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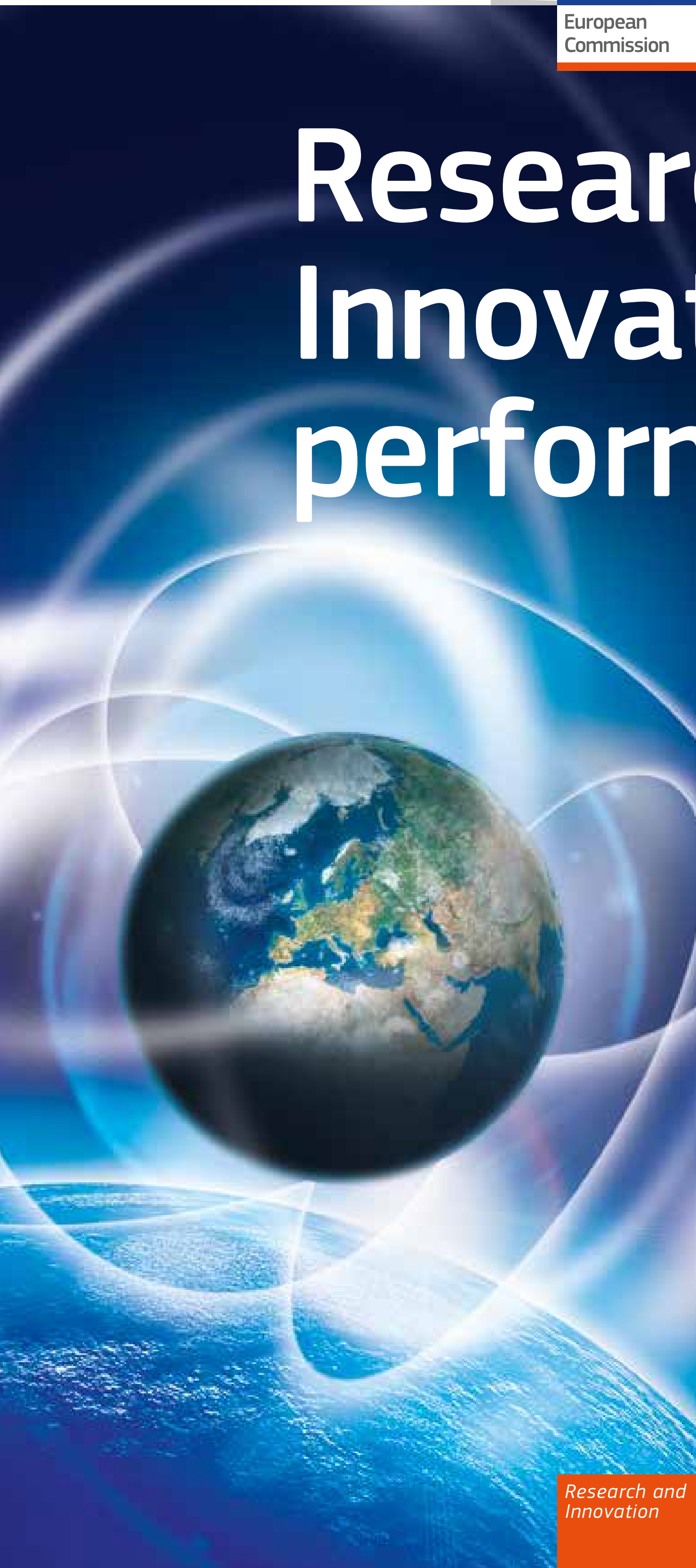

Research and Innovation performance in

Poland

Country Profile

2014

Research and Innovation

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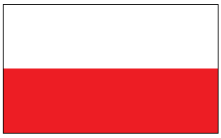


Poland

Improving the quality of the science base and fostering innovation in enterprises

Summary: Performance in research and innovation

The indicators in the table below present a synthesis of research and innovation (R&I) performance in Poland. They relate knowledge investment and input to performance and economic output throughout the innovation cycle. They show thematic strengths in key technologies and also the high-tech and medium-tech contribution to the trade balance. The indicator on excellence in science and technology takes into consideration the quality of scientific production as well as technological development. The Innovation Output Indicator covers technological innovation, skills in knowledge-intensive activities, the competitiveness of knowledge-intensive goods and services, and the innovativeness of fast-growing enterprises, focusing on innovation output. The indicator on knowledge-intensity of the economy focuses on the economy's sectoral composition and specialisation and shows the evolution of the weight of knowledge-intensive sectors and products.

Key indicators of research and innovation performance	
R&D intensity 2012: **0.90 %** (EU: 2.07 %; US: 2.79 %) 2007-2012: **+9.7 %** (EU: 2.4 %; US: 1.2 %)	***Excellence in S&T***[1] 2012: **20.0** (EU: 47.8; US: 58.1) 2007-2012: **+9.8 %** (EU: +2.9 %; US: -0.2)
Innovation Output Indicator 2012: **81.4** (EU: 101.6)	***Knowledge-intensity of the economy***[2] 2012: **34.8** (EU: 51.2; US: 59.9) 2007-2012: **+1.5 %** (EU: +1.0 %; US: +0.5 %)
Areas of marked S&T specialisations: Food, agriculture and fisheries, construction, transport, environment, and materials	***HT + MT contribution to the trade balance*** 2012: **0.6 %** (EU: 4.23 %; US: 1.02 %) 2007-2012: **+14.7 %** (EU: +4.8 %; US: -32.3 %)

Since 2007, Poland has increased its investment in R&D and improved its excellence in science and technology, while focusing on key technologies relevant to industry. The economy has been undergoing structural change towards higher knowledge intensity (an average growth of 1.5 % in 2007-2012) and Poland's global competitiveness is improving at a higher rate than the EU average. Poland scores below average in the Innovation Output Indicator although Polish innovation performance has improved over the last decade. Moreover, the country is still lagging behind the EU average in terms of investment, scientific excellence and knowledge-intensity in the economy, thus leaving room for further progress, illustrated by the ambitious Polish R&D intensity target for the Europe 2020 strategy (1.7 % of GDP by 2020).

