Research and Innovation Report

Research and Innovation Policy

Sustainable Governance Indicators 2018

SGI Sustainable Governance Indicators

BertelsmannStiftung

Indicator

R&I Policy

Question

To what extent does research and innovation policy support technological innovations that foster the creation and introduction of new products?

41 OECD and EU countries are sorted according to their performance on a scale from 10 (best) to 1 (lowest). This scale is tied to four qualitative evaluation levels.

10-9 = Research and innovation policy effectively supports innovations that foster the creation of new products and enhance productivity.
8-6 = Research and innovation policy largely supports innovations that foster the creation of new products and enhance productivity.
5-3 = Research and innovation policy partly supports innovations that foster the creation of new products and enhance productivity.
2-1 = Research and innovation policy has largely failed to support innovations that foster the creation of new products and enhance productivity.

Israel

Score 10

Israel's research and development (R&D) sector is based on three pillars: scientific research performed primarily in academia, research conducted in government institutes, and research conducted by civil-industrial partnerships overseen the by Finance Ministry. For many years, Israel has led the world in research and development (R&D) investment, spending more on R&D as share of GDP than any other developed country. The country was ranked at 16th place in the 2017 Global Innovation Index.

In 2014 the government's social-economic cabinet approved the establishment of an authority aimed to encourage technological innovation. Since the beginning of 2016, the Ministry of Economy and Industry has provided financial support to private companies through a fund focused on such innovation. The fund prioritizes research in developing areas in Israel, as well as in the field of biotechnology.

The Israel Innovation Authority began its activity in early 2017. The Authority was established based on the model of the Office of the Chief Scientist in the Israeli Ministry of Economy and Industry, with the goal of implementing the R&D Law and providing high-quality and effective services for the Israeli innovation ecosystem.

A large portion of Israel's R&D policy is directed toward international cooperation. In 2011, Israel was engaged in 30 different international cooperative research ventures with a variety of European countries and organizations. These resulted in 250 grant applications and projects with a total budget of €250 million. Israel is also signatory to some 29 bilateral R&D agreements and is involved in five EU programs, including Eureka, Eurostars, the Competitive and Innovation Program – Enterprise

Europe Network (CIP-EEN), Galileo and Sesar. In terms of both policy and budgets, the most significant international involvement is through the Framework Programs, such as Horizon 2020, which are managed by the Israel-Europe R&D Directorate (ISERD).

Israel produces a high number of new and important patents every year, mainly in the fields of science and technology. It is a signatory to the Patent Cooperation Treaty. In 2016, an increase of 25% in patent applications was recorded – from 509 in 2015 to 635 in 2015. In addition, the number of patents approved rose from 540 in 2015 to 813 in 2016.

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Sweden

Score 10

Sweden ranks among the top five advanced industrialized democracies on all aspects of research and development (R&D): spending (public and private) per capita; number of researchers; number of patent applications and intellectual ownership licenses. This high level of investment in R&D has existed for considerable time. As an economy with high labor costs, Sweden's competitive edge lies not in large-scale manufacturing but in knowledge-intensive sectors. R&D spending thus directly sustains that competitive edge.

Governments – center-right as well as Social Democratic-Green – rarely miss an opportunity to reinforce the argument that public spending on higher education, research institutions and research and development in general is integral to future prosperity and wealth. There is nothing suggesting that the commitment among all major political players to R&D spending is about to change.

While R&D spending has a long history, converting research and development concepts into valuable products has been far more challenging for Sweden. The

"Swedish paradox," as it is called, is precisely the inability to convert research findings into commercially viable products. However, as recent data show, Sweden now ranks first with regard to patent applications and license fees for intellectual property. This is a valid indicator that R&D is bearing fruit, as securing intellectual ownership of emerging products is a critical stage in the process from the research facility to the market. Public policy has targeted this very issue lately and the data suggest that R&D is now increasingly paying off.

