	IT
87	Unierza V Ljubljani	137	SI
133	Unierzita Karlova V Praze	100	CZ
148	Budapesti Muszaki Es Gazdasagtudomanyi Egyetem	93	HU
161	University of Cyprus	90	CY
173	Tartu Ulikool	84	EE
	Uniwersytet Warszawski	80	PL
	Politechnika Warszawska	62	PL
	Uniwersytet Jagiellonski	56	PL
	Akademia Gorniczo-Hutnicza Im. Stanislawa Staszica W Krakowie	44	PL
	Politechnika Wroclawska	39	PL
	Uniwersytet Im. Adama Mickiewicza W Poznaniu	28	PL
	Poznan University of Technology	26	PL
	Uniwersytet Gdanski	22	PL
	Politechnika Lodzka	19	PL
	Politechnika Slaska	18	PL
	Politechnika Gdanska	16	PL
	Politechnika Krakowska	16	PL
	Universytet Medyczny W Lodzi.	16	PL
	Szkola Glowna Gospodarstwa Wiejskiego	15	PL
	Uniwersytet Wroclawski	15	PL
	Zachodniopomorski Uniwersytet Technologiczny W Szczecinie	15	PL

3.3.6 The Polish National Contact Points for Research Programmes of the European Union (Krajowy Punkt Kontaktowy - KPK) were created in 1999 by the Ministry responsible for scientific research as a result of Poland's participation in the 5th Research Framework Programme of the European Union. These NCPs are hosted by the Institute of Fundamental Technological Research (IPPT PAN), which is one of the biggest scientific establishments of the Polish Academy of Sciences. Under Horizon 2020, the activities of NCPs will be supported and complemented by 11 Regional Contact Points located in major academic centres, and several Stakeholders Contact Points located at the Polish Technology Platforms.

3.3.7 The following spider diagraph illustrates the strengths and weaknesses of the science & high-technology sector in Poland – specifically, information on human resources, scientific production, technology valorisation and innovation.



[Source: DG Research and Innovation reproduced in European Commission (2013f, p. 208)*]*

3.4 The Innovation Union Scorecard

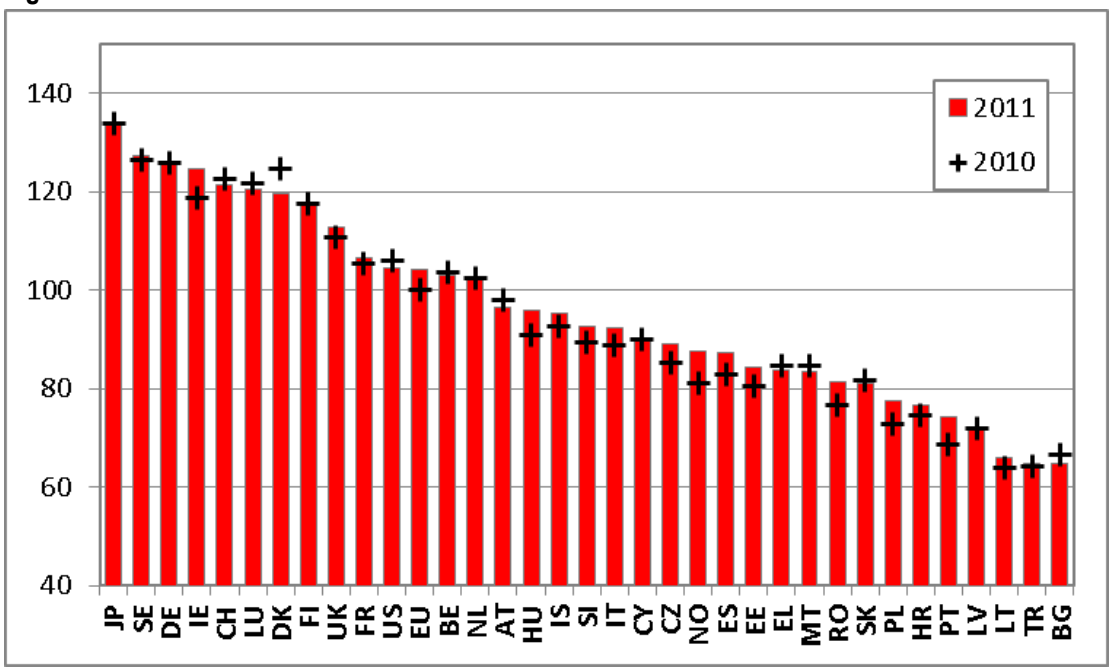
3.4.1 As well as the specific factors identified above, the wider national innovation system also influences a country's ability to access FP7 funding. The European Commission publishes an Innovation Union Scorecard which provides a composite index of innovation and potential for innovation in member states (European Commission, 2013). The index comprises metrics of enabling factors (human resources, research systems, finance and support), firm activities (including investment and innovation) and outputs (effects of innovation activities). The index is presented in Table 8 with the composite index in bold and the sub-divisions of the index reported in the other columns. Poland scores towards the bottom of the index. Particular weaknesses are:

- 'linkages and entrepreneurship' (measures of SME innovation and collaborative activities
- 'innovators' (innovative activity among SMEs).

Poland does somewhat better on the indicators of human resources. Overall Poland's performance places it in the bottom grouping of 'modest innovators' (European Commission, 2013b: 5).

3.4.2 The European Commission has also recently developed a new additional Innovation Indicator (Figure 3). The indicator includes measures of technological innovation, economic structure, competiveness of knowledge-intensive goods and services and employment in fast-growing firms of innovative sectors. On this measure Poland is also considered to be a 'low performer' and ranks close to the bottom (European Commission, 2013c: 5).

Figure 3: Innovation Union Indicator



[Source: European Commission, 2013c]

3.5 Wider participation in European Research Area

3.5.1 The European Union has supported the creation of the European Research Area, and according to Scherngell & Lata (2012) there is some encouraging evidence that the Framework Programmes have made a significant contribution to the realisation of the European Research Area. However, empirical evidence suggests that the most significant determinants of collaboration in European R&D networks established through FP projects are prior acquaintance, thematic proximity and geographical proximity (Paier & Scherngell, 2011). This section attempts to explore the position of the EU13 countries in relation to these factors by examining four important issues which may impact on a country's ability to network and engage with partners from elsewhere in the ERA: the internet; education; the business environment; and demographics.

