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# Enhancing the Innovative Capacity of the Polish Economy

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# Enhancing the Innovative Capacity of the Polish Economy

By Rafał Wielądek

## Summary

Catching up with a low R&D intensity is the norm; turning into a mature economy without stepping up R&D activities is the rare exception. Poland's remarkable economic performance in the past 25 years strongly relied on competitive labour costs in low and low-to-medium-tech industries. Like many catching up economies before, Poland has now reached a stage of economic development where efficiency gains and sustained economic growth are more difficult to achieve. In a previous Brief on Poland\*, we identified the transformation towards medium-high and high-tech sectors as the most important challenge for the Polish economy over the medium to long term.

Since innovation is one of the key drivers of long-term economic growth, strengthening the innovative capacity of the Polish economy is crucial, even more so as employment growth is likely to be constrained by a bleak demographic outlook. Against this background, this Economic Brief looks at a couple of framework conditions important for innovation to understand why the Polish innovation performance has so far been modest and where bottlenecks are. At present, Poland lags significantly behind in many areas that characterise successful R&D and innovation systems. R&D spending in per cent of GDP is well below the EU average; it is also lower than in regional peers in Central and Eastern European countries (CEEC). The number of university graduates with a PhD in science is low. Cooperation between the research community and private enterprises is weak. Public support for R&D and innovation is limited and effectiveness of existing instruments seems limited.

To overcome the bottlenecks, several challenges need to be addressed to prepare the ground for the next 'catching-up' phase towards a mature economy. The EU funding from ERDF, ESF and EFSI is helpful in addressing these deficiencies. In addition, a dedicated strategy and a vision of a knowledge-based and innovation-driven economy have been developed. Now it is of crucial importance to ensure a swift and vigorous implementation of those policy initiatives. In order to release the innovative potential of Polish firms, it is important inter alia to continue focusing on better targeting the financial support for innovative companies, strengthening the links between private companies and the science/research sector, as well as on developing R&D-relevant skills. In addition, ensuring a competitive and open business environment could provide additional incentives for firms to innovate to remain successful in the marketplace.

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\* The Country Focus Volume 11, Issue 9, 2014 was the first in a series of briefs on the key challenges for the Polish economy. The second one was dedicated to the link between the labour market and product specialisation (Country Focus Volume 12, Issue 4, 2015), while this Economic Brief on the innovative capacity of the Polish economy concludes the series.



## Poland's current growth model relies on low- and medium-low technology

While Poland made remarkable economic progress over the last two decades, the catching-up process is getting more difficult. Efficiency gains, relatively high in the early phase of the systemic transformation, are now harder to achieve, which is evidenced by a slow-down in total factor productivity growth (TFP).<sup>1</sup> Moreover, the employment contribution to Poland's growth potential is going to be weakened in view of an unfavourable demographic outlook. According to the 2015 Aging Report, the Polish working age population is set to fall by around 15% over the next 20 years, compared to less than 7% for the EU.<sup>2</sup> As a result, Poland's medium to long term economic prospects depend on the capacity of its firms and the government to strengthen innovation and R&D, which are the key drivers of overall economic growth and especially of TFP.<sup>3</sup>

Since Poland's current product specialisation has a focus on low and medium-low tech industries, there are ample opportunities for the country by moving up the value chain. However, these growth reserves will not be released spontaneously; specific and decisive policy actions are required. Innovation policies play a crucial role in that regard.

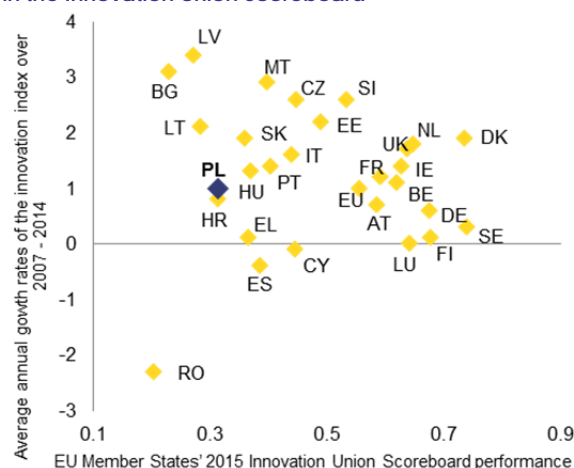
### Innovation – not yet in the spotlight

