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# RIO Country Report 2017: Poland

*Research and Innovation Observatory country report series*

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**RIO Country Report 2017**

The R&I Observatory country report 2017 provides a brief analysis of the R&I system covering the economic context, main actors, funding trends & human resources, policies to address R&I challenges, and R&I in national and regional smart specialisation strategies. Data is from Eurostat, unless otherwise referenced and is correct as at January 2018. Data used from other international sources is also correct to that date. The report provides a state-of-play and analysis of the national level R&I system and its challenges, to support the European Semester.

# Summary


## Key findings

Poland's GDP continued increasing in 2016, with positive forecast for 2017-2018. The Polish R&I system is centralised as regards funding and governance with important reforms of higher education announced in September 2017. Modest BERD continues to increase with 0.63% of GDP reached in 2016 driving the total GERD to 0.97% in 2016.

## Challenges for R&I policy-making in Poland and main policy responses

### Challenge 1 Increase the intensity of private R&I

- increased attractiveness of R&D tax incentives
- public funding agencies offering a large portfolio of support for R&D intensive companies and targeting them with an awareness campaign
- new VC funds launched (Witelo, NCBR VC, NCBR CVC, STARTER, BIZNEST, KOFFI) with corporate partners

### Challenge 2 Strengthen the science and industry cooperation

- focus of policy makers with the higher education reform, plans for the reform of research institutes and the promotion of industrially oriented career tracks for scientists
- launch of the industrial doctorate scheme
- availability of a variety of grants supporting collaboration and commercialisation

### Challenge 3 Increase the quality of the public research base:

- draft of the Higher Education and Science Act and draft of the Łukasiewicz Research Network Act
- stakeholders consultation and expert peer review (PSF H2020) supporting the preparation of the Act on Higher Education and Science
- plans to differentiate between research intensive and teaching universities, change modalities for institutional assessment and allocation of institutional R&D funding
- establishment of Polish National Agency for Academic Exchange (NAWA) - an agency for inward and onward mobility of researchers

### Challenge 4 Strengthen priority setting in the R&I governance system:

- increased inter-ministerial coordination in some areas, e.g. electromobility
- announced intention of streamlining / prioritising the list of smart specialisations presented in the Strategy for Responsible Development

## Other major R&I developments in 2017

- Introduction of the "Seal of Excellence" instruments by NCBR and PARP
- Streamlining the ESIF support measures for R&I as well as changes in the design and management of regional funds

## Smart specialisation

All 16 Polish regions have their Smart Specialisation Strategies and participate in the Smart Specialisation Platform and the national Strategy comprises of 17 priorities. The regions vary in their awareness of competitive advantages and institutional capabilities which results in diverse approaches to monitoring and evaluation. Apart from updates to the priorities, it is hard to identify tangible outcomes of the S3 monitoring process, and the coordination system is under preparation. Silesia region implemented a set of monitoring and pilot evaluation activities to support the updates of their regional strategy. Regions don't use 15% of structural funds for external actors. Strong involvement of universities in the set-up of priorities has not been fully used to drive their implementation given the strong focus of ESIF funding on industrial beneficiaries.

# Foreword

The R&I Observatory country report 2017 provides a brief analysis of the R&I system covering the economic context, main actors, funding trends & human resources, policies to address R&I challenges, and R&I in national and regional smart specialisation strategies. Data is from Eurostat, unless otherwise referenced and is correct as at January 2018. Data used from other international sources is also correct to that date. The report provides a state-of-play and analysis of the national level R&I system and its challenges, to support the European Semester.

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# 1 Economic context for R&I

Poland is a large European country (7.4% of the EU-28 population and 37.9m inhabitants). In 2016, the real GDP grew by 2.7% principally driven by domestic demand, mainly private consumption supported by wage growth and fiscal transfers. The real GDP growth rate for 2016 is lower compared to 2014 and 2015 (3.3% and 3.8% respectively) and GDP per capita expressed in purchasing power standards is still below 60% of the EU average (Eurostat, 2017). 2016 saw a decrease in investments by 5.5%, and the trend continues in 2017. However, investments are projected to grow by 2018 due to the continuation of the strong domestic demand and the high degree of capacity utilisation (EC, 2017a).

The R&D intensity increased by 0.4% of GDP since 2007 and amounted to 1% of GDP in 2015 and 0.97% in 2016 (provisional data). Nevertheless, it is still less than half of the EU average (2.03% in 2016). The gross domestic expenditures on R&D (GERD) have been constantly increasing since 2009 to 2015, whereas in 2016 it slightly decreased to €4,112.3m (compared do €4,316.508m in 2015). The investment in R&D provided by the business sector – the largest R&D contributor in Poland - accounted for 0.47% of GDP in 2015 (and 0.63% of GDP in 2017 - provisional data). Its role has significantly increased since 2006, when its R&D investments constituted 0.17% of GDP. Higher education R&D performance is on the rise in the last three years with 0.3% in 2016 of GDP respectively (Eurostat, 2016). R&D performed by government indicators was stable around 0.24% of GDP till 2015 while 2016 provisional data register a significant drop to 0.02% of GDP.

Since 2011 employment in R&D has been constantly on the rise with 109,249.3 persons employed in R&D in 2015 (full time equivalents), including 82,594.3 of researchers (GUS, 2016b). In 2014, Poland was ranked 23rd among EU Member States in terms of employment in R&D (in FTE) per 1,000 persons employed and 22nd with regards to employment of researchers in R&D. In 2015, there were 6.8 per 1,000 persons employed in R&D in Poland (measured in FTE), whereas this indicator for the whole European Union was almost two times higher (GUS, 2016c).

In comparison to other EU Member States, Poland has a relatively low labour productivity. However, since 2008 its labour productivity has reported a constant growth and the nominal labour productivity per person increased from 61.2% of the EU average in 2008 to 75.3% in 2016. Real labour productivity per person has also been growing, with the growth rate of 2.3% in 2015 and 2016 (Eurostat, 2017). The highest level of labour productivity in 2014 has been reported in Mazowieckie region. 2007-2016 brought an average annual growth of 1.4% in TFP (total factor productivity) with 0.9% in 2016. Poland recorded on average more rapid TFP increase than other EU-15 countries (average growth rate in 2005-2014 was 0.1% for the region), but the rate of TFP increases in Poland has slowed down. It was the only EU country that avoided recession and reported the smallest variations in TFP of 4.1 percentage points throughout the 2007-2016 period (Próchniak, 2015; 2016; 2017). Continuous TPF growth may suggest that Poland slowly improves its relative competitive position among other European countries.

## 1.1 Structure of the economy

Poland's economy relies mostly on services and manufacturing dominated by low-tech and low-to-medium-tech operations. In the period of 2010-2015 value added of services as a share of total value added has been relatively stable and was around 63%. In the same period, manufacturing gained importance and its share in total value added increased from 17,68% in 2010 to 19,69% in 2015. In contrast, lower, but relatively stable growth rates were reported in the EU-28 (varying from 15.45% to 15.77% in the period of 2010-2014). Service industries substantially contributing to the total gross value added (GVA) include: wholesale, retail trade and repair in the automotive industry, construction, public administration and defence, professional, scientific and technical

activities and real estate activates. The top four manufacturing sectors in terms of GVA in 2015 were: manufacturing of food, beverage and tobacco products, manufacturing of fabricated metal products except machinery and equipment, manufacturing of motor vehicles, trailers and semi-trailers and manufacture of rubber and plastic products.

Knowledge-intensive services accounted for 29.24% of the total value added in 2015 and their significance has not changed substantially over the past five years. Similarly, the share of value added of high and medium-high technology industries in the same period has only slightly increased in Poland, from 5.11% in 2010 to 5.73% in 2015.

The structure of the economy measured by the employment shares of individual sectors in total employment confirms that services and manufacturing are the most important in Poland. Manufacturing has a relatively high and stable share in employment (20.2% in 2016) compared to the EU-28 average of around 14%. In the service sector, the highest shares in employment were noted in wholesale and retail trade, transport, accommodation and food service activities (22.5% in 2015) and in public administration, defence, education, human health and social work activities (20.4% in 2015) (Eurostat, 2017). Employment in knowledge-intensive service sectors measured as share of total employment has not significantly changed since 2013 and is still relatively low (29.85% in 2016), compared to EU-28 average (37.2% in 2016).

In conclusion, R&D intensive sectors in Poland to a small extent contribute to the GVA and low-tech sectors still play dominant roles in the structure of the Polish economy.