3.6 The Internet

3.6.1 Access to web content and the real-time exchange of materials are important features of effective trans-national research collaborations. As such, internet connectivity is often an essential pre-requisite for effective participation in the ERA. By implication, therefore, research groups located in countries with more established, reliable and higher speed broadband networks will be better positioned to engage in Framework Programme research projects. Eurostat (2011) shows differences in the extent of broadband penetration across the EU, with higher average penetration in EU15 countries (73%) than the EU13 (58%). In the case of Poland, broadband penetration is in line with the EU13 average as a whole. Besides internet connectivity, countries with a relatively high use of social media may be better positioned to

engage in European research projects through the networking opportunities which these new forms of communication offer. In this respect, the Polish population as a whole utilise social media to a greater extent than the average across the EU15.

3.7 Education

3.7.1 Strong national funding of education may facilitate the creation of stronger research groups. The emphasis placed on research, development and innovation career pathways at all levels in a national education system will affect the progression of students through to employment in research roles. At the same time, university funding (including of postdoctoral opportunities) may foster and attract better researchers. Data show that public expenditure on education as a percentage of gross domestic product is significantly higher across the EU15 than the EU13. The position of Poland is broadly consistent with this overall picture (see Table 8).

3.8 The Business Environment

3.8.1 There are different types of work organisations, some are more Taylorist and/or hierarchical, while others relate to a Discretionary Learning (DL) form of organisation, characterised by high levels of autonomy and learning on the job. Research suggests that the relative importance of different work organisation varies across EU nations, and that the proportions of different types of organisation found within a particular country has a knock on effect on the national system of innovation (Holm et al, 2010). In particular, empirical evidence indicates that DL forms of work are more conducive to innovation. In this respect, Poland exhibits higher levels of DL work organisation than across the EU13 as a whole, but lower than the average level for EU15 countries. (See Table 8).

3.8.2 In addition to work organisation, the ease of 'doing business' within a country has an effect on the level of innovation and entrepreneurship achieved. In this respect, the International Finance Corporation of the World Bank (2013) has produced a rank which provides a composite measure of indicators related to the suitability of each national environment to the creation of new businesses. This ranking shows considerable variability both across the EU 15 and EU13 countries. Poland is ranked in 45th place, above Spain (52nd), Luxemburg (60th) and Italy (65th), but well below Denmark (ranked 5th) and fellow EU13 country Lithuania (ranked 17th).

3.9 Demographics

3.9.1 *Knowledge of English among the population*. The principal language of the international research community, including that of the Framework Programme itself, is English. Thus, countries whose citizens demonstrate high levels of English Language competence are better placed to engage in international research and international research funding programmes. In this respect, with the exception of the former British colonies Cyprus and Malta, significantly lower proportions of the populations of EU13 countries are fluent in English than is the case for the EU15. In Poland, the level of English language competence amongst the population is below even the average of the EU13. (See Table 7).

3.9.2 *Immigration*. Some research "*results suggest that differences in knowledge and capabilities of workers from diverse cultural backgrounds enhance performance of regional R&D sectors*" (Niebuhr, 2010). In other words, regions and nations with more immigrants may be better positioned to engage in collaborative international research. In this respect, the case of Poland is

significant because it has the lowest official rate of immigration, both from within and outside of the EU.[3]

3.9.3 *Urbanisation*. Much literature indicates that most entrepreneurship and innovation originates in cities. Therefore, countries with higher rates of urbanisation may be better positioned to engage in activities related to innovation, such as participation in collaborative R&D&I projects. Data indicates that on average EU15 nations have a higher rate (72%) of inhabitants living in cities when compared to the EU13 (66%). The situation in Poland is consistent with this general picture, with a significantly larger rural population relative to EU15 countries. (See Table 8).

4.0 Wider science and technology context

4.1 This section expands on some of the details of wider science, technology, economic and innovation context, all the data underlying the discussion are provided in Annex 1.

4.2 Spending on R & D

4.2.1 Table 10 provides data on spending on R&D activities by different organisations. The first column provides the level of Government spending on R&D as a proportion of total government expenditure. For Poland the most recent data available come from 2009 when just 0.76 per cent of expenditure was on R&D. This is just half of the EU27 average, although the figure is comparable to a number of the other newer EU members. Columns 2-6 breakdown spending on R&D (GERD funds) by source. Although the overall government budget spend is relatively small it is of disproportionate importance in Poland compared to the EU27 average, some 44.9 per cent of GERD funds come from the Government sector, making it the same size as the business enterprise sector. Across the EU27 the business enterprise sector provides a clearer majority of funding for R & D.

4.2.2 Table 11 provides further details on these spending patterns, looking at per head spend by source. For the EU27 the average EURO spend per head on R&D from the business enterprise sector is 318, from the government sector it is 65. For Poland the respective figures are 22 and 25. These are some of the lowest figures in the EU.

4.3 Patenting

4.3.1 Table 12 presents data on patenting applications to the European Patent Office (EPO) by member states. Poland has a relatively low patenting intensity, with around nine patents per million population, this compares to an EU average of 110 (though this average is driven largely by a relatively small number of highly patent intensive countries). Patenting activity in Poland is significantly lower than a number of other newer member states including the Czech Republic and Hungary. When looking at patenting by GERD spending the gap between Poland and the average reduces.

4.4 High-tech and knowledge intensive services

4.4.1 Table 13 provides data on employment in science and technology. Poland has some 4.5 million employees working in a science and technology occupations; although the proportion of the

[3] Eurostat http://epp.eurostat.ec.europa.eu/statistics_explained/index.php?title=File:Share_of_foreigners_in_the_resident_population,_1_January_2012,%28%25%29.png&filetimestamp=20130325101452

workforce employed in these occupations is relatively low compared to many other European countries, standing at 28.9 per cent compared to an EU average of 33.9.

4.5 Innovation among enterprises

4.5.1 Tables 14 to 18 provide information on firm level innovation from the Community Innovation Survey. The definition of innovation here is relatively broad, encompassing any elements of product and process innovation. The data for Poland shows that:

- Firm level engagement in R & D is relatively weak comparative to other European countries
- Lack of funding for innovation appears an issue for a sizeable proportion of firms
- Improving the quality of goods or services is a core driver of innovation

4.5.2 Compared to many other member states fewer Polish enterprises receive public funding for innovation activities, but Government or public research institutes are a more important sources of information about innovation in Poland than in most other countries.