Because Poland's economy has been able to rely on a robust and lasting catching-up process, its innovative capacity has not had to be tested so much and has stayed latent. The country scores low in key European indices gauging the innovative performance, including the Innovation Union Scoreboard (IUS).<sup>4</sup> Although Poland is considered to be a 'moderate innovator' in 2015, only four EU Member States (Bulgaria, Latvia, Lithuania and Romania) perform worse. Moreover, since 2007 Poland has hardly changed its relative position and lost ground compared to almost all 'moderate' or 'modest' innovators (Graph 1).

Other indicators confirm the perception that R&D and innovation have not been in the spotlight so far. Although Poland's total R&D expenditure has shown an average annual growth of 9.7% between 2007 and 2013, with 0.9% of GDP it remains much below not only the EU average but also relative to regional peers. In particular, private sector R&D spending was especially low at 0.4 % of GDP in 2013. As a catching-up economy, Poland has been filling the technological gap by importing know-how and

technology. For example, in 2012 62% of total innovation expenditures in the core industries consisted of acquisition of machinery, equipment and software, while around 9 % was allocated to purchase external knowledge and R&D technology and 22% supported in-house R&D.<sup>5</sup>

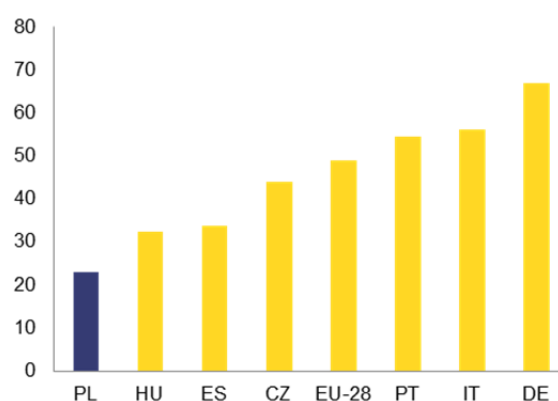
**Graph 1: Poland's ranking relative to EU Members States in the Innovation Union Scoreboard**



*Note:* The Innovation Union Scoreboard (IUS) measures the research and innovation performance of EU Member States: [http://ec.europa.eu/growth/industry/innovation/facts-figures/scoreboards/index\\_en.htm](http://ec.europa.eu/growth/industry/innovation/facts-figures/scoreboards/index_en.htm)  
*Source:* European Commission

Polish companies tend to introduce innovative products and/or processes to a much lesser extent than their counterparts in the EU as a whole. According to Eurostat's latest Community Innovation Survey (CIS)<sup>6</sup> only 23% of Polish firms are perceived as innovative enterprises, compared to almost 67% in Germany and roughly 50% for the EU.<sup>7</sup> Also, countries at a similar stage of economic development – e.g. Hungary and the Czech Republic – have a higher share of innovative enterprises than Poland<sup>8</sup> (Graph 2).

**Graph 2: Share of innovative enterprises in Poland and selected EU countries in 2010 – 2012.**



*Source:* Eurostat

## Ingredients for innovative companies – state of play in Poland

Innovation is a complex process. It is influenced by many factors – firm-specific (e.g. age, size, and ownership structure) or external (e.g. product market regulations, trade framework, availability of skilled labour, access to finance) – which interact and determine the firm's incentive and ability to innovate. This Economic Brief discusses the following framework conditions holding back the Polish innovation performance. First, the intensity of competitive pressure, an important leavening factor for innovation, is covered. Then, the availability of R&D-relevant resources, in particular human resources and financing, is analysed. Finally, a scope of interaction between the scientific and the business communities, an important prerequisite for diffusion and implementation of innovative ideas, is discussed.