Persistently low R&D spending, in particular severe under-investment in R&I in the private sector, and limited in-house technological innovation call for giving way to a new approach targeting different stages of the innovation cycle with well-designed incentives and effective support through public funding, including increased public-private cooperation. Poland has acknowledged the need for this new approach and over the last few years the Polish R&D system has undergone major restructuring. Reforms in the science and higher education systems (2010-2011) introduced significant changes, including the move towards more competitive funding and increased cooperation between science and industry. A major policy document – the Strategy for Innovation and Effectiveness of the Economy 2020 (SIEG) – was adopted in 2013 and focused on stimulating innovativeness and addressing key challenges in the R&D&I system, including stimulation of private expenditure on R&D, internationalisation and genuine innovation. Together with other documents, such as its executive programme PRP (Enterprise Development Programme), the National Smart Specialisation Strategy, the Operational Programmes 'Smart Growth' and 'Knowledge, Education, Development'), those

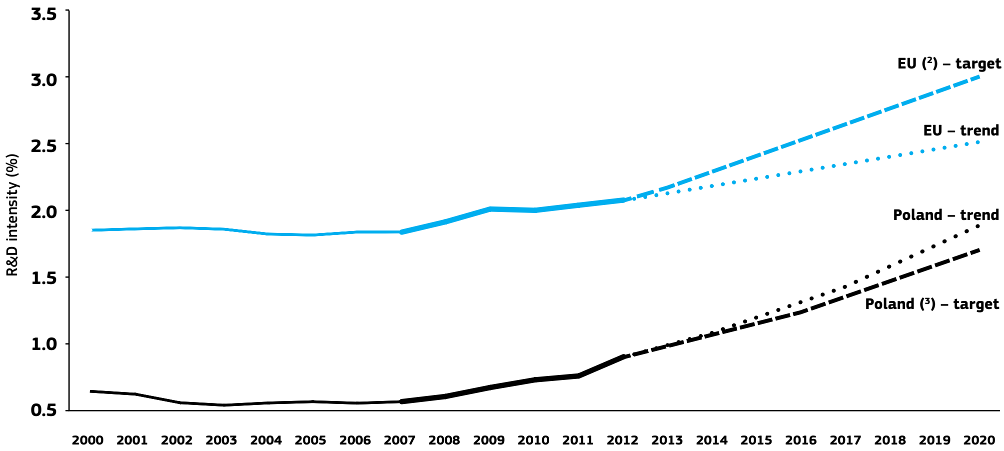
[1] Composite indicator that includes PCT per population, ERC grants per public R&D, top universities and research institutes per GERD and highly cited publications per total publications.

[2] Composite indicator that includes R&D, skills, sectoral specialization, international specialization and internationalization sub-indicators.

policy developments form a coherent approach towards building a more effective R&I ecosystem. It remains to be seen if Poland will successfully move from the strategic level to the systemic and coordinated implementation of measures, which is required to ensure a visible improvement in the innovativeness of Polish companies as well as to maintain sustainable high growth of the economy.

Investing in knowledge

Poland – R&D intensity projections: 2000–2020 (1)



Source: DG Research and Innovation – Unit for the Analysis and Monitoring of National Research Policies
Data: DG Research and Innovation, Eurostat, Member State
Notes: (1) The R&D intensity projections based on trends are derived from the average annual growth in R&D intensity for 2007–2012.
(2) EU: The projection is based on the R&D intensity target of 3.0 % for 2020.
(3) PL: The projection is based on a tentative R&D intensity target of 1.7 % for 2020.

Poland's R&D intensity experienced an average annual growth of 9.7 % between 2007 and 2012, reaching 0.9 % of GDP in 2012 (20th position in the EU). The average annual increase required to hit the ambitious Polish target of 1.7 % by 2020 is slightly lower but is still challenging at 8.3 %. The main weakness remains under investment by the private sector with business R&D expenditure accounting for only 0.33 % of GDP (23rd place within the EU). However, actual R&D expenditure by Polish firms may be underestimated due to the lack of appropriate incentives for businesses to report them. Since the existing tax incentives for R&D, only used by a limited number of big companies, are ineffective in inducing genuine innovations by Polish companies, a reassessment of these tax incentives is needed in view of increasing their effectiveness.

The breakdown of total R&D expenditure by funding source and performance sector illustrates the opposite picture when compared to the EU average. The government remains the main source of R&D funding, contributing 51.3 % of GERD, well above the EU average of 33.4 %. The share of R&D financed and performed by business enterprises declined slightly over the 2000-2010 period before starting to rise again since 2011. In 2012, private businesses performed 37.2 % of total R&D (compared to the significantly higher EU average of 63 %) while the government performed 27.96 % of total R&D (compared to the EU average of 12 %). These indicators do not reflect efforts recently undertaken to increase public R&D spending and trigger private-sector investment in R&D.