4.6 How diffuse is innovative activity?

4.6.1 Table 19 provides details of Euro per head R&D expenditure (GERD) and the location quotients of high-tech employment for the Polish NUTs 2 regions. The data demonstrate a relatively uneven pattern of research and development activities with spending heavily skewed towards the Mazowieckie area (which includes Warsaw) and high-tech employment to the Mazowiecke and Pomorskie areas (which includes Gdansk).

5.0 Qualitative information on research and innovation

5.1 In contrast to the previous sections, which have focused on quantitative data, we now refer to qualitative information that may be related to R&D&I policies. In particular, it sets out the European Commission Recommendations for Poland 2013.

5.2 European Commission Recommendations for Poland 2013

5.2.1 The following text is formed from quotes from the European Council and European Commission (2013e, d). “The recommendations are based on a thorough assessment of every Member State's plans for sound public finances and policy measures to boost growth and jobs”

5.2.2 For Poland the article praised some positive steps. For example, the European Council and Commission are the first to acknowledge that “Poland undertook considerable consolidation efforts in 2011-2012”. The report also points out some areas that could be improved. Below are five selected quotes that may be related to innovation and R&D policies:

- “Tax compliance remains a key issue in terms of combating tax evasion, which also requires reducing the administrative burden on taxpayers and improving the efficiency of tax administration”
- “A low share of growth-enhancing expenditure (education, research and innovation) and declining public investments hamper long term growth prospects”
- “Poland is among the EU countries with the lowest level of R&D expenditure and is one of the worst performers in broader innovativeness indicators. The overall ratio of R&D expenditures to GDP in Poland, at 0.77 % in 2011, was among the lowest in the EU. In particular, private R&D expenditure is low (0.2% of GDP in 2011). Polish enterprises have relied largely on

technology absorption, i.e. application of already existing technologies through fixed capital investment. While this has been successful in ensuring productivity gains and economic growth, Poland now needs a transition towards a more indigenous innovation-based model. Reforms of the science and higher education system initiated a major restructuring to induce science-industry cooperation. (…) A more holistic approach is needed to align efforts in research, innovation and industrial policy and ensuring that there are adequate instruments supporting the whole innovation cycle"

- "Poland's public administration performs below the EU average. Key problems include transparency, the complexity of the tax system and compliance costs, the increasing average length of proceedings in civil and commercial cases, and long insolvency proceedings and low recovery rates. The use of eGovernment in the public administration also remains below the EU average. Poland initiated a reform to facilitate access to regulated professions that is behind the initially announced schedule"

5.2.3 Based on the assessment which included the previous five points, the Commission recommended the following action which could be could be related to R&D&I policies. It should be noted that the 2013 recommendations for Poland were very similar to the previous year.

- "5. Take additional measures to ensure an innovation-friendly business environment by strengthening the links between research, innovation and industrial policy, by further developing revolving instruments and tax incentives and by better targeting existing instruments to the different stages of the innovation cycle. "

ANNEX 1:
Tables on the scale and intensity of research and innovation activities

Table 1: FP7 Participations and success rates of older EU members and Poland; 2007-2012

	FP7 participations	Success rate (%)
Belgium	4,553	26.2
Denmark	2,132	24.2
Germany	13,845	23.8
Ireland	1,512	21.9
Greece	2,910	16.3
Spain	8,357	19.7
France	9,678	25.0
Italy	9,111	18.2
Luxembourg (2010)	148	19.2
Netherlands	6,128	25.4
Austria	2,673	21.9
Portugal	1,747	18.7
Finland	2,060	21.5
Sweden	3,544	23.5
United Kingdom	13,559	23.2
Poland	1,834	18.5

[Source: EC Sixth FP7 Monitoring Report, 2013]

Table 3: FP7 beneficiaries, success rate and resources by country

	Number of beneficiaries in FP7 2007-2012	Success rate in FP7 2007-2012 (%)	Million € captured	Number of beneficiaries /million inhabitants	FP7 €/inhabitant	Average €/beneficiary	SME beneficiaries in FP7 2007-2011	Per cent SME beneficiaries
BG	585	16.4	83	80.1	11.4	141,880	62	21.9
CY	357	15.6	63	446.3	78.8	176,471	39	26.9
CZ	1100	19.9	200	104.8	19.0	181,818	131	22.5
EE	412	21.2	68	316.9	52.3	165,049	51	26.5
HU	1260	20.3	220	127.3	22.2	174,603	163	26.8
LT	350	20.1	48	175.0	24.0	137,143	29	9.5
LV	249	21.7	30	83.0	10.0	120,482	10	19.1
MT	153	19.3	14	382.5	35.0	91,503	15	21.4
PL	1834	18.5	344	47.6	8.9	187,568	138	14.8
RO	862	14.6	119	40.5	5.6	138,051	105	21.9
SI	717	15.9	131	358.5	65.5	182,706	92	23.3
SK	401	18.3	62	74.3	11.5	154,613	85	21.7
HR	317	17.1	59	72.1	13.4	186,120	n.a.	n.a
Average		*18.1*		*80.5*	*13.5*	*167,617*		
Country average		*18.4*		*177.6*	*27.5*	*156,770*		*20*

[Sources: EC Sixth FP7 Monitoring Report, 2013; EC SME participation in FP7 report, 2012; EURADA, 2014; authors' calculations]

Table 4: FP7 Funding adjusted for Purchasing Power Parity (using 2012 prices)

	Millions Euros captured	Euros per inhabitant	Euros per beneficiary
Austria	809.48	96.37	302,835
Belgium	1272.56	115.69	279,499
Bulgaria	171.84	23.54	293,748
Croatia	84.41	19.18	266,266
Cyprus	72.08	90.10	201,911
Czech Republic	277.01	26.39	251,826
Denmark	549.47	98.12	257,723
Estonia	88.43	68.02	214,627
Finland	605.59	112.14	293,975
France	3293.25	50.35	340,282
Germany	5461.92	66.78	394,505
Greece	840.39	70.62	288,794
Hungary	364.84	36.85	289,557
Ireland	363.25	80.72	240,243
Italy	2710.24	44.58	297,469
Latvia	41.90	20.95	168,271
Lithuania	75.12	25.04	214,621
Luxembourg	22.11	44.23	149,412
Malta	17.99	44.99	117,613
Netherlands	2182.16	130.67	356,096
Poland	606.70	15.77	330,808
Portugal	434.23	41.35	248,555
Romania	214.80	10.09	249,190
Slovakia	88.07	16.31	219,621
Slovenia	158.02	79.01	220,393
Spain	2459.43	51.13	294,296
Sweden	988.34	105.14	278,876
United Kingdom	4078.97	65.48	300,831
EU (28 countries)	29350.00	57.65	324,116