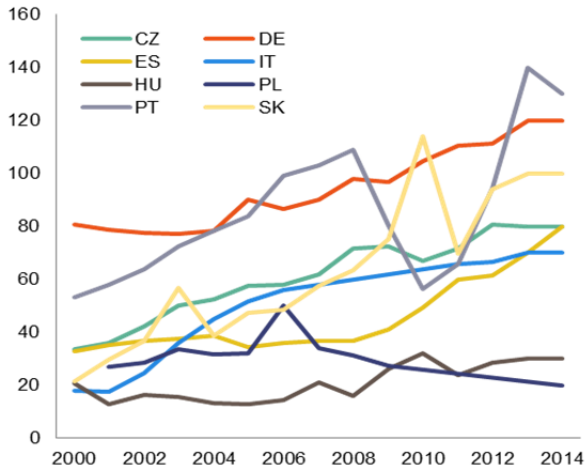
When it comes to the intensity of competitive pressure, the relationship between competition and innovation is rather complex as several factors interact. If markets are concentrated and competition is limited, large players might be willing to innovate as they can earn high margins and cement their position. At the same time, a lack of competition could result in limited incentives to innovate for incumbents as no rivals challenge their position. These countervailing forces may lead to a non-linear relationship between competition and innovation (inverted U-shape).<sup>9</sup> In the case of Poland, the extent of market competition does not appear to be very high. Taking mark-ups as a proxy to measure the degree of competition in a sector (the higher the mark-ups the less competition), a study of the National Bank of Poland (NBP) covering non-financial sectors for the period 1996–2009 concluded that mark-ups in the manufacturing were significantly higher than in the service sectors and have increased since Poland joined the EU.<sup>10, 11</sup> A more recent Commission study looking at the service sector seems to be consistent with NBP's findings.<sup>12</sup> It found mark-ups in the Polish service sector have been fairly stable and elevated since 1996, putting Poland in the group of economies of high (retail, transport and professional services sector) and medium mark-ups (energy and communication sectors) within the EU. While there is no conclusive evidence about where exactly Poland is positioned on the inverted U-shaped relationship, evidence about the degree of competition suggests that additional competition could help innovations.

The availability of input resources is crucial for firms to innovate. One of them is an adequate supply of skilled labour. The specific skills vary with the distance to the global technological frontier; absorption of existing technologies depends more on the quality of secondary and undergraduate education as well as on-the-job training; in contrast creation of new products is more related to the quality of postgraduate education, availability of scientists and engineers. For a country like Poland at an advanced stage of transition and moving closer to the technological frontier, a broad range of skills are required as preconditions for innovation: basic skills like reading and writing, but also generic skills like problem solving, as well as more subtle “soft” skills e.g. communication, managerial or leadership skills<sup>13</sup>. Two OECD skill surveys, the Programme for International Student Assessment (PISA) and the Programme for the International Assessment of Adult Competencies (PIAAC) provide mixed evidence on the ability of the current and future Polish workforce to master skills required for innovation. Although recent PISA results place Polish 15 year old students above or close to OECD averages in mathematics, reading and science, the result for problem solving skills is among one of the five worst-performing EU countries participating in PISA.<sup>14</sup> While Poland scores relatively well in the students' skill survey, the result for the adult one are less favourable. The latest PIAAC survey concludes that working age (16-64 year old) adults in Poland score below the OECD averages for literacy and numeracy.<sup>15</sup> When higher competence skills are tested, the gap to the averages becomes even larger. In addition, Polish adults have relatively little proficiency in problem solving in technology-rich environments. These results, together with a skill mismatch, seem to suggest that the Polish education system does not sufficiently address companies' demand for skills, including those relevant for innovation.<sup>16</sup>