Meanwhile, the new era of digital entrepreneurship has seen Sweden emerge as a global center of digital innovation. This applies to digital communication, computer games and IT-based services. The World Economic Forum, which views Sweden's tax levels as burdensome, suggests that the social welfare safety net has made Swedes less risk averse than entrepreneurs in many other countries. Overall, it appears that much of this success can be attributed to deregulation and other pro-business reforms that were introduced by the previous, non-socialist government between 2006 and 2014.

Citation:
Digitaliseringskommissionen (2015): Digitalisering, främjande och framtid. En utredning kring behov av digitaliseringsfrämjande insatser (Stockholm) (https://digitaliseringskommissionen.se/wp-content/uploads/2015/02/Digitalisering-fr%C3%A4mjande-och-framtid-Slutlig-februari-2015_korrigerad.pdf).
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World Economic Forum (12 October 2017), "Why does Sweden produce so many startups?"

Germany

Score 9

Germany's performance in the area of research and development remains positive. According to the World Economic Forum, Germany's capacity for innovation ranks among the world's top performers. In the Global Competitiveness Report 2017/2018, Germany's ranking improved to 5 out of 140 countries, trailing less than 0.3 points behind leading nation Switzerland in the area of technological development, and product and process innovation (p.126-127). Furthermore, Germany ranked 7 out of 140 countries for patent applications per inhabitant, a one position deterioration over the previous year. The quality of scientific research institutions remains in need of improvement, with Germany ranked only 11 out of 140 (Global Competitiveness Report 2017/2018: 127).

Regarding funding, the German government continues to raise budgets on research and development. Its spending remains above the European average. The budget of the Ministry of Education and Research was increased to €14.0 billion in 2014, €15.3 billion in 2015, €16.4 billion in 2016 and €17.6 billion in 2017, a record setting mark.

In contrast to numerous other European countries, Germany does not offer general R&D tax incentives, but rather concentrates on targeted funding of specific programs. Companies' expenditures on R&D are strong, but public-private

partnerships and collaboration between universities and industry leave room for improvement. The government started its so-called excellence initiative within the tertiary education sector in 2005 and modified the scheme in June 2016. The federal government and states have agreed to resume the Joint Initiative for Research and Innovation, and intend to increase the program's budget by 5% every year. All these measures appear to be effective to some extent. Over the past years, the quality of its scientific research institutions has improved slightly. In the Global Competitiveness Report 2017/18 edition Germany performs well in higher education and training. Germany improved by one position to 15 out of 138 countries (p.127).

Citation:
Global Competitiveness Report 2017/2018. World Economic Forum.

Bundesministerium für Bildung und Forschung – BMBF (2017): Der Haushalt des Bundesministeriums für Bildung und Forschung. Internet source:
https://www.bmbf.de/de/der-haushalt-des-bundesministeriums-fuer-bildung-und-forschung-202.html

Netherlands

Score 9

In 2017, the European Innovation Scoreboard had the Netherlands as an innovation leader, ranked fourth among the top-six countries (jointly with Switzerland, Denmark, Germany, Finland and Sweden). The Netherlands ranked 4 out of 138 economics in the World Economic Forum's Global Competitiveness Report 2016 – 2017 and was the second most competitive economy in Europe. Since 2010, Dutch innovation capacity has increased by 10.4% compared to the EU average. On the specific issue of sustainable competitiveness, in 2015 the Netherlands was given sixth place. The Netherlands scores above average in terms of open, excellent and attractive research systems, as well as in scientific-publication output, finances and support. Its weakness is in financial market development (with low scores for perceived efficiency, and confidence and trust in the financial sector), sales and intellectual assets.

It is unclear whether his national R&D performance is due to government policies (coordinated by the Ministry of Economic Affairs). The country's policymakers aim to secure the Netherlands a place as one of the top five global knowledge economies, and to increase public and non-public R&D investments to 2.5% of GDP (€650 billion). The most recent figures, compiled by the Rathenau Institute, forecast a stop to the decrease in total government R&D expenditures. However, to achieve the aim of 2.5% GDP annual public-private investment in R&D by 2020 a structural increase of €5.5 billion is necessary.