Table 5: Juste Retour of FP7 to overall Member State budget contribution

FP7 return on contribution to the EU budget			
	FP7 funding 2010 (mio EUR)	Contribution to EU budget 2010 (mio EUR)	Ratio FP7/ contribution to the budget (%)
EU15			
AT	131.1	2 432.2	5.4
BE	212.6	3 244.9	6.6
DE	895.2	20 645.8	4.3
DK	108.6	2 159.5	5.0
ES	397.0	9 447.5	4.2
FIN	99.7	1 639.8	6.1
FR	551.5	18 443.1	3.0
GR	98.6	2 240.7	4.4
IRL	73.7	1 215.7	6.1
IT	440.0	13 983.8	3.1
LU	3.9	259.8	1.5
NL	394.6	4 058.2	9.7
PT	55.0	1 525.6	3.6
SE	198.9	2 385.1	8.6
UK	528.5	11 546.8	4.6
EU12			
BG	13.2	311.4	4.3
CY	8.9	159.8	5.6
CZ	32.1	1 242.7	2.6
EE	10.2	124.2	8.2
HU	34.7	862.1	4.0
LT	5.0	248.3	2.0
LV	6.6	161.2	4.1
MT	1.4	52.4	2.7
PL	63.5	3 171.5	2.0
RO	15.5	1 071.3	1.5
SK	8.1	597.6	1.4
SLO	19.6	328.7	6.0

[Sources: DG Research & DG Budget reproduced in Eurada, 2014]

Table 6: FP7 versus ERDF funding

Countries	FP7 contribution 2007-2011 (mio EUR)	ERDF earmarked budget for R&D 2007-2013 (mio EUR)	Ratio FP7/ERDF
Austria	673,3	362	1.90
Belgium	1 096,2	315	3.50
Bulgaria	67,3	386	0.20
Cyprus	45,4	70	0.60
Czech Republic	164,1	3 656	0.04
Germany	4 342,2	4 599	0.90
Denmark	597,1	159	3.80
Estonia	54,8	655	0.08
Greece	619,4	1 474	0.40
Spain	1 744,6	5 645	0.30
Finland	592,6	468	1.30
France	2 835,7	2 240	1.30
Hungary	177,7	2 065	0.09
Ireland	322	138	2.30
Italy	2176	6 060	0.40
Lithuania	33,7	1 017	0.03
Luxembourg	20,6	17	1.20
Latvia	22,4	746	0.03
Malta	11	58	0.20
Netherlands	1 757,7	283	6.20
Poland	**280,7**	**8 580**	**0.03**
Portugal	282,7	3 538	0.08
Romania	96,7	1 111	0.09
Sweden	974,8	405	2.40
Slovenia	98,8	974	0.10
Slovakia	46,7	1 189	0.04
United Kingdom	3 669,9	2 253	1.60
TOTAL EU 27/year	22 804,1	49 711	0.46

[Source: DG Research and DG Regio – Cohesion Policy 2007-2013: Research and Innovation reproduced in Eurada, 2014]

Table 8: Barriers and enablers of participation in R&D&I

	Public expenditure on education as a % of GDP	Scholarly papers published in thousands	Number of universities in the Shanghai 500	% population living in urban areas	Broadband use at home	Social network use in last 3 months, % yes	Discretionary learning at work	Ease of Doing Business ranking	% population able to hold conversation in English
PL	5,1	31,9	2	61	58	56,5	33,5	45	33
EU 28	5,4	31,0	6,5	69,4	66,0	53,0	37,3	41,8	49,5
EU 15	5,6	51,3	177*	72,4	73,1	52,1	41,4	32,6	56,0
EU 13	5,1	7,6	5*	66,0	58,4	59,6	29,7	52,4	43,1
Best	(DK) 7,8	(UK) 153	(DE) 38	(BE)* 99	(SE) 90	(LV) 79	(SE) 67,2	(DK) 5	(NL) 90
Worse	(SK) 3,6	(MT) 0,4	(11 MSs) 0	(PT) 38	(RO) 36	(CZ) 37	(BG) 20,3	(MT) 103	(HR) 20

*Notes: 1) For % of people able to have an English conversation, UK and IE are excluded. Also only EU citizens are included 2) For broadband use at home, for Germany, only Eastern Germany is included. 3) For % of population living in urban areas MT (100%) is excluded. 4) For number of universities in the Shanghai Rank, for EU15 and NMS13, average it is not shown but sum of all in each group. 5) The 11 MSs without any university in the rank, are: BG, CY, EE, EL, HU, LT, LV, MT, RO and SK.