## 1.2 Business environment

In 2018, the World Bank's "Doing Business Index" (DB) ranked Poland 27$^{th}$ out of 190 countries in terms ease of doing business a fall from 24$^{th}$ place in 2017. Doing business in Poland has significantly improved over the last ten years (in 2009 Poland was ranked 76$^{th}$ with Greece being the only EU member state ranked lower and in 2018 16 other EU-28 member states ranked lower than Poland) (World Bank, 2018). The improvements supporting business creation and running include the implementation of transparency of legislative process, the rules for making new law with access to information about projects on the Internet, the simplification of court procedures, extension of rights to secure creditors and the introduction of an electronic system for filing and paying VAT and transport tax. In some of the World Bank ranking's sub-categories Poland occupied high positions, e.g. the easiness of getting a credit by firms - 20th position world-wide, trading across borders - 1$^{st}$ and resolving insolvency – 27$^{th}$.

According to World Bank's DB2018, starting a business in Poland takes on average 37 days (same as in 2017 but 7 days longer than in 2016), costs 12.10% of income per capita, requires compliance with 5 specific procedures and paid-in minimum capital of 10.70% of income per capita. As a result, Poland further slip to the 120th position on the ease of starting business from 85$^{th}$ in 2016 and 107$^{th}$ in 2017 (World Bank, 2017).

According to Global Competitiveness Report 2016-2017 published by the World Economic Forum, the top problematic factors for doing business in Poland were: complexity of tax regulations, restrictive labour regulations, policy instability, tax rates. Other important obstacles included inefficient government bureaucracy, inadequately educated workforce and access to finance (Schwab, 2016: 298). Compared to 2015-2016 report, policy instability seems to be an increasing problem.

Poland ranks 23$^{rd}$ in DESI 2017 with the overall score of 0.43 in the cluster of low performing countries. Although Poland improved in three out of five DESI components (Human Capital, Use of Internet and Connectivity), more progress is needed as regards to the adoption of digital technologies by businesses and the development of digital public services. In the digitalisation of businesses Poland, ranked 27$^{th}$ in DESI 2017 (Integration of Digital Technology), lags behind most EU countries (EC, 2017b).

Poland shows an uneven performance in the Small Business Act's (SBA) 2016 country profile. It performs above the EU average in access to finance, the country's main strength. Yet it scores average when it comes to responsive administration, state aid & public procurement, environment and internationalisation. Although various policy measures supporting skills and innovativeness have been launched since 2015, Poland reports weak in skills and innovation. It may be still too early to evaluate their effectiveness and see their reflection in the statistics (EC, 2017d).

# 2 Main R&I actors

The governmental R&I policies are co-ordinated by the inter-ministerial Council for Innovativeness. The Ministry of Economic Development (MR) develops and implements the innovation policies. MR is also a managing authority overseeing the absorption of the European Structural and Investment Funds (ESIF), co-ordinating activities of funding agencies. The Ministry of Science and Higher Education (MNiSW) supervises the research policies, including higher education and public research organisation sectors, and distributes the national science budget. Key R&I funding agencies include: National Science Centre (NCN) sponsoring fundamental research; National Centre for Research and Development (NCBR) financing applied research and industrial innovations; Polish Agency for Enterprise Development (PARP) supporting business enterprises. R&I funding based on ESIF is also distributed by the Foundation for Polish Science (FNP), a non-governmental organisation that complements the efforts of NCN and NCBR.

Equity investments and venture funding are offered by the Polish Development Fund (PFR), a sovereign wealth fund. In 2017, the importance of PFR increased and it now manages a holding structure which includes: Polish Agency of Enterprise Development (PARP), Agency for Industrial Development (ARP), state-owned bank BGK, PFR Ventures (PFR's investment arm) and export and foreign investment support agency PAIH. The holding structure brings together multiple support organisations to synchronise their activities and reduce overlaps.

In October 2017, a new government agency was established: the National Agency for Academic Exchange (NAWA), tasked with the promotion of international academic mobility and internationalisation of Polish science.

In addition to the central level, each of 16 regions of Poland has separate a R&I budget based on ESIF, with regional authorities overseeing the implementation. In May 2017, the Amendment to the Act on Principles of Implementing Cohesion Policy Programmes Funded in the Financial Perspective 2014-2020 strengthened the influence of central government, allowing the province governor (pl. *wojewoda*) appointed by the government to supervise regional authorities in the design and implementation of ESIF in regions.

R&I performers in Poland include: business enterprises, public Higher Education Institutions (HEIs), non-public HEIs (most of them focusing on teaching in humanities and socio-economic sciences), Public Research Organisations (PROs) such as research institutes pursuing applied research and institutes of the Polish Academy of Sciences (traditionally focused on fundamental research but recently engaging also in applied research projects). In 2015, the population of R&I performers that declared R&D expenditures consisted of: 3735 business enterprises, 219 higher education institutions (including 19 universities, 18 universities of technology and 98 non-public academic institutions) and 295 public research organisations (including 70 institutes of Polish Academy of Sciences and 116 research institutes) (GUS, 2016b).

In 2017, the Polish Academy of Sciences announced plans to establish its own university and thus enter into the HEI sector, benefiting from higher education funding.

MNiSW prepared a comprehensive reform of research institutes, which was initially intended to create a National Institute of Technology, combining resources of the most

strategic PROs to address the needs of industrial partners. The merger process was however considered too complicated from legal point of view, and a quasi-holding structure of "Łukasiewicz Research Network" (pl. *Sieć Badawcza: Łukasiewicz*) was proposed instead (more information in section 3).

| **R&D performers** | **Business enterprises** | **HEIs** | **PROs** |
|---|---|---|---|
| % of R&D performed in 2016 | 65.7% | 31.4% | 2.5% |
| % of R&D performed in 2010 | 26.62% | 37.19% | 35.89% |
| **R&D funders** | **Business enterprises** | **Government** | **Abroad** |
| % of R&D funded in 2016 | 39% | 41.82% | 16.74% |
| % of R&D funded in 2010 | 53.1% | 38.9% | 5.4% |

Sources: Eurostat, 2017; GUS, 2017

Despite popular interpretations, EU funds are not primary sources of R&I funding in Poland, with substantially higher investments from national science budget and mobilization of private capital. Between 2010 and 2016, private funding for R&D increased both as share of the total GERD and in absolute terms. Non-profit organisations do not play important role as R&I funders or performers.

Poland has a vibrant start-up scene, with 2,677 identified start-ups, approximately half of them funded from own resources (Startup Poland, 2016: 10), and 59% being micro-enterprises (Startup Poland, 2016, p. 11). Numerous intermediary organisations support start-ups and offer mentoring, incubation and acceleration services, as well as co-working spaces. Google, Microsoft and Samsung established corporate start-up incubators in Poland, and numerous large companies, including state-owned enterprises, pursue corporate venturing strategies, using support of NCBR and PARP. Investments in innovative start-ups are enabled by dedicated funds of funds, using ESIF co-funding: Witelo Fund (with the involvement of the largest Polish insurance company PZU), NCBR VC (with financial partners VC3.0 and FinCrea), NCBR CVC (corporate VC, with the involvement of PFR and BGK), and other PFR Ventures such as STARTER, BIZNEST and KOFFI.

The Polish innovation system includes numerous knowledge transfer intermediaries, such as entrepreneurship incubators, technology transfer offices and innovation brokers. Despite a large number of formally established clusters, R&I activities within science-industry networks remain limited and ESIF support measures encourage the establishment of project consortia and sectoral organisations. In 2013-2015, 19.2% of innovative industrial companies and 20.8% of innovative service companies declared involvement in cluster initiatives (GUS, 2016a: 106).