Dutch policies used to focus on the reduction of coordination costs in creating public/private partnerships. In addition, there were substantial amounts of money in innovation credits for start-up companies and R&D-intensive SMEs – four to five times as much as for larger companies. SMEs struggle with obtaining access to bank credits and navigating their way through a maze of regulatory details in obtaining

state funds for innovation. Since 2011, national R&D has focused on nine economic sectors identified as a top priority. A special innovation fund for SMEs remains in place.

Citation:
Rathenau Instituut, Voorpublicatie Totale Investeringen in Wetenschap en Innovatie (TWIN) 2015-2021, rathenau.nl, accessed 27 september 2017

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D. Lanser en H. van der Wiel (2011), Innovatiebeleid in Nederland: de (on)mogelijkheden van effectmeting, CPB Achtergronddocument (www.cpb.nl/sites/default/files/publicaties/download/cpb-achtergronddocumenten)

South Korea

Score 9

The South Korean government invests heavily in research and development (R&D), particularly in fields which can be directly commercialized. The current government plans to unify previously fragmented policies in the area of R&D. A presidential committee on the so-called Fourth Industrial Revolution will be established, and President Moon has said his administration will seek to actively harness new technologies and spur innovation in order to create new jobs. The government's science and technology strategy is encompassed in a document entitled "A Nation of the People," implying a focus on improving quality of life through the use of technology. According to the 2018 budget allocation and adjustment plan, significant investments will be made in core technologies, including artificial intelligence. The budget for research and development (R&D) will be about KRW 920 billion, a 20% increase from 2017. KRW 399.2 billion will be invested in supporting science and technology-based entrepreneurship in fields such as biotechnology and ICT, which are viewed as candidates for revitalizing the private sector. In addition, KRW 321.1 billion will be used to support the development of software professionals and cultivate the science and engineering graduates needed by companies.

The plan is to double R&D funding for SMEs and expand venture funds significantly to reach a total of KRW 5 trillion in 2022, from KRW 3.2 trillion as of 2016. When a business which has already employed two young adults as regular workers hires one additional young regular employee, the government will subsidize the wages for the third employee for three years. While applied research is very well developed in the country, cutting-edge basic research of the kind that might lead to Nobel Prize-worthy discoveries, for example, is still lacking. Moreover, the patent commercialization rate, despite the large number of patents registered by Korean firms, is still low. Overall, South Korea needs to enhance the efficiency of its R & D sector.

Citation:
Policy Roadmap of the Moon Jae-in Administration, July 19 2017

Switzerland

Score 9

Switzerland's achievement in terms of innovation is considerable. It spends 3% of its GDP (2013) on research. Standardized by the number of inhabitants, it is an international leader in patent applications, with strengths in health technologies and bio-technology. A total of 75% of research spending is corporate spending with the direct aim of economic innovation, an important factor in the country's strong overall competitiveness. With a share of about 25%, public research funding plays a lesser role than in other European countries and depends on five main actors: the cantonal universities, the two federal institutes of technology, the National Science Foundation, the Federal Commission for Technology and Innovation, and the academies of sciences. These actors are independent of each other, but cooperate on the basis of complementarity and (although limited) competition. The various institutions are highly autonomous, and research policies and processes are driven by bottom-up operations. Thus, Swiss research policy is not centralized, but rather relies on a concept of decentralized innovation with periodic intervention by the federal government. The output of the research system is impressive. The Federal Institutes of Technology Zürich and Lausanne belong to the top-ranked universities in the world, and the universities of Basel, Bern, Geneva and Zürich regularly appear on the list of the 150 best universities worldwide.

Some deficits persist, however, such as coordination among universities and the new universities of applied sciences as well as the weakness in social science and humanities research relative to that conducted in the natural sciences and technologically.

In 2016, the federal government defined its research and innovation goals for the coming four years: increased support for (1) continuing education in vocational training, (2) young academics, (3) training in medicine and (4) innovation. The resources for education, research and innovation should grow by 2% annually.