Table 9: Innovation index

	Summary Innovation Index	Human resources	Research systems	Finance and support	Firm investments	Linkages & entrepreneurship	Intellectual assets	Innovators	Economic effects
EU	**0.544**	0.557	0.478	0.585	0.406	0.532	0.555	0.571	0.603
Belgium	**0.624**	0.644	0.737	0.527	0.417	0.809	0.534	0.722	0.585
Bulgaria	**0.188**	0.429	0.094	0.085	0.111	0.088	0.231	0.064	0.245
Czech Republic	**0.402**	0.537	0.227	0.343	0.409	0.429	0.275	0.518	0.486
Denmark	**0.718**	0.605	0.800	0.729	0.569	0.831	0.828	0.632	0.671
Germany	**0.720**	0.626	0.553	0.610	0.637	0.731	0.814	1.000	0.728
Estonia	**0.500**	0.565	0.289	0.760	0.594	0.604	0.483	0.606	0.409
Ireland	**0.597**	0.758	0.682	0.320	0.305	0.566	0.425	0.702	0.791
Greece	**0.340**	0.506	0.294	0.151	0.220	0.485	0.122	0.676	0.347
Spain	**0.407**	0.433	0.493	0.436	0.223	0.297	0.399	0.318	0.507
France	**0.568**	0.669	0.664	0.631	0.347	0.498	0.516	0.532	0.611
Italy	**0.445**	0.420	0.354	0.289	0.287	0.404	0.519	0.616	0.535
Cyprus	**0.505**	0.577	0.378	0.198	0.479	0.731	0.427	0.494	0.543
Latvia	**0.225**	0.451	0.083	0.375	0.111	0.103	0.330	0.123	0.220
Lithuania	**0.280**	0.645	0.144	0.563	0.396	0.229	0.128	0.227	0.214
Luxembourg	**0.626**	0.549	0.692	0.636	0.231	0.630	0.666	0.876	0.652
Hungary	**0.323**	0.452	0.169	0.271	0.244	0.217	0.250	0.131	0.590
Malta	**0.284**	0.129	0.224	0.104	0.356	0.220	0.293	0.363	0.419
Netherlands	**0.648**	0.648	0.864	0.720	0.339	0.753	0.649	0.621	0.603
Austria	**0.602**	0.597	0.538	0.474	0.473	0.769	0.796	0.636	0.476
Poland	**0.270**	**0.550**	**0.094**	**0.383**	**0.319**	**0.094**	**0.271**	**0.078**	**0.324**
Portugal	**0.406**	0.404	0.435	0.414	0.279	0.416	0.312	0.728	0.378
Romania	**0.221**	0.421	0.087	0.218	0.137	0.083	0.101	0.124	0.433
Slovenia	**0.508**	0.671	0.385	0.521	0.437	0.623	0.506	0.476	0.479
Slovakia	**0.337**	0.746	0.116	0.302	0.210	0.301	0.155	0.289	0.470
Finland	**0.681**	0.827	0.550	0.788	0.621	0.689	0.690	0.628	0.663
Sweden	**0.747**	0.900	0.775	0.829	0.659	0.802	0.767	0.693	0.612
United Kingdom	**0.622**	0.749	0.795	0.730	0.459	0.832	0.452	0.271	0.626
Croatia	**0.302**	0.586	0.125	0.292	0.218	0.379	0.107	0.389	0.350

[Source: European Commission 2013 Innovation Union Scoreboard]

Table 10: Sources of spending on Research and Development, per cent, 2010

	Total GBAORD as a % of total general government expenditure. 2011	Business enterprise sector	Government sector	Higher education sector	Private non-profit sector	Abroad
EU27	1.47	53.9	34.6	0.9	1.6	8.9
Belgium	1.21	:	:	:	:	:
Bulgaria	0.7	16.7	43.2	0.5	0.1	39.6
Czech Republic	1.56	48.9	39.9	0.8	0	10.4
Denmark	1.77	60.7	27.1	:	3.5	8.7
Germany	2	65.6	30.3	:	0.2	3.9
Estonia	2.06	43.6	44.1	0.6	0.2	11.4
Ireland	1.05	52.6	29.5	0.8	0.6	16.5
Greece	0.53	:	:	:	:	:
Spain	1.51	43	46.6	3.9	0.7	5.7
France	1.5	53.5	37	1	0.8	7.6
Italy	1.13	44.7	41.6	0.9	3.1	9.8
Cyprus	0.97	12.7	68.3	3.5	0.5	15
Latvia	0.38	38.8	26.4	1.4	:	33.4
Lithuania	1.19	32.4	46	1.5	0.2	19.9
Luxembourg	1.39	44.3	34.8	0.1	0.1	20.7
Hungary	0.6	47.4	39.3	:	0.9	12.4
Malta	0.53	53.9	34.7	0.2	0.1	11.1
Netherlands	1.58	:	:	:	:	:
Austria	1.53	44.7	38.7	:	0.5	16.1
Poland	**0.76****	**24.4**	**60.9**	**2.5**	**0.3**	**11.8**
Portugal	2.08	44.1	44.9	3.2	4.6	3.2
Romania	0.68	32.3	54.4	2.2	0	11.1
Slovenia	1.09	58.4	35.3	0.3	0.1	6
Slovakia	1.23	35.1	49.6	0.4	0.3	14.7
Finland	2	66.1	25.7	0.2	1.1	6.9
Sweden	1.62	:	:	:	:	:
United Kingdom	1.22	44	32.3	1.2	4.8	17.6
Croatia		38.8	49.2	2	0.2	9.9

***Figures from 2009*

[Source: EUROSTAT: rd_e_fundgerd; gba_nabste]

Table 11: Levels of funding for Research and Development by source of funds, 2011

	Total	Business enterprise sector	Government sector	Higher education sector	Private non-profit sector
EU27	510.8	318.4	64.7	122.5	5
Belgium	686.9	461.1	62	157	6.8
Bulgaria	29.8	15.9	10.7	3.1	0.2
Czech Republic	274.2	165.4	48.1	59.3	1.3
Denmark	1,337.4	903.7	28.9	399.2	5.7
Germany	901.4	603.6	133.3	164.5	:
Estonia	282.8	177.2	23.2	79.8	2.6
Ireland	599.7	405.9	28.9	165	:
Greece	:	:	:	:	:
Spain	307.3	160.3	59.9	86.7	0.5
France	691.2	438.4	97.6	146.6	8.5
Italy	325.9	176.5	44.7	93.1	11.6
Cyprus	102.6	16.3	17.5	54.2	14.6
Latvia	67.8	18.8	15.8	33.2	:
Lithuania	92.4	24.1	18.1	50.2	:
Luxembourg	1,187.5	813.1	227.6	146.7	:
Hungary	120.6	75.3	19	24.3	:
Malta	113.9	76	3.7	34.2	0
Netherlands	738	385.2	80	272.8	:
Austria	983.2	669.5	52.5	256.6	4.7
Poland	**73.6**	**22.2**	**25.4**	**25.8**	**0.2**
Portugal	241.9	111	18.2	92.6	20
Romania	30.7	11.1	12.5	7	0.1
Slovenia	436.2	322.2	62.4	51.4	0.2
Slovakia	86.9	32.3	24	30.4	0.2
Finland	1,332.7	939	117.9	266.4	9.4
Sweden	1,389	962.5	60.2	361.8	4.5
United Kingdom	495.8	304.7	46	133.2	11.8
Croatia	76.2	34.1	20.9	21.2	0.1

[Source: EUROSTAT: rd_e_gerdact]