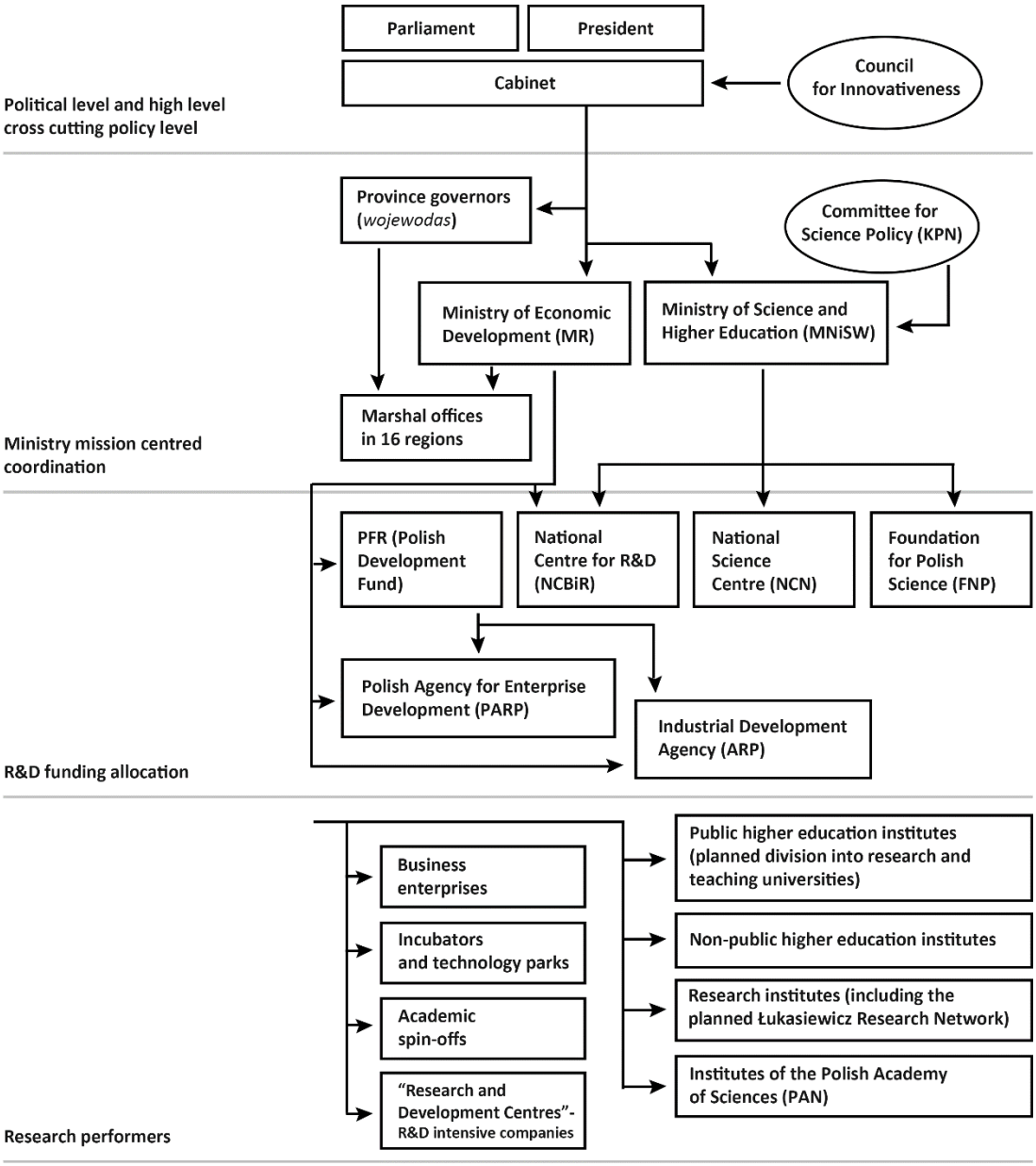


**Figure 1:** Structure of the Polish R&I system

# 3 R&I policies, funding trends and human resources

**Table 1:** Main R&I policy developments in 2017

| *Document title, hyperlink and date of publication/announcement* | *Short description* |
|---|---|
| **Industrial doctorates call**<br>May 2017<br>http://www.nauka.gov.pl/komunikaty/ogloszenie-konkursu-w-ramach-i-edycji-programu-doktorat-wdrozeniowy.html | Following the Act deregulating HEIs (2016), MNiSW called on HEIs and their business partners to apply for co-funding industrial doctorates (pl. *doktoraty wdrożeniowe*). Met with a positive response from the business sector and strong involvement of large companies planning to employ PhD candidates. Altogether, the first cohort of 500 PhD projects will be carried out at 54 HEIs, with multiple business partners involved at each HEI. |
| **"Seal of Excellence" instruments by NCBR and PARP**<br>May 2017<br>http://www.ncbr.gov.pl/fundusze-europejskie/poir/konkursy/seal-of-excellence2017/aktualnosci/<br>https://poir.parp.gov.pl/granty-dla-seal-of-excellence/ogloszenie-o-konkursie-do-poddzialania-2-4-1-w-2017-r | R&I funding agencies NCBR and PARP introduced funding instruments targeted at applicants of Horizon 2020 SME Instrument, who received "Seal of Excellence" (passed the threshold but did not received the H2020 funding in this call). |
| **NCBR VC and NCBR** corporate VC **programmes**<br>April 2017<br>http://www.ncbr.gov.pl/fundusze-europejskie/poir/ncbr-vc/<br>http://www.ncbr.gov.pl/fundusze-europejskie/poir/ncbr-cvc/ | NCBR established two funds of funds, co-funded with ESIF (previously presented as part of "NCBR BRIDge" scheme). NCBR VC (with companies VC3.0 and FinCrea) will offer venture capital investments in start-up companies, and NCBR CVC (corporate VC) is implemented jointly with state-owned organisation PFR and BGK with a timeline for the set-up 2017-2019 and investments in 2020-2023. In November 2017, the Polish Financial Supervision Authority revoked the authorisation to perform financial activities by FinCrea, NCBR's VC partner and the future of NCBR VC remains uncertain. |
| **Amendment to the Act on Principles of implementing cohesion policy programmes funded in the financial perspective 2014-2020**<br>May 2017<br>https://www.mr.gov.pl/strony/aktualnosci/rzad-przyjal-nowele-tzw-ustawy-wdrozeniowej/ | Introducing important changes in the design and implementation of ESIF, 2014-2020: reducing administrative burden, stronger enforcement of confidentiality of applications (incl. IP), nomination of a spokesperson of ESIF beneficiaries. At the same time, the new regulation restricts the autonomy of regional authorities - a province governor appointed by the central government (pl. *wojewoda*) will supervise regional authorities in ESIF design and implementation. |
| **Streamlining ESIF support measures for R&I at multiple agencies** | Introduction of generic, repetitive calls supporting innovative research programmes, internships and doctoral studies, with relatively simple, standardized rules, instead of multiple small and focused calls (NCBR-managed ESIF-funded calls based on |

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|---|---|
| | Operational Programme Knowledge, Education and Development – POWER).<br>NCBR focused on one standardized R&D support measure for companies based on Operational Programme Smart Growth (POIR) (so-called "fast-track projects", POIR 1.1.1). On-site visits in the applicant companies were introduced to further verify the commercial feasibility of the project. NCBR developed a database of innovative companies that have not been using public funding for R&I in order to better target them with promotional message, inviting to participate in R&I calls.<br>NCBR launched new sectoral programs based on POIR 1.2 measure, with dedicated, sectoral research agendas offering support for R&D projects proposed by companies.<br>PARP strengthened its flagship support measure "Research for market" (POIR 3.2.1), supporting the implementation of innovations by business enterprises. One of calls in 2017 was dedicated only to companies from mid-sized cities to ensure more balanced geographical distribution of beneficiaries. |
| **Establishment of National Agency for Academic Exchange (NAWA)**<br>October 2017<br>http://www.nauka.gov.pl/aktualnosci-ministerstwo/nawa-z-podpisem-prezydenta-rp.html<br>http://orka.sejm.gov.pl/proc8.nsf/ustawy/1550_u.htm | To promote brain circulation and international academic mobility. It will offer inbound and outbound mobility scholarships and introduce measures stimulating international cooperation of Polish scientists. NAWA will launch its first instruments in 2018. |
| **Act on Amending Some Acts to Improve Legal Environment for Innovative Activities**<br>November 2017<br>https://legislacja.rcl.gov.pl/projekt/12298150 | Prepared by MNiSW and elaborated in inter-ministerial and social consultations (April-August 2017). It implements multiple recommendations from the White Paper on Innovation, (MNiSW, 2016). It includes a substantial increase in the R&D tax incentives scheme and the introduction of the industrial habilitation path. Unanimously adopted by the Parliament in November 2017 and came into force on 1.01.2018. |
| **Draft Act on Research Network: Łukasiewicz**<br>August 2017<br>https://legislacja.rcl.gov.pl/projekt/12297460 | The draft Act intends to introduce a wide-ranging reform of public research institutes in Poland. The Łukasiewicz Research Network will be a quasi-holding structure, with 36 PROs and about 8000 employees. PROs in the network will no longer be supervised by sectoral ministries. Central management, optimization of administrative researchers and research infrastructures aims to facilitate the pursuit of cross-institute projects and increase knowledge transfer. The institutes will focus on cooperation with industry and applied R&D, benefiting from dedicated public co-funding modalities. |
| **Act on Higher Education and Science** | Following over 18 months of analyses and social consultations, the process of reforming higher |