Besides the basic and generic skills, the availability of highly specialized personnel in science and engineering is another relevant factor for innovations.<sup>17</sup> Although the tertiary education attainment rate is constantly growing in Poland, the number of doctoral graduations in engineering, science, mathematics and computing has been comparatively low and broadly stagnating since Poland has joined the EU (Graph 3a).<sup>18</sup> In a similar vein, Polish firms employ a relatively small number of R&D personnel, which is around a third of the share observed in Hungary and Italy and less than one fourth in Czech Republic and one fifth in Germany (Graph 3b). Even if the current low number of PhD graduates was a result of limited

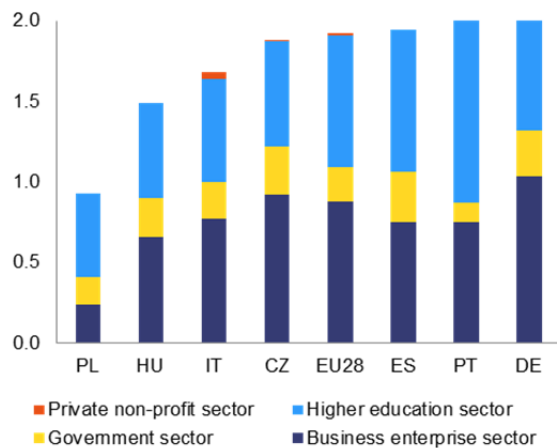
demand by companies, it could become a medium-term bottleneck once firms' innovative activities increase.

**Graph 3a: Number of doctoral graduations in engineering, science, mathematics and computing per 100 000 population aged 25-34**



Source: Eurostat

**Graph 3b: R&D personnel by sector (2013, % of total employment)**



Notes: R&D personnel is defined in accordance with Frascati Manual (6<sup>th</sup> Edition, OECD 2002), i.e. it includes all persons employed directly on R&D, as well as those providing direct services such as R&D managers, administrators, and clerical staff.

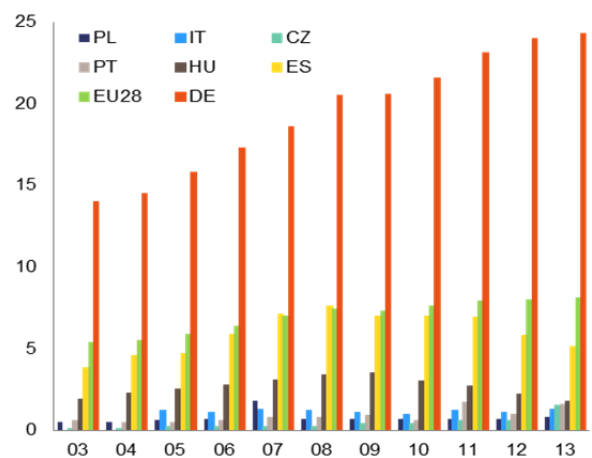
Source: Eurostat

The scope of interaction between the scientific and the business communities is another essential R&D-triggering factor. Experience from other EU Member States with high R&D intensity suggests that strong links between research institutions and companies support the diffusion of innovative ideas and contribute to higher innovative output. In countries like Germany privately financed R&D expenditure of the higher education sector considerably surpasses the EU average. Poland reaches only a small fraction of Germany's amount or of the EU28

average spending (Graph 3c). In terms of public-private scientific co-publications, which can be used as a proxy for the link between business and academia, Poland trails behind in particular compared to regional peers like the Czech Republic and Hungary (Graph 3d).

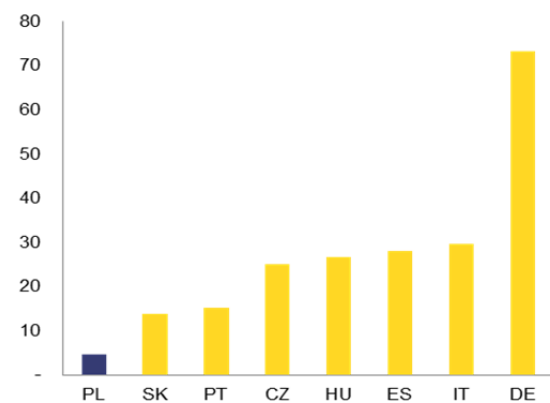
Financing is another crucial input for innovation, in particular for start-ups and small companies at the early stage of their development.<sup>19</sup> While larger, well established companies usually do not face a financing constraint and can rely on internal cash-flow or credit lines, small firms or innovative start-