Table 12: Patent applications to the European Patent Office, 2010

	Number	Per million inhabitants	Per million EURO of total R & D expenditure (GERD)	High-tech patents. Number
EU27	54,921.12	109.6	223.55	4,662.45
Belgium	1,335.12	123.17	189.45	174.75
Bulgaria	11.62	1.54	54.1	:
Czech Republic	183.25	17.44	78.49	7.03
Denmark	1,173.34	212	162.77	89.4
Germany	22,718.71	277.73	325.44	1,675.88
Estonia	51.53	38.45	221.92	4.05
Ireland	348.93	78.1	124.78	36.53
Greece	89.57	7.92	:	3.83
Spain	1,567.84	34.09	107.47	132.12
France	8,605.18	133.01	197.22	1,089.88
Italy	4,117.49	68.24	210.73	199.89
Cyprus	17.53	21.83	202.66	1
Latvia	:	8.48	175.52	:
Lithuania	8	2.4	36.56	2
Luxembourg	59.28	118.07	90.15	5.08
Hungary	184.5	18.42	163.84	21.27
Malta	:	19.6	210.33	:
Netherlands	3,249.59	196.05	301.75	253.67
Austria	1,647.41	196.7	208.78	85.45
Poland	**332.63**	**8.72**	**127.57**	**38.38**
Portugal	87.49	8.22	31.84	5.13
Romania	32.72	1.52	57.11	3
Slovenia	128.87	62.96	172.76	4.32
Slovakia	27	4.98	64.85	2.3
Finland	1,293.84	241.77	185.6	117.53
Sweden	2,526.5	270.48	212.85	247.92
United Kingdom	5,098.88	82.2	169.56	462.03
Croatia	18.84	4.26	56.21	1

[Source: EUROSTAT: pat_ep_ntot]

Table 13: Employment in Science and Technology, 2012

	Employed in a Science and Technology Occupation (thousands)	Percentage employed in science and technology occupations
European Union (27 countries)	73,004	33.9
Belgium	1,645	36.4
Bulgaria	685	23.4
Czech Republic	1,556	31.9
Denmark	1,164	43.3
Germany	15,599	39.2
Estonia	205	32.9
Ireland	611	33.5
Greece	1,004	26.7
Spain	4,791	27.7
France	9,633	37.4
Italy	7,046	30.8
Cyprus	120	31.1
Latvia	269	30.4
Lithuania	432	33.8
Luxembourg	128	54.6
Hungary	1,182	30.5
Malta	52	30.4
Netherlands	3,302	39.7
Austria	1,421	34.1
Poland	**4,486**	**28.9**
Portugal	1,133	24.9
Romania	1,853	20.0
Slovenia	309	33.7
Slovakia	666	28.6
Finland	972	39.2
Sweden	1,949	42.1
United Kingdom	10,792	36.9
Croatia	407	28.4

[Source: EUROSTAT: hrst_st_ncat; hrst_st_nocc]

Table 14: Types of innovation undertaken by innovative enterprises in core NACE activities[4] related to innovation, 2010, per cent

	Enterprises, engaged in in-house R&D activities	Enterprises, engaged in external R&D activities	Enterprises, engaged in acquisition of machinery, equipment and software	Enterprises, engaged in acquisition of other external knowledge	Enterprises, engaged in training for innovation activities	Enterprises, engaged in market introduction of innovations	Enterprises, engaged in other innovation activities	Enterprises, engaged continuously in in-house R&D activities	Enterprises, engaged occasionally in in-house R&D activities
Belgium	56.3	31.5	61.0	20.6	60.0	35.8	30.4	31.5	24.8
Bulgaria	14.8	9.6	65.9	18.3	34.0	26.1	29.5	4.4	10.4
Czech Republic	58.1	30.1	77.5	25.4	47.1	41.5	43.9	28.5	29.7
Denmark	44.8	20.7	48.0	39.5	29.6	n/a	n/a	n/a	n/a
Germany	48.5	16.9	n/a	n/a	n/a	n/a	n/a	28.3	20.1
Estonia	51.9	29.3	86.0	48.2	52.7	35.8	79.9	15.4	36.5
Ireland	45.5	20.9	50.1	12.9	n/a	n/a	n/a	n/a	n/a
Spain	32.3	19.0	31.5	1.8	23.6	17.2	7.8	23.8	8.5
France	66.8	32.2	57.8	30.8	60.3	37.1	44.7	40.9	25.9
Croatia	64.7	31.5	83.1	30.5	54.3	42.9	42.9	10.3	54.3
Italy	46.2	17.0	83.5	13.0	31.9	29.1	9.7	27.0	19.2
Cyprus	42.0	39.8	99.2	64.6	90.6	57.0	91.4	8.7	33.3
Latvia	33.0	18.7	51.6	30.8	35.7	36.3	29.0	12.2	20.8
Lithuania	53.6	40.7	71.4	42.0	60.6	46.8	37.4	23.8	29.8
Luxembourg	n/a	21.6	62.9	23.9	68.2	51.9	27.6	n/a	n/a
Hungary	46.5	26.3	65.8	21.0	37.6	25.5	39.2	20.8	25.8
Malta	35.1	1.8	38.3	9.9	36.9	28.8	28.4	18.5	17.6
Netherlands	56.9	24.1	53.1	16.8	39.2	27.1	23.7	36.9	20.0
Austria	50.9	28.3	62.5	34.4	59.1	46.2	47.8	27.4	23.5
Poland	**31.1**	**20.5**	**77.5**	**21.0**	**55.5**	**36.0**	**42.9**	**13.4**	**17.7**
Portugal	42.9	22.9	66.9	13.6	56.6	26.5	33.2	16.7	26.3
Romania	37.2	12.4	77.4	14.9	36.3	38.4	27.0	16.6	20.7
Slovenia	74.2	37.5	74.3	35.1	44.4	44.4	40.5	30.9	43.2
Slovakia	49.0	27.1	71.5	19.6	61.3	57.2	50.7	18.8	30.2
Finland	79.2	54.9	66.6	42.3	34.7	39.3	37.9	37.7	41.5
Sweden	59.7	28.0	74.8	52.3	23.5	34.7	22.6	27.1	32.6
United Kingdom	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

[Source: EUROSTAT: inn-cis7_type]