Denmark

Score 8

Among OECD countries, Denmark has the fourth highest ratio of public R&D spending to GDP, second highest ratio of researchers to overall population (after Israel) and seventh highest submission rate of patent applications. These factors suggest that there is scope for Denmark to improve its competitiveness in the future.

The target for R&D investments is 3% of GDP. This figure was actually reached in 2009, with 1.02% public and 2.1% private research investments. Since Danish businesses are less innovative than foreign competitors, the Social Democratic-led government took various initiatives, including the creation of a Business Innovation

Fund as well as a Globalization Fund.

The Liberal government that came to power in June 2015 set a target of 1% of GDP for publicly funded research. As part of the government's recent fiscal bill, public expenditure on research and education was cut. Spending was reduced in 2016, while further cuts are planned for 2017 to 2020. Public debate about these cuts has been vivid, particularly regarding how these cuts relate to the government's aim to strengthen productivity and increase competitiveness.

Denmark scores reasonably high in international comparisons on competitiveness. Denmark is ranked 12 out of 137 countries in the latest 2017 – 2018 Global Competitiveness Index (3 in 2008 and 15 in 2013 – 2014). Denmark continues to score reasonably well on higher education and training (ranked 6) and labor market efficiency (ranked 10).

The current three-party government includes a minister for public sector innovation based in the Ministry of Finance.

Citation:
World Economic Forum, The Global Competitivenes Report 2017-2018. http://www3.weforum.org/docs/GCR2017-2018/05FullReport/TheGlobalCompetitivenessReport2017%E2%80%932018.pdf (accessed 5 November 2017).

Produktivitetskommissionen: www.produktivitetskommissionen.dk

France

Score 8

Having improved since 2007, France performs well in research and development policy. According to the EU Innovation Scoreboard 2017, France is ranked 11 out of 28 EU countries with respect to innovation capacity. In the report's global innovation index, France performs slightly above the EU average and is ranked in the group of "strong innovators," behind the group of "innovation leaders." Overall spending on research and development represents 2.23% of GDP (last findings for 2015), below the OECD average and far from the EU target of 3%. Whereas public spending is comparable to the best-performing countries, private spending remains less strong. France's main relative weaknesses are its low private investment, a less than innovative corporate environment, especially with small- and medium-sized businesses, and weak cooperation between the private and public sectors.

On the positive side, the measures taken by the Hollande administration have fostered the dynamics of new technology-based firms (startups). According to the Deloitte Technology Fast 500 Index, in the past four years, France has featured the highest number of fast-growing startups in the last years (97 in 2017, compared to 92 for the UK, 50 for the Netherlands and 48 for Sweden).

However, barriers to innovation still exist. Cooperation between academic institutions and businesses is still restricted by cultural traditions, such as a lack of

investment by small-and medium-sized companies and the reluctance of researchers to invest in policy-relevant or applied research. Productivity levels and public research could also be improved. However, the development of joint public-private initiatives as well as the launching of incubators by private investors are improving the quantity and quality of initiatives and investments, in particular in new technologies.

The Macron government has decided to give a major boost to research and innovation not only by supporting the development and growth of startups but by dedicating €50 billion to this objective over the next five years. The money should not come from new taxes but, for a large part, from the selling of non-strategic assets owned by the state.

Citation:
European Innovation Scoreboard 2017
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Deloitte: 2017 Technology Fast 500 Europe, Middle East, Africa
(https://www2.deloitte.com/global/en/pages/technology-media-and-telecommunications/articles/technology-fast-500-emea.html)

Luxembourg

Score 8

In its Europe 2020 strategy, Luxembourg set a goal of raising public expenditure on research and innovation to between 2.3% and 2.6% of GDP, of which 0.7 to 0.9 percentage points are earmarked for public use (0.73% in 2015) and 1.6 to 1.7 percentage points earmarked for private research. The overall European goal is 3% of GDP.

Luxembourg supports private research projects: innovation and research can benefit from financial support up to 35%. Private sector innovation can receive grants up to 50% and feasibility studies up to 75%.