| | |
|---|---|
| **and National Science Congress**<br>September 2017<br>https://nkn.gov.pl/<br>https://legislacja.rcl.gov.pl/docs//2/12303102/12458855/12458856/dokument309025.pdf | education sector dubbed "Law 2.0" concluded with the National Science Congress in September 2017, where the draft Act on Higher Education and Science was presented. The ministry intends to introduce one legal Act replacing the existing, extensive body of legislations and to significantly reduce the number of ordinances required to implement the Act. |
| **Peer-review of the Polish** its Higher Education and Science **system by H2020 Policy Support Facility**<br>January-September 2017<br>https://rio.jrc.ec.europa.eu/en/policy-support-facility/peer-review-polish-research-and-innovation-system | Poland hosted the peer-review co-ordinated by the H2020 Policy Support Facility. The independent experts and international peers provided insights into the bottlenecks of the R&I system, commented on the alternative proposals of the HE draft prepared by the national expert teams, shared good practices from other countries and weighed in on the effectiveness and efficiency of planned policies and measures.. |
| **Institutional assessment of scientific units in Poland**<br>October 2017<br>http://www.nauka.gov.pl/komunikaty/wyniki-kompleksowej-oceny-jakosci-dzialalnosci-naukowej-lub-badawczo-rozwojowej-jednostek-naukowych-2017.html | The country-wide institutional assessment of 993 scientific units was concluded in October 2017, involving 180 peer-reviewers working in 20 thematic evaluation teams. The assessment did not lead to major differentiation between scientific units, as their excessive number was ranked in two highest categories: 4.73% were classified as „A+" and 33.43% as „A", with only 14.8% of units receiving the lowest rank „C". Based on the draft of the Higher Education and Science Act, units ranked as „B" or „C" would not be allowed to award habilitations and have restricted access to public funding. The stringency of planned regulations may explain the relatively lenient approach to the current ranking. |

**R&I funding trends**

GERD in Poland amounted to €4,316.5m in 2015 and it slightly decreased to €4,112.3m in 2016 but the data are still provisional. For many years, the government has remained the main source of funding for GERD, but the share of funding coming from private sector has increased substantially over time and surpassed the public funding in 2016, as business enterprises accounted for 53.1% of GERD (39% in 2015). This change can be attributed also to the introduction of R&D tax incentives. Between 2010 and 2016, private funding for R&D increased both as share of the total GERD and in absolute terms, and is expected to further grow thanks to the increased attractiveness of newly amended R&D tax incentives.

## 3.1 Public allocation of R&D and R&D expenditure

The government-funded part of GERD was distributed in 2015 mainly among HEIs (46.1% of the public R&D funding) and PROs (42.7%), with only 11.1% allocated to business enterprises. The public science budget has been increasing significantly year-to-year, and the public funding for privately-performed R&D has experienced proportional increases. Official statistics on GBAORD (Government budget appropriations or outlays on R&D) do not present a consistent tendency, with a decrease in 2016 that may be due to the provisional data (see figure below).

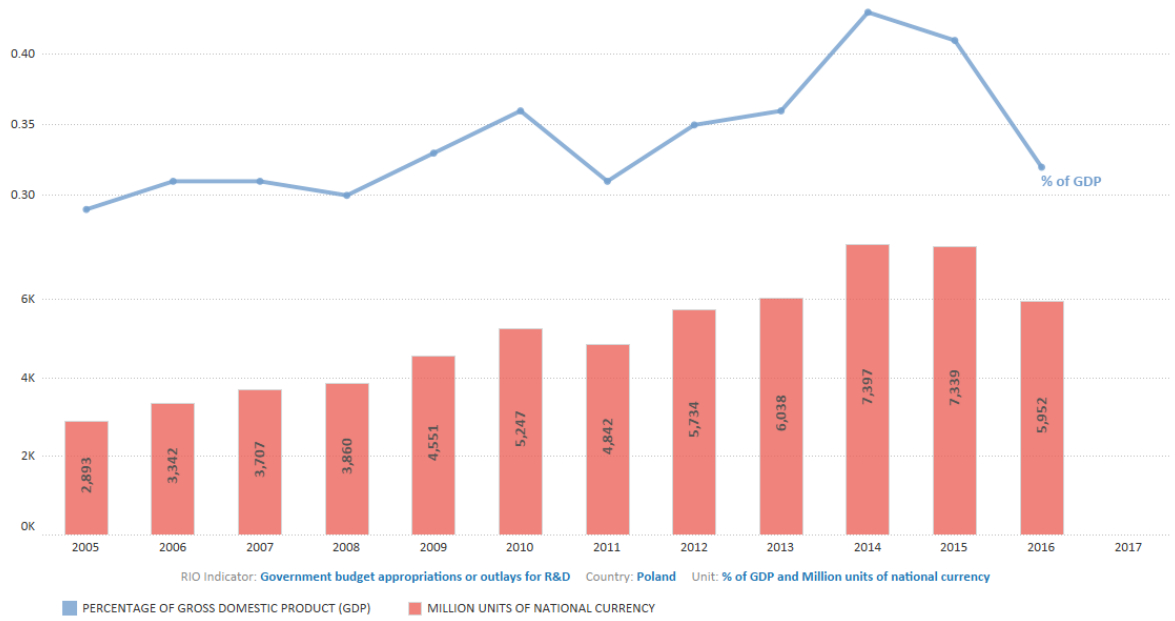


**Figure 2:** Government budget appropriations or outlays for R&D in Poland 2005-2016

In the years of 2005-2016, the public science budget has increased a rate slower than the growth of the Polish GDP. Starting from 2016, Poland has R&D tax incentives promoting in-house R&D activities rather than technology acquisition. The regulations were amended in 2016, offering additional tax benefits in 2017, and draft amendments were prepared by MNiSW in 2017 to further incentivize the R&D activities of companies in 2018 (making 100-150% of R&D costs deductible and specifying types of eligible costs). The Act came into force on 1.01.2018. Despite popular interpretations, EU funds are not important sources of R&I funding in Poland, with substantially higher investments from national science budget and mobilization of private capital (with only 10% of BERD funded by foreign sources, including ESIF, in 2015).

## 3.2 Private R&D expenditure

BERD intensity in Poland is limited when compared with some of the EU member states, but it has strongly increased in 2010-2016 (see figure below) and matches the levels of Spain and Portugal (PL: 0.63% GDP in 2016; ES: 0.64%, PT: 0.61%). The growth is accompanied by positive developments in the counts of R&D personnel in business sector. Moreover, BERD statistics suffer from a problem of underreporting, as many companies were able to optimize their tax burdens by booking certain R&D expenditures as investments in fixed assets, when R&D tax incentives were not available or less attractive than alternative accounting solutions. Amendments to the R&D tax incentives, adopted in 2017, should motivate the firms to report R&D costs as for the first time they outweigh the financial benefits of accounting the R&D expenditures as other cost categories, and the Polish R&D incentives will become financially attractive in an international comparison starting from 2018.