4 Innovative enterprises with 'Product and/or process innovative enterprises, regardless of organisational or marketing innovation (including enterprises with abandoned/suspended or on-going innovation activities)'. NACE: B, C, D, E, G46, H, J58, J61, J62, J63, K and M71

Table 15: Highly important barriers to innovation reported by innovative enterprises in core NACE activities related to innovation, 2010, per cent

	Lack of qualified personnel	Lack of information on technology	Lack of information on markets	Difficulty in finding cooperation partners for innovation	Markets dominated by established enterprises	Uncertain demand for innovative goods or services	No need to innovate due to prior innovations	No need to innovate due to no demand for innovations	Lack of funds within the enterprise or group	Lack of finance from sources outside the enterprise	Innovation costs too high
Belgium	13.6	3.8	4.2	5.3	12.9	10.2	4.0	4.2	18.0	9.5	16.5
Bulgaria	16.6	7.7	9.7	19.8	20.8	26.7	5.4	7.7	35.5	28.8	37.9
Czech Rep	10.8	2.1	2.5	3.5	18.1	11.0	3.1	5.2	30.9	17.1	23.2
Denmark	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.9
Germany	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.2
Estonia	14.0	4.1	3.7	4.7	12.1	8.9	4.2	4.8	20.1	17.5	36.5
Ireland	8.2	2.7	5.1	5.8	13.2	15.6	5.0	6.8	24.6	20.2	27.4
Spain	10.6	7.9	8.8	12.2	17.4	26.9	6.1	8.7	37.4	35.8	37.2
France	14.1	4.6	6.1	8.8	14.4	18.8	3.2	4.6	32.6	19.0	30.7
Croatia	14.0	4.7	5.4	9.8	16.1	14.9	2.0	3.2	40.9	31.5	32.0
Italy	8.6	3.4	4.2	11.6	16.0	21.1	0.2	4.1	27.5	27.5	29.1
Cyprus	9.7	7.9	5.2	8.9	15.5	15.1	0.2	n/a	26.2	27.7	27.3
Latvia	11.5	4.2	6.0	10.2	18.0	11.4	5.1	6.9	23.2	16.8	11.1
Lithuania	12.2	5.4	5.7	8.7	16.5	9.5	3.4	1.4	21.3	15.5	26.9
Luxembourg	12.5	1.3	2.5	10.7	19.4	15.1	5.3	8.0	12.1	5.3	22.5
Hungary	10.6	3.5	4.7	5.6	13.9	22.3	2.3	6.3	28.4	18.2	32.3
Malta	6.8	3.2	7.2	7.7	16.2	17.6	2.7	5.0	21.2	18.5	38.7
Netherlands	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Austria	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Poland	**8.0**	**6.2**	**5.7**	**8.7**	**17.0**	**15.8**	**5.2**	**6.3**	**28.7**	**24.0**	**27.9**
Portugal	12.9	6.8	7.4	13.8	19.1	21.2	5.2	8.8	34.6	31.8	8.3
Romania	9.3	3.8	5.1	7.6	21.3	19.3	5.6	5.2	36.3	26.2	21.7
Slovenia	5.8	1.5	2.1	2.8	4.7	4.0	0.6	0.9	10.5	8.0	13.1
Slovakia	10.0	4.2	4.8	4.6	14.0	10.4	n/a	n/a	27.0	n/a	10.9
Finland	10.0	2.8	4.5	3.4	6.4	10.4	3.4	3.3	17.8	11.9	13.3
Sweden	11.5	1.7	2.7	2.6	12.1	6.6	1.5	1.9	16.2	10.3	23.4
UK	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

[Source: EUROSTAT:inns_cis7_ham]

Table 16: Highly important objectives of innovation reported by innovative enterprises in core NACE activities related to innovation, 2010, per cent

	Increasing range of goods or services	Replacing outdated products or processes	Improving quality of goods or services	Improving flexibility for producing goods or services	Increasing capacity for producing goods or services	Reducing labour costs per unit output	Improving health or safety of the employees	Entering new markets or increasing market share	Reducing environmental impacts	Reducing material and energy costs per unit output
Belgium	49.7	38.7	47.0	27.6	27.0	20.1	14.7	41.2	16.2	14.7
Bulgaria	40.9	29.9	45.9	28.7	27.1	25.9	28.9	39.8	20.7	21.2
Czech Rep	49.2	31.9	44.7	27.7	24.2	25.0	16.1	33.0	15.1	19.0
Denmark	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Germany	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Estonia	40.3	38.0	46.5	28.0	32.5	25.3	17.3	36.5	12.9	18.9
Ireland	47.9	30.3	52.6	33.8	30.2	40.2	30.1	55.3	23.2	34.9
Spain	35.0	28.2	43.2	33.6	36.1	24.8	20.9	35.6	19.2	18.1
France	58.8	35.9	48.1	24.1	26.7	24.5	21.3	61.3	21.3	18.5
Croatia	48.1	38.2	58.7	39.9	31.5	30.4	25.4	40.9	26.3	23.5
Italy	43.4	26.4	51.3	24.6	24.3	15.3	27.3	33.4	16.8	14.4
Cyprus	68.8	76.1	84.1	75.3	72.4	46.8	50.4	64.2	36.8	36.3
Latvia	49.6	44.5	57.5	29.7	31.8	31.7	27.8	53.6	26.6	31.5
Lithuania	42.8	44.1	54.7	37.7	37.6	32.4	31.1	41.3	26.2	27.5
Luxembourg	74.8	33.4	69.8	38.2	33.7	25.5	24.5	53.1	23.7	16.7
Hungary	61.4	47.8	68.2	46.0	35.6	25.0	33.0	66.4	34.9	34.5
Malta	41.0	19.8	44.6	27.9	21.6	24.3	23.9	33.8	17.6	20.3
Netherlands	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Austria	50.3	41.1	58.0	33.3	28.8	19.4	21.1	49.1	19.9	21.0
Poland	**49.4**	**39.5**	**49.6**	**24.8**	**31.8**	**21.8**	**25.4**	**43.0**	**21.5**	**21.3**
Portugal	39.8	30.0	50.8	32.0	34.2	35.4	34.0	42.1	26.0	27.2
Romania	57.9	40.9	67.3	38.1	41.1	27.9	37.6	46.7	29.8	30.4
Slovenia	72.8	46.3	66.3	38.1	35.1	43.6	33.9	55.2	32.9	37.2
Slovakia	54.8	40.6	60.3	46.4	30.8	24.0	31.9	41.6	24.4	29.3
Finland	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Sweden	40.2	28.5	38.9	20.8	21.2	21.2	16.5	34.3	18.2	18.0
UK	49.7	38.7	47.0	27.6	27.0	20.1	14.7	41.2	16.2	14.7