**Graph 3c: R&D expenditure of the higher education sector financed by private firms (EUR per inhabitant)**



Source: Eurostat

**Graph 3d: Public-private scientific co-publications per million population (2012)**

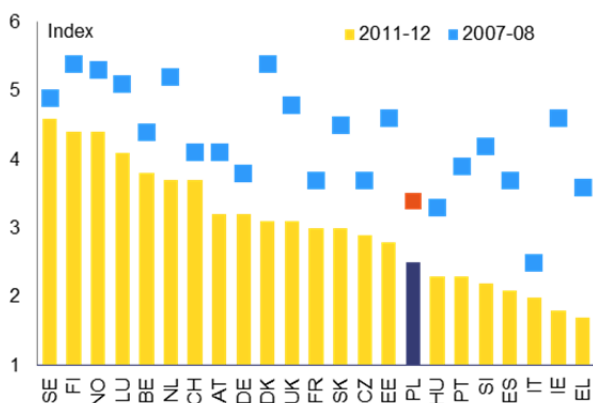


Source: Eurostat

ups face several barriers ranging from lack of collateral, limited cash-flow, perceived riskiness of the project or lack of a track record. These characteristics limit access to traditional financing instruments. In particular access to bank loans, which is already relatively constrained in Poland (Graph 4a), becomes often an unsurmountable challenge. Consequently, alternative means of

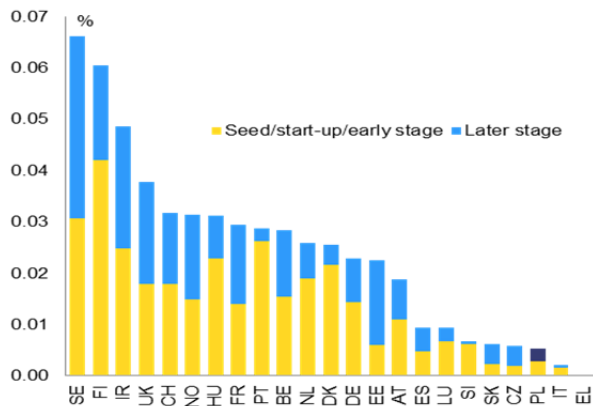
financing through business angels or venture capital are necessary. In this field, Poland still has room for improvement. In 2013, around 160 business angels provided EUR 7 million in 38 companies as seed investment, which is significantly lower compared to mature EU economies.<sup>20</sup> Venture capital investment is also relatively weak at less than 0.005% of GDP (Graph 4b). The limited availability of venture capital, which plays a more prominent role at a later stage of the innovation cycle, is especially problematic for young Polish companies that intend to commercialise their product and roll it out to the market.<sup>21</sup>

**Graph 4a: Ease of access to bank loans in selected OECD countries, 2007-08 and 2011-12**



Notes: Scale from 1 to 7 from hardest to easiest, weighted averages; the index is based on the World Economic Forum's Opinion Survey of business executives' views of their operating environment. Source: OECD

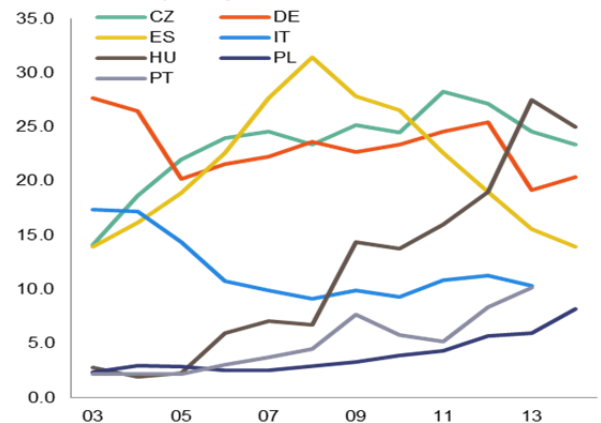
**Graph 4b: Venture capital investment in selected OECD countries as % of GDP, 2014**