Structural Funds are an important source of funding for R&I activities. Of the EUR 67 billion of Structural Funds allocated to Poland over the 2007-2013 programming period, around EUR 9.4 billion (14 % of the total) related to RTDI[3]. As regards the

[3] RTDI includes the following sectors: (01) RTD activities in research centres, (02) RTD infrastructures and centres of competence, (03) Technology transfer and improvement of cooperation of networks, (04) Assistance to RTD, particularly in SMEs (and RTD services in research centres), (06) Assistance to SMEs for the promotion of environmentally friendly products and processes, (07) Investment in firms directly linked to research and innovation, (09) Other methods to stimulate research and innovation and entrepreneurship in SMEs, and (74) Developing human potential in the field of research and innovation.

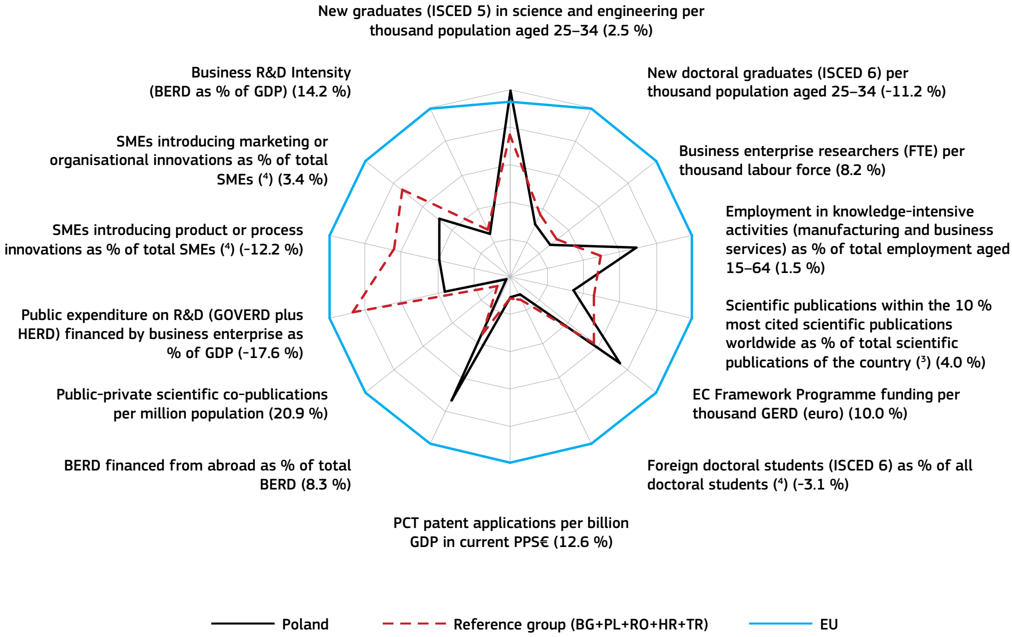
EU's Seventh Framework Programme (FP7) signed grant agreements, Poland ranks 13th in number of applicants and 15th in terms of requested EC contributions. Almost 2150 partners from Poland have participated in FP7, receiving EC financial contributions of over EUR 392 million. Given Poland's low level of participation in FP7 (19th in terms of applicants' success rate and 21st in terms of the success rate in financial contributions), clearly there are new opportunities available for Poland to engage in partnership with established centres of R&I excellence.

An effective research and innovation system building on the European Research Area

The graph below illustrates the strengths and weaknesses of the Polish R&I system. Reading clockwise, it provides information on human resources, scientific production, technology valorisation and innovation. Average annual growth rates from 2007 to the latest available year are given in brackets.

Poland, 2012 (1)

In brackets: average annual growth for Poland, 2007–2012 (2)



Source: DG Research and Innovation – Unit for the Analysis and Monitoring of National Research Policies
Data: DG Research and Innovation, Eurostat, OECD, Science-Metrix/Scopus (Elsevier), Innovation Union Scoreboard.
Notes: (1) The values refer to 2012 or to the latest available year.
(2) Growth rates which do not refer to 2007–2012 refer to growth between the earliest available year and the latest available year for which comparable data are available over the period 2007–2012.
(3) Fractional counting method.
(4) EU does not include EL.

The Polish R&I system is primarily public-based with only 37.2 % of research being performed by the business sector (the EU average is 63 %). Poland's relative weaknesses are mainly on the output side and relate to the private sector's innovation performance. Its relative strengths are pronounced in human resources, where the average annual growth of new graduates in science and engineering exceeds the EU average. However, the number of new doctoral graduates and foreign doctoral students shows a significant decline (-11.2 % over the 2007-2012 period for new doctoral graduates). Poland has a low intensity of business researchers which reflects the minor role the business sector plays in the national R&I system. On a more positive note, the number of business researchers increased in 2012, showing a positive average annual growth over the 2007-2012 period.

Poland relies on foreign technology transfers to upgrade its economy. Domestic knowledge production is limited, and it has low scores in terms of both high-impact scientific publications and patent applications, where the difference from the EU average is particularly large. Only around 4 % of Polish scientific publications qualify for the top 10 % of most-cited scientific publications worldwide. This is the third lowest ranking among EU countries. The level of public-private co-publications is equally very low, highlighting weak linkages and a lack of cooperation culture between science and industry. While Poland performs better than other countries in the reference group in relation to the level of employment in knowledge-intensive activities, this indicator remains one of the lowest in the EU. High growth is observed for business R&D intensity, PCT patent applications and BERD financed from abroad. An alarming decline can be seen in all the innovation activities performed by small and medium-sized enterprises (SMEs): the percentage of SMEs introducing a new product or process is falling significantly. The same trend is observed for public expenditure on R&D financed by businesses.