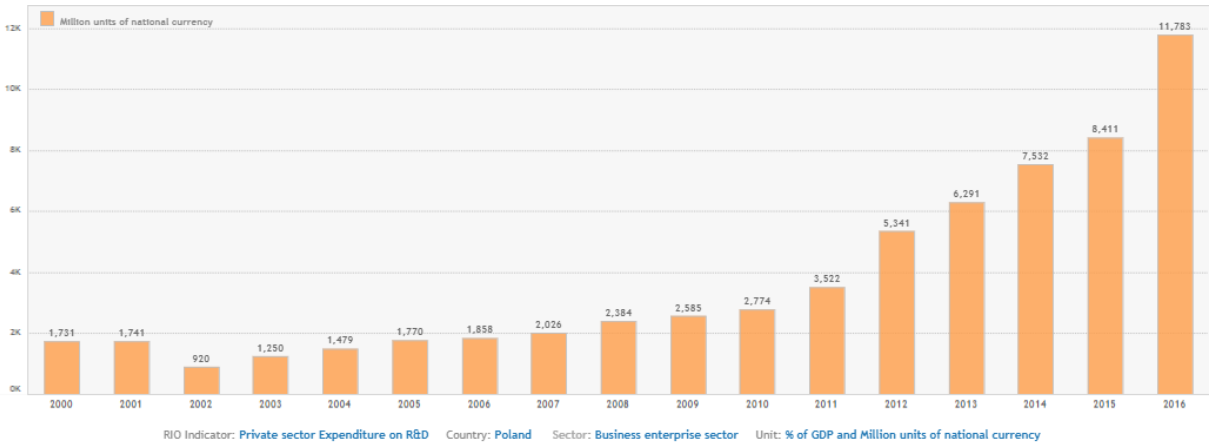


**Figure 3:** Private Enterprise Expenditure on R&D in Poland (2000-2016).
Source: RIO-PSF website

For 2010-2012, manufacturing and services accounted for more than 95% of BERD expenditures, with similar BERD intensity in both sectors (for an analysis of BERD trends, see: Klincewicz and Szkuta, 2015). Key industrial sectors contributing to BERD are: the manufacture of motor vehicles, the manufacture of electrical equipment and the pharmaceutical sector. Among service sectors, Information and Communication services and professional, scientific and technical activities contribute most in terms of R&D expenditures. Poland is an important supplier of knowledge-based services including software development, clinical trials of drugs and business analytics, with strong position of offshoring sector. The largest R&D investors include: ICT companies Asseco Poland and Comarch, pharmaceutical companies Adamed, Polpharma and Mabion, chemical company Synthos and the defence group PGZ (Polska Grupa Zbrojeniowa) . Large R&D expenditures are also incurred in Poland by multinational pharmaceutical companies Amgen, AstraZeneca, Janssen-Cilag and Roche.

The Polish government actively attracts R&D-intensive FDIs. The government agency dealing with foreign investments and export promotion, PAIH, considers R&D investments a priority, with government subsidies for strategic investments available under the 'Programme for the support of investments of considerable importance for Polish economy for years 2011-2020'. R&I support measures are available to all business enterprises in Poland, including foreign-owned companies.

## 3.3 Supply of R&I human resources

In 2016, the supply of human resources in science and technology reached 5.1k of people (compared to 3.3k in 2002). In 2016, women constituted 58% of human resources employed in science and technology and their share was relatively stable in the analysed period.

Poland's position in terms of R&D employment in the EU is still relatively low. In 2015 there were 109.2k of people employed in R&D measured in full-time equivalents (FTE). However, in comparison to 2006 there were almost 35% more people employed in R&D, year-to-year changes are also visible. In the period of 2013-2014 there was significant improvement in year-to-year R&D employment (3.24% in 2013, 10.16% in 2014), whereas in 2015 it decreased again to 4.48%.

The total number of researchers employed in R&D measured in FTE in 2015 was 82.594k and increased by 3.972k compared to 2014. Since 2011 there has been a significant shift with regards to sectoral employment of researchers. Since 2011, the employment of researchers in the higher education sector has been decreasing in favour of the business enterprise sector. In 2015 the majority of researchers (48.58%) worked in the higher education sector. However, the importance of business enterprise sector in terms of researcher's employment is constantly growing since 2011 (16.48% in 2011; 22.52% in 2012; 31.75% in 2014), while higher education sector seems to become less important

(48.58% in 2015; 50.49% in 2014; 56.94% in 2012; 64.63% in 2008). In 2015 the government sector had a share of 16.49% of researchers employed (17.61% in 2014; 20.27% in 2012).

In 2015 there were 30.19% of female researchers. In the period of 2007-2014 there was a negative change in the proportion of female researchers (from 39.39% in 2007). The gender ratio in researcher population varies across sectors. In 2015, in the business sector women represented 13.71% of all researchers, with a diminishing share since 2008 when female researchers accounted for 29.30%. In higher education and government sectors the gender ratio is relatively stable with around 40% of female scientists employed.

There were 1.405m students in 2015 in Poland (4.4% less than in 2014) and women accounted for 57.7% of all students. The share of women among the population of students was relatively stable between the academic years of 2010/2011 – 2015/2016. When it comes to STEM (Science, Technology, Engineering and Mathematics) students, who constituted 24.7% of all students, the share of women is much lower: in 2015, it was 44.7% (GUS, 2016c). In terms of graduates in STEM (science, maths, computing, engineering, manufacturing, construction) Poland has a higher than EU average number of new graduates per 1,000 population (3.03 vs 2.3 for EU-28 for 2014). However, it lags behind the EU average in new doctoral graduates with the value of 0.51 per 1000 population aged 25-34 in 2015 and the EU-28 average value being above 1.

In terms of gender equality, the Polish Labour Code offers several provisions prohibiting discrimination of women in the labour market access. It also provides additional protection for pregnant women, and those on maternity leaves in order to help them maintain their work-life balance. Moreover, in order to support female researchers in applying for grants R&D funding agencies, NCN and NCBR, introduced special ways of calculating the maximum age while applying for young researchers' grants, which exclude the duration of maternity and child care leaves when defining the age of eligibility of applicants. Similar rules apply also to students and PhD students, who can extend their study periods on this basis (the ordinance of the Minister of Science and Higher Education, 2011).

As of 2017, the number of women-oriented initiatives, including those promoting girls to engage in STEM studies, has been growing. Examples include: "New Technologies for Girls" programme by Intel Technology Poland and the Educational Foundation "Perspectives"; the scholarship programme "Women and Science" run by the Foundation L'Oréal and UNESCO; the mentoring programme "Girls go start-up!" run by the Association TOP500 Innovators and the Educational Foundation "Perspectives"; the "Girls on technical universities" programme managed by the Conference of Rectors of Polish Technical Universities. The majority of the initiatives are run by non-government entities.

# 4 Policies to address innovation challenges

## 4.1 Challenge 1: Increase the intensity of private R&I

**Description** – The business expenditure on R&D in Poland is low when compared with other EU member states but has more than doubled in recent years (from 0.18% of GDP in 2010 to 0.63% of GDP in 2016). Still it remains significantly lower than BERD to GDP ratios in Czech Republic and Hungary (CZ: 1.03%; HU: 0.89%) but already on par with Spain (0.64%) and Portugal (0.61%). BERD in Poland might be underestimated due to the limited attractiveness of R&D tax incentives (see: Klincewicz et al., 2017: 16), and the European Innovation Scoreboard 2017 reveals strong performance of Polish companies in non-R&D innovation expenditures and design applications compared to other EU countries (EC, 2017c: 62). The main weakness of Poland is the limited innovative activities of SMEs, including low occurrence of product or process innovations in this sector, and insignificant share of SMEs innovating in-house (EU, 2017: 62).

Moreover, international patenting activities through Patent Cooperation Treaty are also lagging behind other EU member states (EU, 2017: 62).

**Policy response** – The need to mobilize private investments in R&D has been recognized by policy makers and is a recurring theme in the design and implementation of R&I support measures:

- there is a portfolio of instruments promoting privately co-funded industrial research, using ESIF and national budget, including "fast track" projects (POIR 1.1.1), co-funding in-house R&D carried out by companies of various types, and "sectoral programmes" (POIR 1.2) based on research agendas co-designed with industry (managed by NCBR);
- introduction of dedicated initiatives for zero-emission transport, energy blocks and cyber security as public procurement for innovations or pre-commercial procurements (NCBR);
- PARP streamlined its key measure supporting the implementation of industrial innovations – "Research for market" (POIR 3.2.1) and launched dedicated calls for companies from mid-sized cities to ensure a broader reach of the measure;
- NCBR started directly targeting companies that had not yet used R&I support measures to broaden up its reach;
- NCBR and PARP introduced the support for H2020 Seal of Excellence to ensure synergies between H2020 and national funding;
- Ministry of Economic Development supported investments in R&D infrastructures of enterprises (POIR 2.1).

Furthermore, dedicated VC funds were established to support innovative start-ups (e.g. Witelo, NCBR VC, NCBR CVC, STARTER, BIZNEST, KOFFI), with involvement of large corporate partners. MNiSW introduced the scheme of "industrial doctorates", co-funding the employment of doctoral students by companies to make their PhD project industrially-relevant. Finally, MNiSW amended R&D tax incentives regulations, adopted in 2017, increase the attractiveness of corporate investments in R&D: allowing companies to deduct 100% of R&D costs and as much as 150% of costs in the case of companies with formal status of R&D centres, with additional clarifications related to the eligibility of specific categories of R&D costs.