Luxembourg has a high proportion of high-skilled workers, with 59.5% of jobs demanding a high level of education or training. More than 40% of the working age population has achieved a tertiary level of education and/or is employed in the science and technology sector. This creates synergies between public research and industry. Luxembourg ranks among the top ten on the Innovation Output subindex and is number 12 in the overall assessment of the 2017 Global Innovation Index (GII).

In the World University Rankings 2017, Luxembourg increased 14 places compared to 2016 and is now ranked 179 out of 1,000 universities. The new Belval campus, designed for 7,000 students, 3,000 researchers and about 6,000 residents, is one of the largest urban conversion projects in Europe. In 2017, more than 1,600 employees, including doctoral candidates and more than 3,100 students were teaching, learning and working in this modern location. The relocation to Belval

(with the exception of parts of the Faculty of Law, Economics and Finance) will be completed in 2019. After initially increasing in 2016, the budget of Belval University is now stagnating at the 2017 level. In its 2016 and 2017 evaluation, the OECD recommends better impact control and further investments in the Belval campus.

Citation:
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Canada

Score 7

Overall, Canada's economic conditions and general policy environment are conducive to innovation and investments in productivity growth. The country benefits from stable macroeconomic policies, well-developed regulations that ensure competition, largely open trade in goods and capital, and an educated population.

At the same time, a 2015 report from the federal government's Science, Technology and Innovation (STI) Council found that the country continues to tread water as a mid-level performer in STI, for years lagging behind other countries when it comes to key innovation measures like filing patents and corporate spending on research and development. In the 2017 budget, the government introduced CAD 950 million to support "innovation superclusters" similar to those in Silicon Valley to help drive innovation, R&D and economic growth. How effective government policy is in encouraging R&D investment and productivity gains remains contentious, however. Questions exist about the effectiveness of the federal government's Scientific Research & Experimental Development (SR&ED) tax program in increasing business-sector R&D (the program has never been formally evaluated) and the impact of budget cuts for government R&D labs. Critics have also pointed to the inadequacy of government programs to facilitate technology transfers, and persuade small and medium-sized businesses to adopt best practices. Finally, increased rates of higher education participation have failed to yield increased business sector R&D and productivity.

Public policy in Canada continues to encourage a strong research capacity in the academic sector. In September 2012, the Council of Canadian Academies released an assessment of science and technology in Canada, based on a survey of over 5,000 leading international scientists, that found the country's scientific research enterprise to be ranked fourth-highest in the world, after that of the United States, the United Kingdom and Germany.

Citation:
2017 Federal Budget "Building a Strong Middle Class; #Budget2017," posted at http://www.budget.gc.ca/2017/docs/plan/budget-2017-en.pdf

Council of Canadian Academies (2012) Expert Panel Report on the State of Science and Technology in Canada, September, http://www.scienceadvice.ca/uploads /eng/assessments%20and%20publicatio ns%20and%20news%20releases/sandt_ii /stateofst2012_fullreporten.pdf

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Finland

Score 7

Finland was earlier among the forerunners in research and development (R&D) spending as well as in the number of researchers and patent applications. Indeed, in 2014, Finland had the EU's highest R&D intensity, followed by Sweden and Denmark. However, this lead position has declined in the wake of weakening economic prospects. The innovation system's low level of internationalization is a particular weakness. Moreover, the focus of R&D has been on applied research, with basic research at universities and other institutes benefiting little. Undermining commitments laid out in the government program, the Sipilä government has repeatedly carried out dramatic cuts in government spending for education and higher learning. In the long run, given the obvious dependence of applied research on basic-research developments, the heavy bias in favor of applied research and the continuing neglect of the financial needs of schools and higher learning institutions will carry negative consequences for product development and productivity.

Furthermore, the system of technology transfer from universities to the private sector is comparatively weak, and academic entrepreneurship is not well developed.

Citation:
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"Statistics Finland - Science, Technology and Information Society - Research and Development", www.stat.fi
Data on R&D expenditure; http://ec.europa.eu/eurostat/

Ireland

Score 7

While government policy is supportive of research and innovation by indigenous firms, the most striking success of Irish industrial policy has been in attracting foreign-owned firms in high-tech sectors to Ireland. This trend continued during the economic crisis. Indeed, the inflow of FDI in the IT and pharmaceutical sectors contributed significantly to the economy's strong recovery. The location of these firms in Ireland has created opportunities for innovative small Irish firms to develop technological inputs to supply them.