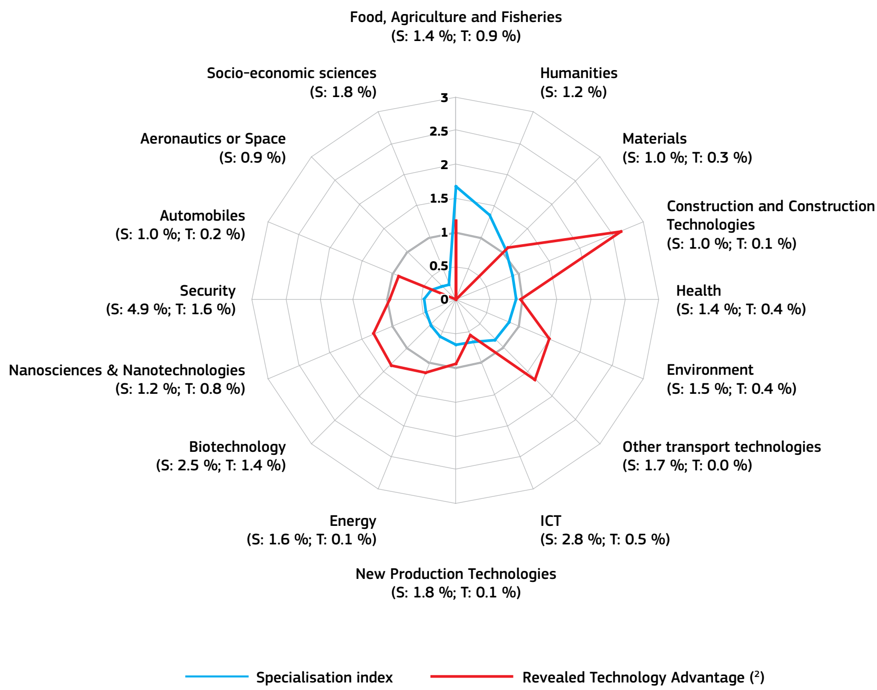
Overall, business enterprises' low level of R&D expenditure and low R&D and innovation activity, coupled with insufficiently favourable framework conditions, has resulted in a poor scientific and technological performance.

Poland's scientific and technological strengths

The graph below illustrates the areas, based on the Framework Programme thematic priorities, where Poland shows scientific and technological specialisations. Both the specialisation index (SI, based on the number of publications) and the revealed technological advantage (RTA, based on the number of patents) measure the country's scientific (SI) and technological (RTA) capacity compared to that at the world level. For each specialisation field it provides information on the growth rate in the number of publications and patents.

Poland – S&T National Specialisation ([1]) in thematic priorities, 2000–2010

in brackets: growth rate in number of publications ([3]) (S) and in number of patents ([4]) (T)



Source: DG Research and Innovation – Unit for the Analysis and Monitoring of National Research Policies
Data: Science-Metrix Canada; Bocconi University, Italy
Notes: ([1]) Values over 1 show specialisation; values under 1 show a lack of specialisation.
([2]) The Revealed Technology Advantage (RTA) is calculated based on the data corresponding to the WIPO-PCT number of patent applications by country of inventors. For the thematic priorities with fewer than 5 patent applications over 2000–2010, the RTA is not taken into account. Patent applications in 'Aeronautics or Space' refer only to 'Aeronautics' data.
([3]) The growth rate index of the publications (S) refers to the periods 2000–2004 and 2005–2009.
([4]) The growth rate in number of patents (T) refers to the periods 2000–2002 and 2003–2006.

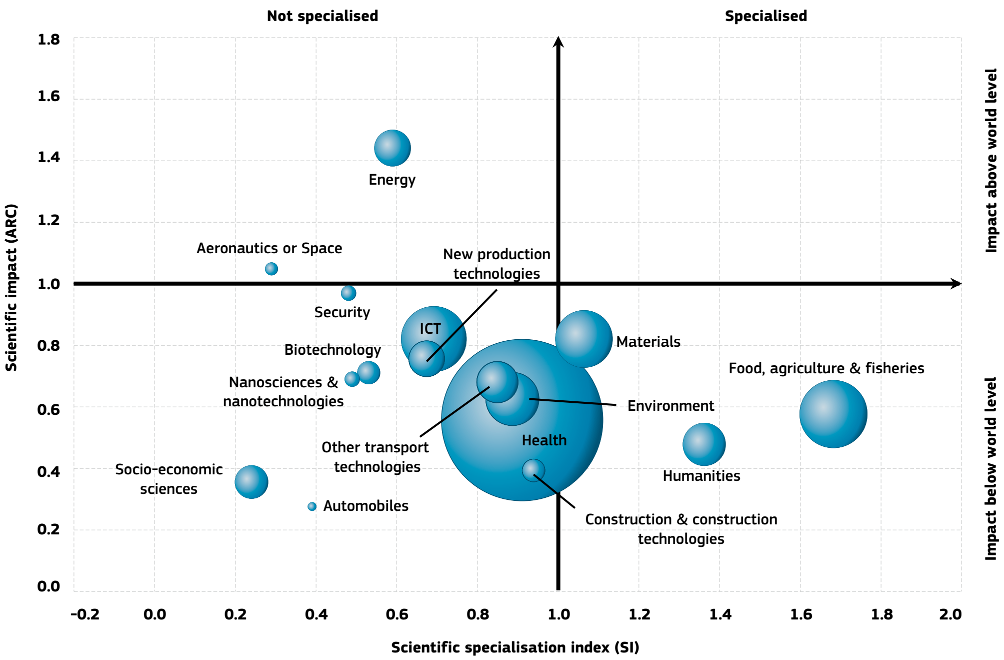
Comparison of the scientific and technological specialisation in selected thematic priorities shows a mixed situation with some co-specialisations as well as some mismatches. The technology production is strongly specialised in construction and construction technologies, transport, environment, biotechnology, nanosciences/ nanotechnologies, and energy. However, no corresponding scientific specialisation can be found for those fields, with the exception of the science base in construction. These sectors mainly correspond to the scientific and economic fields identified in two national strategic documents in the area of research, development and innovation: the National Research Programme (KPB) and InSight2030 which formed the starting point for determining smart specialisation strategies at the national level.