**Assessment** – The policy interventions have yielded positive results as the private investments in R&D experience regularly increases (see chapter 3.2. The available BERD data started to fully capturing the effects of the recently introduced R&D tax incentives and further, significant increases in BERD intensity can be expected. The proposed amendments make the R&D tax incentives as attractive as in other EU MS. In addition, the comprehensive portfolio of R&I support measures offered by NCBR and PARP leverages private funding for R&I thanks to targeting specific sectors/types of technologies, launching activities to expand the population of R&I performers and experimenting with alternative funding modalities (including public procurement for innovations, venture funds for start-ups and complementing H2020 calls thanks to the "Seal of Excellence").

## 4.2 Challenge 2: Strengthen the science and industry cooperation

**Description** – Before the science and higher education reform of 2010-2011, Polish scientific organisations were overwhelmingly focusing on fundamental research, with very little industry-oriented knowledge transfer or patenting activities. The implementation of R&I policies targeting the science-industry cooperation contributed to the changes of mindsets among scientists, transformed internal structures and procedures of HEIs and PROs to better respond to the needs of the private sector, and established numerous

opportunities for funding industrially-oriented R&D projects. These changes were supported by the EU Structural Funds in 2007-2013, and are further incentivised by ESIF and national funding in the current financial perspective. At the same time, the demand side is lagging (see also: Challenge 1). In 2015, only insignificant shares of R&D expenditures were funded by business enterprises - 2.6% for HEIs, 4.5% for PROs (GUS, 2016d, p. 67). Counts of public-private co-publications are smaller than in other EU MS but on the rise since 2010. The Polish Community Innovation Survey, covering years 2013-2015, yielded interesting results as for the first time in history, more industrial companies in Poland declared innovative cooperation with HEIs as more valuable that cooperation with suppliers of equipment, materials, components or software (21.2% industrial companies rating cooperation with HEIs as the most beneficial, and 20.7% emphasising the benefits of cooperation with suppliers) (GUS, 2016a, p. 106). In the past, limited confidence of business sector in the possibility of receiving useful inputs into innovation processes from scientific organisations was a recurring outcome of various surveys. Currently, the scientific and industrial R&I actors seem better aligned for joint innovative initiatives.

**Policy response** – MNiSW, NCBR and FNP strongly incentivise science-industry cooperation in various support measures and the issue remains one of core themes of R&I policies. In 2017, the preparation of reforms of HEIs (draft of the Higher Education and Science Act and National Science Congress) and PROs (plans to establish the Łukasiewicz Research Network) emphasized the importance of scientific organisations engaging in applied R&D and industrial cooperation. According to the draft plans for the reforms, universities will be incentivized for industrial engagement, and institutes forming the Łukasiewicz Research Network will be mandated to offer R&D services to industrial clients. The planned changes to R&D tax incentive scheme are expected to stimulate both in-house and extramural R&D efforts of companies, encouraging science-industry cooperation. MNiSW implemented the scheme of industrial doctorates, promoting PhD projects carried out jointly with industrial employers, and proposed the introduction of "industrial habilitations" as a variation of the existing post-doctoral degree, which would value industrially-oriented research achievements, patenting and successful R&D commercialisations, complementing track of record in scientific publications, which had traditionally been required as the basis for habilitation.

**Assessment** – Quantitative output indicators present unsatisfactory picture of the science-industry cooperation but the policy interventions have generated first positive results, with many HEIs and PROs engaging in applied R&D and knowledge transfer activities, and business enterprises positively assessing the inputs into innovation processes provided by university researchers. While many support measures and policy interventions target HEIs and PROs to stimulate their cooperation with companies, there still seems to be insufficient demand from the private sector. The government policies seem successful in inducing behavioural changes in academia.

## 4.3 Challenge 3: Increase the quality of the public research base

**Description** – The European Innovation Scoreboard 2017 ranks Poland as the third to last research system in the EU (EC, 2017c: 21), based on low performance in international co-publications, highly cited papers and foreign doctorate students. The Polish institutional evaluations of scientific organisations takes into account both international and local publications, and fail to adequately incentivise high impact research, resulting in the Polish research output less internationally oriented than in most other EU member states. The issue was already identified by the Country Specific Recommendations for Poland, 2016 (the low degree of internationalisation of Polish higher education and limited participation in international scientific collaboration, CEU, 2016: 2). Polish organisations absorb comparatively smaller funding from Horizon 2020, than in FP7 (based on eCorda database), and tend to finance R&D projects from nationally-funded programmes and ESIF.

**Policy response** – The draft of the Higher Education Act includes plans to differentiate between research-intensive and teaching universities, change the institutional assessment of scientific organisations and mechanisms for allocating institutional R&D funding so that high-impact research weighs more in the evaluation than counts of scientific publications. Moreover, it is also expected to modify the models of doctoral studies and scientific careers. The draft published in September 2017 is congruent with key recommendations of the Peer Review of the Polish system of innovations, carried out by the H2020 Policy Support Facility in 2017. The plan to establish Łukasiewicz Research Network complements the HEI reform, enforcing strong orientation of research institutes becoming part of the Network towards industrially relevant R&D, while expecting the remaining PROs to strive for scientific excellence. MNiSW and its agencies further expanded the portfolio of support measures promoting quality of research, with NCN offering new instruments for younger researchers and scientists who had never benefited from public R&D project funding ("MINIATURA" and "SONATINA"), and NCBR promoting the internationalisation of science and the introduction of innovative doctoral programmes using ESIF-based measures of POWER programme. NCN jointly with Max Planck Society launched a call for Dioscuri Centre of Scientific Excellence. Dedicated agency NAWA was established on 1 October 2017 that will support the international mobility of scientists and attract foreign researchers to Poland. The quality of public science was also one of key themes covered by the peer-review of the Polish innovation system, carried out within the framework of H2020 Policy Support Facility.

**Assessment** – Reforms prepared by MNiSW have adequately diagnosed the problems with quality of public science and are likely to trigger positive changes. Nevertheless, currently the institutional evaluation of scientific organisations still fails to incentivize high-impact research promoting instead opportunistic behaviours of scientists, HEIs and PROs. This is evidenced by excessive number of Polish scientific journals and limited interests of scientists in international publications or participation in H2020 projects, as well as overrepresentation of highly ranked scientific units (as many as 38.16% of scientific units were assigned to the highest categories "A+" and "A+", indicating a limited selectivity of the institutional assessment of 2017). Recent initiatives such as the establishment of NAWA or launch of dedicated calls to establish centres of excellence or expand the group of scientists benefiting from competitive project funding are expected to yield positive results and seem adequately targeted. What is more, the University of Warsaw was promoted by 100 positions in the Academic Ranking of World Universities, significantly improving its scientific standing.

## 4.4 Challenge 4: Priority setting in the R&I governance system

**Description** – The Polish innovation system encompasses multiple and sometimes contradictory sets of R&I priorities and directions. The country has a list of 20 National Smart Specialisations, the Regional Smart Specialisations in each of 16 regions, sectoral programmes of NCBR, RANBs (Regional Scientific Agendas) of NCBR, the key innovation clusters and lists of sectors prioritised for export promotion. The top-level policy document the Strategy for Responsible Development (SOR) declares the need to narrow-down the list of Smart Specialisations in order to better concentrate R&I investments. In 2017, the government started offering support for selected flagship initiatives such as e-mobility (electric cars and buses), but the selection of intervention areas did not directly result from the consultative process that contributed to the development of Smart Specialisations.

**Policy response** – In 2017, the comprehensive sets of R&I priorities were not reorganized. In particular, the intentions to narrow-down the list of Smart Specialisations, outlined in the SOR, were not implemented. Activities of stakeholder expert groups working on Smart Specialisation Strategies were limited and did not yield major changes. In some areas, an increased inter-ministerial coordination became visible, e.g. for initiatives related to electromobility and zero-emission transport launched

by NCBR, PARP and National Fund for Environmental Protection and Water Management, (interestingly, the electromobility was actually not included among 17 national Smart Specialisations). Some of the launched "sectoral programmes" of NCBR (POIR 1.2) concerned technological areas did not belong to the National Smart Specialisations either (aviation, steel, unmanned aerial vehicles, electronics and ICT). Similarly, the inter-ministerial initiative promoting electromobility remains disjoint from the formally adopted Smart Specialisations.