Source: OECD  
 Since innovation activities often generate positive externalities, such as knowledge or information spillovers, which are not captured by the investing firms, the overall level of innovation activity is usually suboptimal ('underinvestment'). Therefore, public support can be justified to ensure appropriate incentives to innovate. For example, public funds

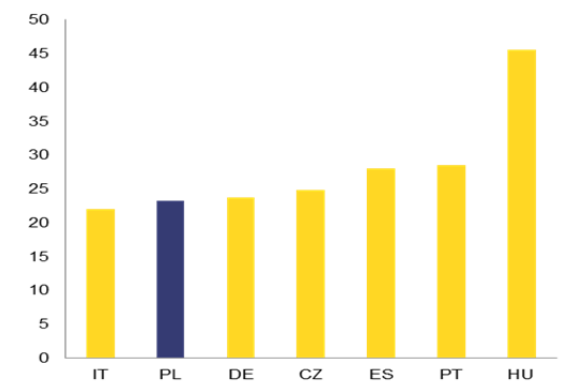
could be used to support innovative companies to get access to financing. Although Poland has put a support system in place, several indicators suggests that some changes might be required enhancing its effectiveness. Compared to other EU countries Polish companies still receive limited support for their in-house R&D expenditure, albeit it has improved steadily (Graph 5a) and the share of Polish innovative companies declaring access to any form of public funding is at a low level (Graph 5b). According to recent business surveys by international consultancies, companies argue that a major obstacle to get public financial support in Poland is the burdensome administrative environment.<sup>22, 23</sup> Moreover, the selection process for Polish and EU public support seems (according to the World Bank) biased towards low risk projects in the field of technology absorption and often ignores more risky projects related to technology creation.<sup>24</sup> In addition, beneficiaries largely consisted of big companies, receiving capital investment grants for investment in low-

**Graph 5a: Private sector R&D intramural expenditure financed by the government sector (PPS per inhabitant at 2005 constant prices)**



Source: Eurostat

**Graph 5b: Innovative enterprises receiving public funding (% of all innovative enterprises, 2010)**



Source: Eurostat



and medium-low tech manufacturing rather than medium-high and high tech sectors. Also, the existing system of indirect public support proved to be ineffective in promoting R&D for start-ups or small companies, as the available tax incentives were primarily used by a limited number of big, well established companies acquiring new technologies.<sup>25</sup>

### What policy response to unleash the innovative potential of Polish firms?

Poland is fully aware of the need to enhance the innovative performance of its firms and the government intends to create conditions for an open, efficient and innovation-driven economy supporting jobs and growth. Recent strategic policy initiatives set out a comprehensive medium-term agenda, which goes in the right direction. The 2013 Strategy for Innovation and Effectiveness of the Economy 2020 (SIEG) defines research and innovation policy priorities, while the 2014 Enterprise Development Programme (PRP) proposes a wide range of measures enhancing the support system for innovative activities of enterprises covering the full innovation cycle. These strategic documents, alongside the National Research Programme, are the basis for Poland's Smart Specialization Strategy, which is reinforced by Operating Programs under the European Regional Development Fund (ERDF) with an estimated allocation of more than EUR 8 billion (ca 2 % of GDP) in 2014-2020. On top of the comprehensive strategic plans and an extensive ERDF support, a relevant reinforcement for the Polish innovative companies is envisaged under the new EU flagship initiative – the European Fund for Strategic Investments (EFSI) –, within the so-called “SME window”. The EFSI offers guarantees and counter-guarantees, aiming specifically at the supporting high-risk, innovative or research-oriented companies. The facilities under the “SME window” are already operational in Poland.<sup>26</sup> In January 2016, the R&D framework has been reinforced with the Innovation Council, which is coordinating the government's innovation policies.