Poland's scientific specialisation index shows that the main scientific fields are food, agriculture and fisheries, as well as humanities, and materials. In food, agriculture and fisheries, materials, and health, Polish technology production is quite important – these are the sectors with the corresponding matching between science and technology specialisations. The recently drafted Polish Smart Specialisation Strategy identifies 18 national smart specialisations in five thematic areas, which include sectors with important innovation potential: healthy society, bio-economy in the agri-food processing and environment, sustainable energy, natural resources and waste management, and innovative technologies and industrial processes.

Poland, together with Bulgaria, Romania, Turkey and Croatia, is classified as a low-knowledge-capacity system with a specialisation in low-knowledge intensity[4].

The graph below illustrates the positional analysis of Polish publications showing the country's situation in terms of scientific specialisation and scientific impact over the period 2000-2010. The scientific production of the country is reflected by the size of bubbles, which corresponds to the share of scientific publications from a science field in the country's total publications.

Poland – Positional analysis of publications in Scopus (specialisation versus impact), 2000–2010



Source: DG Research and Innovation – Unit for the Analysis and Monitoring of National Research Policies
Data: Science-Metrix Canada, based on Scopus
Note: Scientific specialisation includes 2000–2010 data; the impact is calculated for publications of 2000–2006, citation window 2007–2009.

4 Source: Innovation Union Competitiveness report

There is a room for scientific impact improvement in some of the sectors ranking high on the science specialisation index, i.e. food, agriculture and fisheries, materials, construction, and humanities (for which a strong level of co-specialisation in S&T has also been identified). It is interesting to note the high level of scientific excellence attained in energy, while this sector has a low scientific specialisation indicator. Taking into account Polish technological specialisation in this field, the country would probably benefit from fostering scientific specialisation in energy.

The excellence in research correlates to more cooperation with researchers from other European countries and beyond. Therefore, in order to increase its research excellence, Poland would benefit from actively supporting and providing incentives for its researchers to connect to Horizon 2020 networks. Considering its share of grants by FP7 fields, there is room for improvement, for instance, in the ICT sector. The availability of significant Structural Funds during the 2007-2013 period tended to reduce the attractiveness of participation in highly competitive European research programmes. Through the new financial perspective (2014-2020), more support instruments will enhance the participation of Polish applicants in international projects. The Operational Programme 'Smart Growth' includes instruments ensuring the complementarity of Polish R&D funding with Horizon 2020 and plans to support the preparation of applications in the Horizon 2020 and COSME programmes.

Policies and reforms for research and innovation

The challenges of increasing the quality and effectiveness of the Polish R&I system and linking science and industry have been addressed by reforms in higher education and science (2010-2011) which spurred significant changes, including a move towards more competitive funding schemes. In 2013, the Committee for Evaluation of Scientific Institutions (KEJN), an advisory body set up in 2010, conducted its first nationwide evaluation of scientific institutes by defining the levels of institutional funding on the basis of several criteria, including technology transfers to industry and collaborative projects. The Polish government has declared that by 2020 it will distribute 50 % of its entire science budget through competitive mechanisms. However, already in 2013, 44.1 % of all science funds were allocated through competitions (as against 30.9 % in 2007), which was largely due to the performance-based funding allocated by NCN[5] (a basic research executive agency established in 2010) and NCBiR[6] (an applied research executive agency established in 2007 and reinforced by the above-mentioned reforms).

Projects run by the NCBiR are successful in inducing substantial new investment in private R&D by focusing on the stimulation of science-industry cooperation and supporting the commercialisation of R&D. Recent initiatives, such as BRIdge VC, Bridge Alfa or DEMONSTRATOR+, the so-called 'fast-track support scheme', induce the use of financial instruments, venture capital funds, and enhance the transfer of research results to the economy. The sectoral programmes (INNOLOT, INNOMED) have been very successful in fostering cooperation within industry and between industry and academia. Further measures to encourage innovation, such as increasing the role of scientists in the process of knowledge commercialisation, and better matching the higher education system to business needs are foreseen in recently proposed amendments to the Acts on Higher Education and on the Principles of Financing Science. In addition, already adopted amendments to the Act on public procurement have relaxed the binding restrictions on R&D services, and the first project supporting the use of pre-commercial procurement by the Polish public administration was launched by NCBR in July 2013. Thirty 'brokers of innovation' selected during the first competition launched by the Ministry of Science and Higher Education (September 2013) will deal with the commercialisation of research, the creation of spin-off companies and the conclusion of licence agreements. The second edition of the competition for the Polish KNOW (National Leading Scientific Centres) is ongoing in parallel with the Top 500 innovators initiative which aims to improve the technology transfer skills of researchers and professionals. To strengthen the technology transfer of universities and public research organisations, in 2013, the ministry launched the 'Innovation Incubators' programme and the NCBiR launched the SPIN-TECH programme.