**Assessment** – In 2017, Smart Specialisations have not been actively evaluated and updated through the entrepreneurial discovery process with the involvement of stakeholders. As of 2017, the efforts to narrow-down the list of specialisations remain limited and partly disjointed from the current allocation of funds (flagship initiatives).

# 5 Focus on R&I in National and Regional Smart Specialisation Strategies

Poland has developed smart specialisations at both, national and regional levels (KIS, pl. *Krajowe Inteligentne Specjalizacje*; RIS, pl. *Regionalne Inteligentne Specjalizacje*). As of 2017, Poland and all its 16 regions are registered in the S3 Platform.

**National level**

The latest list of KIS includes 17 specialisations with detailed descriptions. The identified specialisations cover most of areas of industrial R&D, but do not include software or aviation technologies, despite both fields being seen as important technological areas by companies in Poland (MR, 2016). The process of KIS identification was in line with the requirements of the ex-ante conditionalities defined in ESIF-related regulations and involved stakeholder's consultation, foresight exercises (2006-2009 foresight of scientific research directions; 2011-2012 foresight of industrial technologies), as well as quantitative data analysis related to patents and R&D activities.

The regional smart specialisations are co-ordinated by regional Marshall's Offices (in all 16 regions). The regions vary in their smart specialisations development and approaches adopted. This heterogeneity could be attributed to differentiated awareness of competitive advantages at the sectoral and technological level and institutional capacities related to the development and update of Regional Innovation Strategies (Czyżewska-Misztal, Golejewska, 2016). In some regions identified specialisations are described in a more detail, and only some of them are clearly related to R&I, while others might focus on the regionally available natural resources or industry sectors that are strongly represented in the region, regardless of their actual innovative activities or R&I potential. Due to variety of methods and techniques used, the regional approaches to monitoring and evaluation processes are also diverse (Piatkowski et al., 2014, World Bank assessment of RIS progress) which has negative impact on the comparability.

As of 2017, various measures and funding schemes use KIS and RIS as the basis for funding eligibility. In case of KIS, these include measures based on ESIF – in particular, the majority of R&D funding in POIR's will be allocated to areas consistent with smart specialisations (MR, 2017a). Accordingly, regions take into account their smart specialisations (RIS) in the distribution process of R&I-related funding from Regional Operational Programmes (RPOs).

Monitoring mechanisms of KIS and RIS in Poland are not entirely set up. As of 2017, it is composed of the Working Groups for National Smart Specializations (pl. *Grupy Robocze ds. krajowych inteligentnych specjalizacji*), the Economic Observatory (pl. *Obserwatorium Gospodarcze*), Steering Committee (pl. *Komitet Sterujący*) and the Consultative Group (pl. *Grupa Konsultacyjna*) constituted by national and regional authorities. The Steering Committee composed of the representatives of the Ministry of Economic Development, the Ministry of Science and Higher Education and the Ministry of Infrastructure and Construction, aimed at monitoring effects of the KIS implementation evaluates outcomes

and targets and selects experts to be engaged in the Working Groups for National Smart Specialisations (MR, 2014). The working groups provide regular, detailed updates of the contents of technologies and research areas linked to each of the 17 specialisations. The Economic Observatory (pl. *Obserwatorium Gospodarcze*), composed of experts from various industries and organisations analyses current and emerging potential of Polish R&I, identifies relevant barriers, threats and opportunities, important market niches, development trends, R&D results and prepares cyclical reports on KIS implementation in order to support KIS monitoring process (MR, 2015). Apart from updates to KIS, it is hard to identify any tangible outcomes of the monitoring process. In particular, no analytical reports or data summaries were published by the Economic Observatory.

The top-level policy document, the Strategy for Responsible Development (SOR) highlights new policy developments regarding KIS and RIS. It divides KIS into two groups of specialisations – regular specialisations and "fast-track programmes" (pl. *programy pierwszej prędkości*) (MR, 2017b: 68). As of 2017, the latter includes 10 specialisations, but do not constitute a closed catalogue and will be subject to monitoring and cyclic updates (MR, 2017b: 89). Selected specialisations are planned to be fuelled with additional funding and additional support, including coaching and mentoring. Furthermore, their development will be supported by an elimination of legislative, organisational and institutional barriers and by facilitating links between business and science.

Among the strategic programmes outlined in SOR there is the Coordination system for KIS and RIS (pl. *System koordynacji Krajowych Inteligentnych Specjalizacji (KIS) i Regionalnych Inteligentnych Specjalizacji (RIS))*, which is under preparation since 2017 and is expected to be ready by 2020. It is aimed at establishing and implementing a model of coordination KIS and RIS in order to support synchronisation of undertaken actions and ensure complementarity and synergies of specialisations at national and regional levels (MR, 2017b: 205).

SOR also outlines the need to narrow-down the list of identified priorities with the view to better focus R&I investments. However, it is still unclear how, when and based on what evidence this process will be conducted.

In 2017, smart specialisations designed at national level have not yet been evaluated, nor extensively updated through entrepreneurial discovery process (EDP). As of 2017, Poland is not widely engaged in strategic inter-regional and cross-border cooperation related to smart specialisations. The use of the 15% of the structural funds that can be used to fund external actors is limited among regions in Poland. The involvement of universities in the development and implementation of regional Smart Specialisation Strategies had initially been an important driving force in the EDP process. HEI representatives participated in dedicated workgroups and taskforces on both national and regional levels, providing scientific expertise and complementing the scarce involvement of companies. However, the academic interests in S3 efforts have weakened once the stakeholders realized that regional funding based on ESIF in Poland is primarily targeting industrial research and relevant instruments in most regions are not available to universities or academic researcher teams.

Regional level – two examples

Silesia was one of the first regions in Poland to join the Smart Specialisation Platform (Romanowska, Firgolska, Hrudeń, 2014)[1]. The Regional Innovation Strategy of the Śląskie Voivodeship for the years 2013-2020 complies with the regional specialisations outlined in the Silesian Voivodeship Technology Development Program for the years 2010

[1] The selection of smart specialisations in the region was prepared taking into account: identified unique features and assets of the region that will serve to build competitive advantage; vision aimed at achieving a higher level of prosperity in the region; development of regional innovation systems; maximization of knowledge flows and regional dissemination of benefits related to innovation; compliance with Regional Innovation Strategy and Technology Development Program and inclusion of their achievements (Sejmik Województwa Śląskiego, 2012: 17-22; Brzóska, 2014).

– 2020. They include: electric power industry, health industry, information and communication technologies (Sejmik Województwa Śląskiego, 2012: 17-22; Zarząd Województwa Śląskiego, 2011) and will be updated by the end of 2018 (Urząd Marszałkowski Województwa Śląskiego, 2017). Moreover, in order to help the process, in the period of 2017-2019 the region runs projects co-financed from RPO:

- the network of Regional Specialized Observatories (pl. *Regionalne Obserwatorium Specjalistyczne*) in partnership with 12 institutions, aimed at identification of growth sectors of the region that will help to update or complement already identified specialisations; (pl. *Projekt „Sieć Regionalnych Obserwatoriów Specjalistycznych w Procesie Przedsiębiorczego Odkrywania"*);
- the Aerospace Technology Observatory implemented in partnership with Silesian Science and Technology Centre of Aviation Industry (pl. *Projekt „Proces Przedsiębiorczego Odkrywania w obszarze technologii lotniczych i z nimi powiązanych"*).

As of 2017, monitoring and evaluation processes of regional smart specialisations in Silesia included two pilot evaluation studies. The former, conducted in 2017, led to the identification of potential market niches and specializations in the period 2020+. The latter is still in progress. Moreover, the representatives of the region are actively engaged in the work of the Regional Forum for Smart Specialization and the Consultative Group led by MR in terms of KIS and RIS monitoring, as well as implementation of EDP (Staś, 2017).

Another Polish region, Podkarpackie has a well-established Regional Innovation System and good practices in terms of monitoring and evaluation of RIS progress. Podkarpackie has the highest share of innovative companies in Poland, high growth rate of employment in R&D in the total employment and has developed many local and international co-operations (Deloitte, 2013: 23).