While crucial innovation bottlenecks have been recognised and numerous tailored measures have been identified in the strategic documents, effective and timely implementation of the strategic plans remains to be ensured. Second, addressing specific R&D framework flaws requires a focused and comprehensive approach. As identified in the previous sections, this is particularly important in the fields of i) R&D human resources and quality of science, ii) financial support to firms' R&D

activities, as well as iii) cooperation of private companies and the science sector.

First, Poland has made considerable progress in developing R&D-relevant skills and scores relatively well in students' skill surveys. Further equipping students with innovation-relevant skills, like problem-solving or communication skills, will help match demand for qualified personnel. While recent reforms of higher education introduces important changes, such as performance-based funding models, existing deficiencies in human resources management result in a limited influx of young researchers to academia. Moreover, the quality and organisation of doctoral study programmes is often hampered by overly theoretical curricula and suffers from inadequate coverage of, inter alia, research methodology. The ‘Programme for the development of higher education and science 2015-2030’ aims at addressing the quality of public research and higher education, but no specific financial commitments or an action plan for implementation is foreseen.

Second, although access to bank loans is easier in Poland than in many other EU countries, the availability of alternative private sources of financing firms' R&D activity remains limited, especially among SMEs and start-ups. In particular, the availability of venture capital is still problematic for young firms endeavouring to commercialise their products. The development of the venture capital market and take-up ratio will take time, therefore the public financial support for firms' innovative projects will be crucial. To this end, multiple measures have been introduced recently also under the ERDF's ‘Smart Growth’ Operational Programme. This includes the ‘4Stock’, an instrument aimed at assisting SMEs wishing to raise equity or debt finance in capital markets, and ‘Biznest’, an instrument to help bringing together private investors and entrepreneurs interested in syndicated private investment for start-ups. Complementing the public support system with an accurate design of tax incentives was also identified as important for companies' innovative activity. For this purpose, the system of R&D tax incentives has been overhauled as of the beginning of 2016 with a number of improvements.<sup>27</sup> Nevertheless, the effectiveness of new R&D tax incentives will depend on the way they are implemented, in particular to what extent it will be accessible to start-ups and small companies. In this respect, light administrative proceedings could enhance the take-up. Finally, in the context of a broad public financial support to companies, it is important that the

emphasis is laid on in-house R&D without, however, excluding the adaptation of existing technology, which is likely to remain important.

Third, the need to strengthen the links between private companies and the science/research sector is still acute, especially in terms of facilitating diffusion of ideas at all stages of the innovation cycle that would help achieving concrete, market-applicable results. In order to improve the collaboration between science and industry, a number of policy initiatives were introduced in recent years. Recent reforms of the science and higher education systems initiated a major restructuring impact affecting the system of intellectual property rights. This allows for, inter alia, easier creation of spin-off companies, but the results still remain to be seen. Further works to facilitate links between private companies and academia are still ongoing, including amending the industrial property law to simplify procedures and the use of electronic tools at the Patent Office.

Last, but not least, aside targeted measures, a continuous improvement of the general framework conditions in which firms are acting remains important to facilitate innovations. This includes well-functioning product, labour and financial markets as well as a well-designed and enforced competition policy allowing to increasing competitive pressure.

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<sup>1</sup> See Bogumil and Wieladek (2014).

<sup>2</sup> European Commission and the Economic Policy Committee (2014c).

<sup>3</sup> See for example Griffith et al. (2003), Madsen et al. (2009) and Hall (2011).

<sup>4</sup> The Innovation Union Scoreboard (IUS) is the measurement framework used in Innovation Union, one of the European Union flagship initiatives within the Europe 2020 strategy, aimed at creating an innovation-friendly environment to foster growth and jobs. The IUS distinguishes between 3 main types of indicators and 8 innovation dimensions, capturing in total 25 different indicators. For further details see the IUS website: [http://ec.europa.eu/growth/industry/innovation/facts-figures/scoreboards/index\\_en.htm](http://ec.europa.eu/growth/industry/innovation/facts-figures/scoreboards/index_en.htm).