New policy documents are directed at boosting indigenous local innovation by Polish companies. In January 2013, the 'Strategy for the Innovation and Effectiveness of the Economy' (SIEG), the country's main document setting out its R&I policy priorities, was adopted. By addressing significant weaknesses within the Polish R&I system, the most important being the innovative output, the new innovation strategy foresees greater emphasis on financial engineering and demand-side measures. Its executive programme PRP introduces the proposition

5 The National Science Centre

6 The National Centre for Research and Development

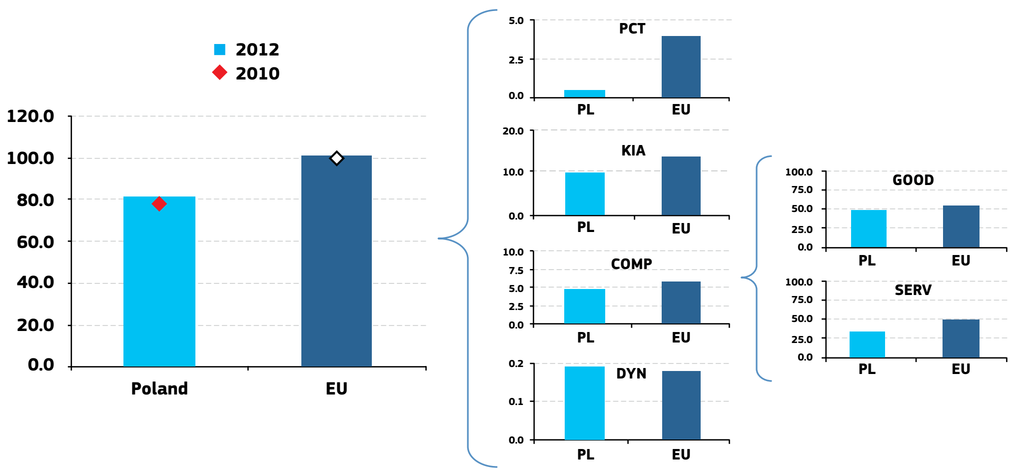
of tax incentives for innovative companies[7] and proposes adequate instruments for different phases of the innovation cycle, i.e. grants for projects with a higher risk level and financial instruments to help with implementation and internationalisation stages. The Smart Growth OP, adopted by the government in January 2014, will implement the PRP. With the proposed budget of EUR 8.6 million for R&D, it will focus on the development of in-house innovations "from idea to market", covering the entire innovation cycle, and on the business funding of R&D via financial instruments, such as loans, public guarantees and PPPs with venture capital funds. Until now, risk aversion remains a significant problem for participants in the Polish R&I system with only 30 % of entrepreneurs using outside funding, with conservative selection panels, and grants remaining the predominant source of funding even for less-risky projects. Together with the National Strategy for Smart Specialisation (KIS), which forms an integral part of the PRP, new policy documents aim at streamlining and prioritising the support measures and enhancing innovation, and will be used as the basis for supporting R&I in the period 2014-2020.

Raising the innovativeness of Polish companies and strengthening science-industry cooperation has been a long-standing challenge for which different policy responses have been proposed in recent years. Strategically, Poland is addressing those challenges well. The way forward would be to fully implement these innovation-oriented reforms and conduct the systematic evaluation of policies to determine whether and how policy interventions can achieve the desired change.

Innovation Output Indicator

The Innovation Output Indicator, launched by the European Commission in 2013, was developed at the request of the European Council to benchmark national innovation policies and to monitor the EU's performance against its main trading partners. It measures the extent to which ideas stemming from innovative sectors are capable of reaching the market, providing better jobs and making Europe more competitive. The indicator focuses on four policy axes: growth via technology – (patents); jobs (knowledge-intensive employment); long-term global competitiveness (trade in mid/high-tech commodities); and future business opportunities (jobs in innovative fast-growing firms). The graph below enables a comprehensive comparison of Poland's position regarding the indicator's different components:

Poland – Innovation Output Indicator



Source: DG Research and Innovation – Unit for the Analysis and Monitoring of National Research Policies
Data: Eurostat, OECD, Innovation Union Scoreboard 2014, DG JRC
Notes: All data refer to 2012 except PCT data, which refer to 2010.
PCT = Number of PCT patent applications per billion GDP, PPS.
KIA = Employment in knowledge-intensive activities in business industries as % of total employment.
DYN = Innovativeness of high-growth enterprises (employment-weighted average).
COMP = Combination of sub-components GOOD and SERV, using equal weights.
GOOD = High-tech and medium-high-tech products exports as % total exports. EU value refers to EU-28 average (extra-EU = 59.7 %).
SERV = Knowledge-intensive services exports as % of total service exports. EU value refers to EU-28 average (extra-EU = 56 %).

7 The introduction of tax relief for R&I is foreseen following the removal of Poland's excessive deficit procedure.

Improving the economic impact of innovation remains one of the main challenges for the Polish R&I system. Poland is a below average performer in the Innovation Output Indicator, even though its performance has clearly been improving since 2010. A very low performance in patents (PCT) is linked to the still overall limited research capacity, the low level of internationalisation of the science sector as well as to the Polish economic structure, which is characterised by businesses' limited investment and innovativeness. There is a lack of large Polish multinational manufacturing companies, and the international companies, including motor-vehicle producers, which have production facilities in Poland tend to do their research and patenting in the headquarter country.