The Regional Strategy of Innovation of the Podkarpackie Voivodeship for the years 2014-2020 on smart specialization (RIS3) was updated in 2016 (Woźniak, et al., 2016). The draft strategy was subject to public consultations and evaluation carried out by experts of the European Commission in 2014 (Dziedzic, Woźniak, Czerepiuk, 2016: 115; Urząd Marszałkowski Województwa Podkarpackiego, 2016). Moreover, the Marshal's Office of the Podkarpackie Voivodeship commissioned sectoral analyses in order to supplement the updates of smart specialisations in the strategy (InnoReg, 2016). The updated document presents results of many stages of the entrepreneurial discovery process, justification for the selection of smart specialisations, RIS implementation concept with relevant monitoring and evaluation procedures, guidelines for the operational programmes and action plans for each smart specialization. These actions led to identification of three main smart specialisations (aeronautics and space technology, quality of life, automotive industry) and an ancillary one (information and telecommunication). Although initial actions taken in order to identify and monitor smart specialisations in Podkarpackie Voivodeship seem to be well organised and consistent, no specific activities related to RIS monitoring could be identified after 2015 (Zarząd Województwa Podkarpackiego, 2017; Serwis Regionalnego Programu Operacyjnego Województwa Podkarpackiego, 2016).

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## Abbreviations

| | |
|---|---|
| ARP | Industrial Development Agency (*Agencja Rozwoju Przemysłu*) |
| BERD | Business Expenditures on Research and Development |
| CEE | Central and Eastern Europe |
| CIS | Community Innovation Survey |
| CSR | Country Specific Recommendations |
| DESI | Digital Economy and Society Index |
| EC | European Commission |
| EDP | Entrepreneurial Discovery Process |
| ESIF | European Structural and Investment Funds |
| EU | European Union |
| EU-15 | The 15 Member States of the European Union from 1995 until 30.4.2004 (BE, DK, DE, EL, ES, FR, IE, IT, LU, NL, AT, PT, FI, SE, UK) |
| EU-28 | European Union including 28 Member States |
| FDI | Foreign Direct Investment |
| FNP | Foundation for Polish Science (*Fundacja na rzecz Nauki Polskiej*) |
| FP7 | The EU 7$^{th}$ Framework Programme for Research and Technological Development |
| FTE | Full-time Equivalent |
| GBAORD | Government Budget Appropriations or Outlays on R&D |
| GDP | Gross Domestic Product |
| GERD | Gross Domestic Expenditures on R&D |
| GUS | Central Statistical Office (*Główny Urząd Statystyczny*) |
| GVA | Gross Value Added |
| HEI | Higher Education Institute |
| H2020 | Horizon 2020 |
| ICT | Information & Communication Technologies |
| JRC | Joint Research Centre, European Commission |
| KIS | National Smart Specialisations (*Krajowe Inteligentne Specjalizacje*) |
| MNiSW | Ministry of Science and Higher Education (*Ministerstwo Nauki i Szkolnictwa Wyższego*) |

| | |
|---|---|
| MR | Ministry of Economic Development (*Ministerstwo Rozwoju*) |
| NAWA | National Agency for Academic Exchange (*Narodowa Agencja Wymiany Akademickiej*) |
| NCBR | National Research and Development Centre (*Narodowe Centrum Badań i Rozwoju*) |
| NCN | National Science Centre (*Narodowe Centrum Nauki*) |
| PAIH | Polish Investment and Trade Agency (pl. *Polska Agencja Inwestycji i Handlu*) |
| PARP | Polish Agency for Enterprise Development (*Polska Agencja Rozwoju Przedsiębiorczości*) |
| PCT | Patent Co-operation Treaty |
| PFR | Polish Development Fund (*Polski Fundusz Rozwoju*) |
| PLN | Polish zloty |
| POIR | Operational Programme Smart Growth (*Program Operacyjny Inteligentny Rozwój*) |
| POWER | Operational Programme Knowledge, Education and Development (*Program Operacyjny Wiedza, Edukacja i Rozwój*) |
| PPI | Public Procurement for Innovation |
| PRO | Public Research Organisation |
| R&D | Research and Development |
| R&I | Research and Innovation |
| RIO | Research and Innovation Observatory |
| RIS | Regional Smart Specialisations (*Regionalne Inteligentne Specjalizacje*) |
| RPO | Regional Operational Programmes |
| SBA | Small Business Act |
| SOR | Strategy for Responsible Development (*Strategia na rzecz Odpowiedzialnego Rozwoju*) |
| SME | Small and Medium-sized Enterprise |
| STEM | Science, Technology, Engineering and Mathematics |
| TFP | Total Factor Productivity |

# Factsheet

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **2009** | **2010** | **2011** | **2012** | **2013** | **2014** | **2015** | **2016** | **2017** | **2018** |
| GDP per capita (euro per capita) | 8300 | 9400 | 9900 | 10100 | 10300 | 10700 | 11200 | 11100 | | |
| Value added of services as share of the total value added (% of total) | 63.68 | 63.92 | 62.83 | 63.42 | 64.52 | 63.85 | 63.4 | 63.6 | | |
| Value added of manufacturing as share of the total value added (%) | 18.5 | 17.68 | 18.1 | 18.44 | 17.91 | 18.92 | 19.87 | 20.42 | | |
| Employment in manufacturing as share of total employment (%) | 19.28 | 18.58 | 18.71 | 18.6 | 19.02 | 19.1 | 19.37 | 20.2 | | |
| Employment in services as share of total employment (%) | 55.77 | 56.88 | 56.65 | 57.27 | 57.75 | 58.3 | 58.21 | 58.45 | | |
| Share of Foreign controlled enterprises in the total nb of enterprises (%) | 0.42 | 0.42 | 0.43 | 0.44 | 0.46 | 0.46 | 0.44 | | | |
| Labour productivity (Index, 2010=100) | 93.7 | 100 | 104.7 | 106.5 | 108.3 | 109.6 | 111.7 | 114.1 | | |
| New doctorate graduates (ISCED 6) per 1000 population aged 25-34 | | | | 0.41 | 0.48 | 0.44 | 0.51 | 0.49 | | |
| Summary Innovation Index (rank) | 24 | 25 | 25 | 25 | 25 | 25 | 26 | 25 | | |
| Innovative enterprises as a share of total number of enterprises (CIS data) (%) | | | | 23 | | 21 | | | | |
| Innovation output indicator (Rank, Intra-EU Comparison) | | | 19 | 20 | 19 | 20 | | | | |
| Turnover from innovation as % of total turnover (Eurostat) | | 8 | | 6.3 | | | | | | |
| Country position in Doing Business (Ease of doing business index WB)(1=most business-friendly regulations) | | | | | | 28 | 25 | 24 | 24 | 27 |
| Ease of getting credit (WB GII) (Rank) | | | | | | 16 | 18 | 19 | | |
| Venture capital investment as % of GDP (seed, start-up and later stage) | 0.001 | 0.002 | 0.007 | 0.002 | 0.006 | 0.006 | 0.007 | | | |
| EC Digital Economy & Society Index (DESI) (Rank) | | | | | | 22 | 23 | 24 | 23 | |
| E-Government Development Index Rank | | 45 | | 47 | | 42 | | 36 | | |
| Online availability of public services – Percentage of individuals having interactions with public authorities via Internet (last 12 months) | 25 | 28 | 28 | 32 | 23 | 27 | 27 | 30 | 31 | |
| GERD (as % of GDP) | 0.66 | 0.72 | 0.75 | 0.88 | 0.87 | 0.94 | 1 | 0.97 | | |
| GBAORD (as % of GDP) | 0.33 | 0.36 | 0.31 | 0.35 | 0.36 | 0.43 | 0.41 | 0.16 | | |
| R&D funded by GOV (% of GDP) | 0.4 | 0.44 | 0.42 | 0.45 | 0.41 | 0.43 | 0.42 | | | |
| BERD (% of GDP) | 0.19 | 0.19 | 0.22 | 0.33 | 0.38 | 0.44 | 0.47 | 0.63 | | |
| Research excellence composite indicator (Rank) | 26 | 25 | 23 | 21 | 24 | 23 | | | | |
| Percentage of scientific publications among the top 10% most cited publications worldwide as % of total scientific publications of the country | | 4.01 | 3.83 | 4.11 | 4.78 | 4.82 | | | | |
| Public-private co-publications per million population | 2.99 | 4.6 | 4.81 | 4.12 | 4.18 | 4.71 | 3.68 | | | |
| World Share of PCT applications | 0.14 | 0.16 | 0.16 | 0.16 | 0.19 | 0.19 | 0.2 | | | |
| Global Innovation Index | | | | 49 | 45 | 46 | 39 | 38 | | |

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