[Source: EUROSTAT: inn_cis7_obj]

Table 17: Public funding for innovation reported by innovative enterprises in core NACE activities related to innovation, 2010, per cent

	Enterprises that received any public funding	Enterprises that received funding from local or regional authorities	Enterprises that received funding from central government (including central government agencies or ministries)	Enterprises that received funding from the European Union	Enterprises that received funding from the 7th Framework Programme
Belgium	22.6	15.2	9.4	5.9	2.3
Bulgaria	16.1	0.5	7.9	9.9	0.9
Czech Republic	24.0	2.9	12.7	16.4	5.9
Denmark	n/a	n/a	n/a	n/a	n/a
Germany	21.6	8.5	14.2	4.0	3.2
Estonia	24.5	1.7	17.6	11.3	2.1
Ireland	n/a	n/a	n/a	n/a	n/a
Spain	26.9	16.9	14.2	2.6	1.3
France	46.1	13.3	41.5	9.1	2.1
Croatia	29.0	5.5	25.4	2.1	0.1
Italy	29.2	20.3	9.7	2.9	0.5
Cyprus	42.0	2.6	37.8	9.8	2.3
Latvia	14.3	0.9	4.0	13.8	4.8
Lithuania	35.8	2.8	6.3	34.0	3.7
Luxembourg	16.8	0.0	15.9	3.3	2.0
Hungary	34.4	1.0	19.5	20.6	2.1
Malta	19.4	n/a	16.7	8.1	0.5
Netherlands	34.1	13.0	32.6	3.9	1.0
Austria	n/a	n/a	n/a	n/a	n/a
Poland	**19.6**	**3.5**	**5.6**	**15.6**	**3.1**
Portugal	24.1	2.5	19.2	6.8	1.7
Romania	9.3	2.2	6.1	4.0	1.4
Slovenia	31.3	3.5	25.2	15.3	4.2
Slovakia	15.5	0.4	4.3	12.7	1.9
Finland	35.2	6.5	30.6	5.8	1.7
Sweden	n/a	n/a	n/a	n/a	n/a
United Kingdom	n/a	n/a	n/a	n/a	n/a

[Source: EUROSTAT: inn_cis7_pub]

Table 18: Highly important sources of information for product and process innovation reported by innovative enterprises in core NACE activities related to innovation, 2010, per cent

	The enterprise or the enterprise group	Suppliers of equipment, materials, components or software	The clients or customers	The competitors or other enterprises of the same sector	Consultants commercial labs or private R&D institutes	Universities or other higher education institutes	Government or public research institutes	Conferences, trade fairs, exhibitions	Scientific journals and trade/technical publications	Professional and industry
Belgium	54.4	26.9	25.7	8.9	5.3	4.9	1.7	9.6	7.1	4.2
Bulgaria	30.2	23.1	25.7	14.8	6.4	3.6	2.3	14.1	10.8	6.2
Czech Rep	42.9	20.9	35.6	16.8	3.8	4.1	2.6	11.0	4.8	1.8
Denmark	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Germany	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Estonia	31.0	28.1	18.4	10.5	6.2	4.1	1.0	11.2	2.1	1.1
Ireland	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Spain	46.1	25.2	20.7	10.5	8.4	5.1	6.5	8.0	4.9	4.3
France	53.3	19.2	26.9	10.1	5.8	3.7	2.9	10.3	8.4	5.7
Croatia	45.0	25.7	32.8	15.1	5.1	2.2	0.7	11.5	6.8	2.7
Italy	35.8	21.6	17.1	4.8	14.2	3.4	0.9	9.7	5.0	5.0
Cyprus	90.7	71.3	60.8	45.3	41.8	8.2	6.8	56.0	32.0	15.3
Latvia	41.7	23.2	30.0	18.6	9.5	4.2	1.8	18.1	8.3	4.9
Lithuania	45.4	21.7	28.6	18.1	4.9	3.1	2.3	9.7	9.3	7.3
Luxembourg	61.4	30.4	38.1	24.0	10.3	5.3	4.0	29.1	18.7	18.0
Hungary	50.4	27.3	38.0	22.2	12.8	10.8	4.4	14.4	9.3	6.9
Malta	42.3	32.0	34.2	21.2	7.2	3.6	1.4	13.1	4.1	4.5
Netherlands	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Austria	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Poland	**47.4**	**20.9**	**18.8**	**11.2**	**5.8**	**5.4**	**6.4**	**13.2**	**10.3**	**4.8**
Portugal	36.7	19.5	29.9	11.0	7.5	4.2	2.7	13.0	6.9	6.3
Romania	43.4	33.4	33.5	23.0	7.5	3.7	2.5	14.0	11.0	5.0
Slovenia	63.6	30.0	46.0	23.7	7.5	5.5	3.4	17.1	9.6	5.8
Slovakia	49.5	26.2	43.1	17.3	3.5	2.2	1.1	11.5	11.3	3.0
Finland	62.1	14.8	39.5	11.5	3.8	4.5	2.8	7.3	3.7	3.3
Sweden	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
UK	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

[Source: EUROSTAT: inn_cis7_sou]

Table 19: Euro per head R&D expenditure, 2011, and location quotients of high-tech employment, 2012

	Spending per inhabitant on R & D (Euro)	High-tech sectors
Lódzkie	55.2	0.9
Mazowieckie	215.4	2.2
Malopolskie	88	0.5
Slaskie	54.1	0.8
Lubelskie	42.1	0.6
Podkarpackie	61.8	1.0
Swietokrzyskie	27.1	0.5
Podlaskie	28.1	1.5
Wielkopolskie	64.1	1.3
Zachodniopomorskie	27.7	1.0
Lubuskie	13.3	1.5
Dolnoslaskie	60.3	1.7
Opolskie	20.1	0.4
Kujawsko-Pomorskie	21.7	1.3
Warminsko-Mazurskie	33.6	0.6
Pomorskie	66.7	3.4

[Source: Eurostat: htec2_emp_reg2; rd_e_gerdreg]

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