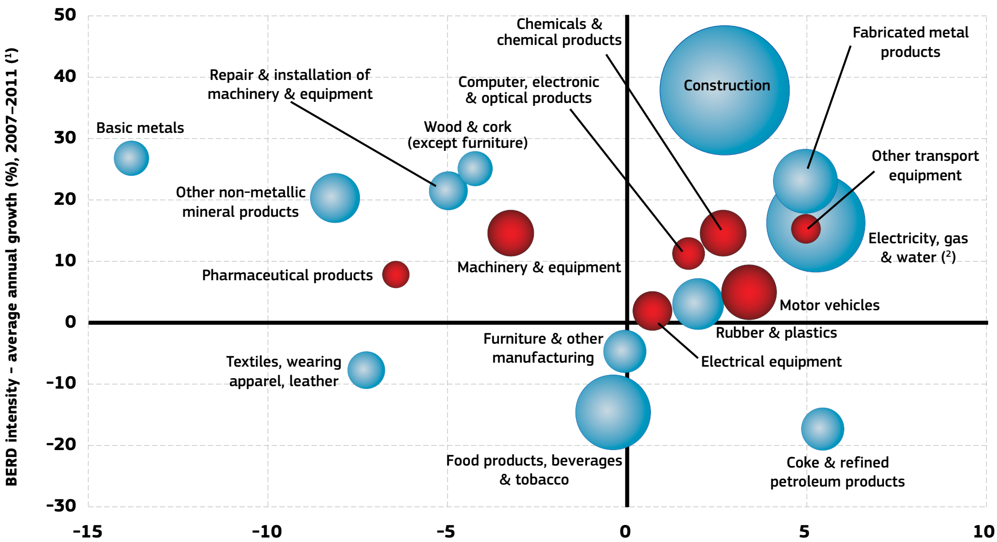
The importance of employment in agriculture and construction to the Polish economy contributes a low share of employment in knowledge-intensive activities (KIA). In addition, the low share of knowledge-intensive service exports (SERV) is explained by relatively high exports of non-KIS transport services (mainly road freight transport, but also pipelines) and construction services, not compensated by any strongholds in KIS exports. Poland performs above the EU average in the innovativeness of fast-growing innovative firms (DYN). This is the result of a high share of the financial services sector among fast-growing firms.

There is strong awareness of those challenges at national level and support mechanisms have been launched to encourage science-industry cooperation and foster the innovativeness of Polish companies. The new Strategy for the Innovation and Effectiveness of the Economy is aiming for an integrated approach to R&I embedded in a wider economic context.

Upgrading the manufacturing sector through research and technologies

The graph below illustrates the upgrading of knowledge in different manufacturing industries for the period of 2007-2011. The position on the horizontal axis illustrates the changing weight of each industry sector in value added over the period. The general trend to the left-hand side reflects the decline in manufacturing in the overall economy. The sectors above the x-axis are those where research intensity has increased over time. The size of the bubble represents the sector share (in value added) in manufacturing (for all sectors presented on the graph). The red sectors are high-tech or medium-high-tech sectors.

Poland – Share of value added versus BERD intensity: average annual growth, 2007–2011 (1)



Share of value added in total value added - average annual growth (%), 2007–2011 (1)

Source: DG Research and Innovation – Unit for the Analysis and Monitoring of National Research Policies
Data: Eurostat
Notes: (1) 'Electricity, gas and water', 'Wood and products of wood and cork': 2007–2010; 'Coke and refined petroleum products', 'Furniture and other manufacturing': 2008–2011.
(2) 'Electricity, gas and water' includes 'sewerage, waste management and remediation activities'.
(3) High-tech and medium-high-tech sectors (NACE Rev. 2 – two-digit level) are shown in red.

Comparison of the positioning of the high-tech or medium-tech sectors for 2007-2011, with their previous positioning illustrated in the 2013 country profile for the years 1995-2007, shows a clear increase in the R&D intensities in all the research-intensive sectors: machinery and equipment, chemicals and chemical products, motor vehicles, electrical machinery and apparatus, medical precision and optical instruments. For numerous sectors (with the exception of machinery and equipment and pharmaceutical products) this shift was accompanied by an increasing share of value added in the overall economy. This finding suggests that Poland is moving towards more research-intensive, higher-value-added products in high-tech and medium-tech industries. However, with the exception of motor vehicles, the share of those sectors (in value added) in manufacturing is not gaining any special importance.

Poland's economic structure is still dominated by less research-intensive sectors, mainly construction, fabricated metal products, and electricity, gas and water. The visible increase in Polish business R&D intensity, especially for construction, basic metals, wood and cork, fabricated metal products, repair and installation of machinery and equipment, furniture and other manufacturing, reflects the economy's continuous reliance on the country's traditional sectors.

The above economic structure is reflected in the sectors of activity of the top Polish corporate R&D investors. Poland has four out of 1000 companies analysed in the 2013 EU Industrial R&D Investment Scoreboard, coming from the fields of telecommunications, banking, software and computers. Overall, the relatively stable sectoral composition of Polish industry around low research-intensive sectors reflects the country's comparative weaknesses in terms of R&I performance.