<sup>5</sup> According to the Statistical Classification of Economic Activities in the European Community (NACE, rev. 2), these include all core NACE activities related to innovation activities: B (mining and quarrying), C (manufacturing), D (electricity, gas, steam and air conditioning supply), E (water supply, sewerage, waste management and remediation activities), G46 (wholesale trade except of motor vehicles and motorcycles), H (transportation and storage), J58 (publishing activities), J61 (telecommunications), J62 (computer programming and broadcasting activities), J63 (information service activities), K (financial and insurance activities) and M71 (architecture and engineering activities, technical testing and analysis).

<sup>6</sup> The Community Innovation Survey (CIS) is a harmonised survey of innovation activity in enterprises. It is designed to provide information on the innovativeness of sectors by type of enterprises, on the different types of innovation and on various aspects of the development of an innovation, such as the objectives, the sources of information, the public funding, the innovation expenditures etc. Surveys are carried out with two years' frequency.

<sup>7</sup> Eurostat's definition covers firms that conduct innovation activities during the period under CIS review. Innovative enterprises are further broken down into four categories: product, process, organisational and marketing innovative enterprises. For more details see [http://epp.eurostat.ec.europa.eu/cache/ITY\\_SDDS/en/inn\\_esms.htm](http://epp.eurostat.ec.europa.eu/cache/ITY_SDDS/en/inn_esms.htm).

<sup>8</sup> For comparison purposes we adopted broadly the same set of countries as in the previous Country Focus on Poland. Therefore, as benchmark countries, we use Germany, Italy, Portugal and two Central and Eastern European Countries, notably the Czech Republic and Hungary. This set of EU Member States is meant to highlight Poland's position vis-à-vis key regional peers as well as vis-à-vis exemplary cases of growth-striving (Germany) and growth-struggling (Italy and Portugal) Western European economies. This set was extended with Spain, which, as former catching-up EU economy, faced comparable structural challenges to Poland.

<sup>9</sup> See for example Aghion et al. (2005).

<sup>10</sup> A markup is the ratio of good or service selling price to its marginal cost. High markups usually signal the existence of monopoly rents.

<sup>11</sup> Hagemeyer and Popowski (2012).

<sup>12</sup> See Thum-Thysen and Canton (2015). They use the QUEST model with EU KLEMS and ORBIS data in 1996-2013 for the main service sub-sectors (retails, energy, communication, transport and professional services) in 28 EU Members States and selected OECD countries.

<sup>13</sup> For a comprehensive literature review on skills conducive to R&D see for example OECD (2011).

<sup>14</sup> OECD (2014).

<sup>15</sup> OECD (2013).

<sup>16</sup> European Commission (2015a).

<sup>17</sup> OECD (2011).

<sup>18</sup> At 42.1 %, Poland stands above the EU average and outperforms most of the regional peer countries. For more details see the Europe 2020 indicators website: <http://ec.europa.eu/eurostat/web/europe-2020-indicators>

<sup>19</sup> See Hall and Lerner (2009) for a comprehensive literature review on the role of financing of R&D and innovation

<sup>20</sup> European Business Angels Network (2014)

<sup>21</sup> Financial Times, 04.09.2015

<sup>22</sup> See for example KPMG (2013), PWC (2014) and Deloitte (2014).

<sup>23</sup> This finding is in line with the conclusions of the recent World Bank 2015 Doing Business Report showing that overall the administrative burden in Poland has not diminished significantly.

<sup>24</sup> See Kapil et al. (2013).

<sup>25</sup> See European Commission (2014a).

<sup>26</sup> For example, in July 2015, The European Investment Fund (EIF) and Bank Gospodarstwa Krajowego (BGK) - the Polish national promotional bank - signed an agreement for €250 million to reach SMEs over the next two years under the COSME Loan Guarantee Facility.

<sup>27</sup> For example, the definition of qualifying R&D costs has been broadened to include internal R&D activities. The new law also creates tax exemptions for funds on the sale of stocks of qualifying companies in which funds hold at least 10 % of capital, which is to stimulate equity financing for innovative businesses.

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