Key indicators for Poland

POLAND	2000	2005	2006	2007	2008	2009	2010	2011	2012	Average annual growth 2007–2012 (1) (%)	EU average (2)	Rank within EU
ENABLERS Investment in knowledge												
New doctoral graduates (ISCED 6) per thousand population aged 25–34	:	1.00	1.01	1.02	0.92	0.82	0.53	0.48	0.56	-11.2	*1.81*	26
Performance in mathematics of 15-year-old students: mean score (PISA study)	:	:	495	:	:	495	:	:	518	22.1 (3)	495 (4)	4 (4)
Business enterprise expenditure on R&D (BERD) as % of GDP	0.23	0.18	0.18	0.17	0.19	0.19	0.20	0.23	0.33	14.2	1.31	23
Public expenditure on R&D (GOVERD + HERD) as % of GDP	0.41	0.39	0.38	0.39	0.42	0.48	0.54	0.53	0.56	7.4	*0.74*	16
Venture capital as % of GDP	0.11	0.06	0.11	0.14	0.20	0.15	0.14	0.19	0.14	0.3	0.29 (5)	11 (5)
S&T excellence and cooperation												
Composite indicator on research excellence	:	:	:	12.5	:	:	:	:	20.0	9.8	47.8	24
Scientific publications within the 10% most cited scientific publications worldwide as % of total scientific publications of the country	:	3.5	3.5	3.5	3.4	3.8	:	:	:	4.0	11.0	24
International scientific co-publications per million population	:	178	189	192	194	206	205	215	226	3.3	343	25
Public–private scientific co-publications per million population	:	:	:	2	3	3	4	5	:	20.9	53	26
FIRM ACTIVITIES AND IMPACT Innovation contributing to international competitiveness												
PCT patent applications per billion GDP in current PPS (EUR)	0.3	0.2	0.3	0.3	0.4	0.5	0.5	:	:	12.6	3.9	22
License and patent revenues from abroad as % of GDP	0.02	0.02	0.01	0.02	0.04	0.02	0.05	0.05	0.05	14.9	0.59	21
Community trademark (CTM) applications per million population	0.8	20	25	33	42	41	46	51	56	10.9	152	23
Community design (CD) applications per million population	:	7	10	14	17	23	21	25	27	14.3	29	13
Sales of new-to-market and new-to-firm innovations as % of turnover	:	:	10.1	:	9.8	:	8.0	:	:	-9.8	14.4	23
Knowledge-intensive services exports as % total service exports	:	22.6	23.2	22.2	24.5	26.1	26.1	28.3	:	6.2	45.3	18
Contribution of high-tech and medium-tech products to the trade balance as % of total exports plus imports of products	-5.74	-1.99	-0.93	-0.39	0.34	0.45	0.37	0.88	0.58	-	4.23 (6)	19
Growth of total factor productivity (total economy): 2007 = 100	86	96	98	100	100	99	100	101	101	1 (7)	97	3
Factors for structural change and addressing societal challenges												
Composite indicator on structural change	:	:	:	32.2	:	:	:	:	34.8	1.5	51.2	23
Employment in knowledge-intensive activities (manufacturing and business services) as % of total employment aged 15–64	:	:	:	:	8.2	8.9	9.4 (8)	9.6	9.7	1.5	13.9	24
SMEs introducing product or process innovations as % of SMEs	:	:	20.4	:	17.5	:	13.5	:	:	-12.2	33.8	27
Environment-related technologies: patent applications to the EPO per billion GDP in current PPS (EUR)	0.00	0.03	0.01	0.03	0.06	0.06	:	:	:	29.3	0.44	19
Health-related technologies: patent applications to the EPO per billion GDP in current PPS (EUR)	0.03	0.05	0.04	0.06	0.06	0.06	:	:	:	-1.2	0.53	24
EUROPE 2020 OBJECTIVES FOR GROWTH, JOBS AND SOCIETAL CHALLENGES												
Employment rate of the population aged 20–64 (%)	61.0	58.3	60.1	62.7	65.0	64.9	64.3 (8)	64.5	64.7	0.3	68.4	19
R&D intensity (GERD as % of GDP)	0.64	0.57	0.56	0.57	0.60	0.67	0.74	0.76	0.90	9.7	*2.07*	20
Greenhouse gas emissions: 1990 = 100	84	85	89	89	88	83	88	88	:	-2 (9)	83	14 (10)
Share of renewable energy in gross final energy consumption (%)	:	7.0	7.0	7.0	7.9	8.8	9.3	10.4	:	10.4	13.0	18
Share of population aged 30–34 who have successfully completed tertiary education (%)	12.5	22.7	24.7	27.0	29.7	32.8	34.8	36.5	39.1	7.7	35.7	15
Share of population aged 18–24 with at most lower secondary education and not in further education or training (%)	:	5.3	5.4	5.0	5.0	5.3	5.4	5.6	5.7	2.7	12.7	5 (10)
Share of population at risk of poverty or social exclusion (%)	:	45.3	39.5	34.4	30.5 (11)	27.8	27.8	27.2	26.7	-3.3	24.8	17 (10)

Source: DG Research and Innovation – Unit for the Analysis and Monitoring of National Research Policies
Data: Eurostat, DG JRC – Ispra, DG ECFIN, OECD, Science Metrix / Scopus (Elsevier), Innovation Union Scoreboard
Notes: (1) Average annual growth refers to growth between the earliest available year and the latest available year for which compatible data are available over the period 2007–2012.
(2) EU average for the latest available year.
(3) The value is the difference between 2012 and 2006.
(4) PISA (Programme for Internatonal Student Assessment) score for EU does not include CY and MT. These Member States were not included in the EU ranking.
(5) Venture capital: EU does not include EE, HR, CY, LV, LT, MT, SI and SK. These Member States were not included in the EU ranking.
(6) EU is the weighted average of the values for the Member States.
(7) The value is the difference between 2012 and 2007.
(8) Break in series between 2010 and the previous years. Average annual growth refers to 2010–2012.
(9) The value is the difference between 2011 and 2007. A negative value means lower emissions.
(10) The values for this indicator were ranked from lowest to highest.
(11) Break in series between 2008 and the previous years. Average annual growth refers to 2008–2012.
(12) Values in italics are estimated or provisional.

2014 Country-specific recommendation on R&I adopted by the Council in July 2014

"Improve the effectiveness of tax incentives in promoting R&D in the private sector as part of the efforts to strengthen the links between research, innovation and industrial policy, and better target existing instruments at the different stages of the innovation cycle."

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