Ireland's overall information and communication technology (ICT) readiness continues to lag behind most other northern and western European countries as well as Israel. Nonetheless, the World Economic Forum's Competitiveness Report for 2014 ranked Ireland 12th worldwide in terms of "technological readiness," a rise from 17th place in 2012. This rank was maintained in the 2015 report. The Global Enabling Trade Report for 2016 ranked Ireland 20 out of 136 countries in the Enabling Trade Index 2016.

The so-called double Irish tax facility, which provided significant tax incentives for multinational corporations to attribute intellectual property income (wherever its origin) to their Irish subsidiaries, was abolished in the 2015 budget in order to avert EU penalties over illegal state aid to industry. In the 2016 budget, the minister for finance announced some details of a new "knowledge box" scheme that will partially replace this facility. This will provide a 6.25% corporate tax rate on profits arising from "certain patents and copyrighted software which are the result of qualifying R&D carried out in Ireland." The Irish government intends to remain in the forefront in the competition to attract R&D-intensive investment.

Japan

Score 7

Science, technology and innovation (STI) receive considerable government attention and funding. Current policies are based on the Fifth Science and Technology Basic Plan (2016-2020), approved in December 2015. The government has determined to spend one% of GDP on science and technology. A major focus is on creating a

"super-smart" society, also dubbed Society 5.0. Concrete measures include a reform of the career system for young researchers, an increase in (international) mobility, measures supporting the development of a cyber society, and – as before – the promotion of critical technologies, including defense-related projects considered indispensable for Japan's security.

The government and outside observers realize that Japan's strong position among the world's top technology nations is slowly declining, based on various indicators, including the often-used Nature Index. One problem frequently heard is that researchers find it difficult to pursue long-term projects, as they are pressured to produce short-term results. Another major issue is young researchers' difficulty in finding stable professional positions, with tenured positions often held by older staff. This is one of the problems that the current Basic Plan takes seriously and tries to address.

In institutional terms, basic research and innovation policy is overseen by the Council for Science and Technology Policy (CSTP). This body is headed by the prime minister, signaling the high status accorded to STI issues. In previous times, the council lacked concrete authority and clout. However, the LDP-led government has changed this situation by installing the CSTP as a think tank above the ministries, and providing it with budgetary power and increased personnel. It is unclear whether the addition of a new bureaucratic layer above the ministries will ultimately increase efficiency.

Citation:
Council for Science, Technology and Innovation/Cabinet Office, Report on the 5th Science and Technology Basic Plan, 18 December 2015

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Lithuania

Score 7

Lithuania's economy is characterized by the exploitation of cheap factors of production rather than innovation-led growth. According to the EU Innovation Scorecard, the country performs below the EU average, falling into the "moderate innovators" group. However, its overall innovation performance has improved since 2008, despite a small decline in 2015. The country was ranked 38 out of 141 countries assessed in the 2015 Global Innovation Index. The country has set an ambitious target of spending 1.9% of GDP on R&D by the 2020. This level has been slowly increasing over recent years, reaching 1.2% in 2014. Moreover, the share of this sum spent by the business sector was very low (totaling just 0.3% of GDP in 2014), as research and innovation policy is dominated by the public sector and

highly dependent on EU funds. Within the country's innovation system, research is oriented only weakly to the market, research products are not supported with sufficient marketing or commercialization efforts, investment is fragmented, funding levels are not competitive with other European states, and enterprises do not participate in international markets to any significant degree, although there are some exceptions demonstrating good practices in the biotechnology and laser industries. The recent OECD review of the country's innovation policy recommended introducing favorable framework conditions for innovation, developing innovation-oriented higher education and skills training, improving governance in the innovation system, balancing the policy mix and supporting international knowledge linkages.

Lithuanian authorities have used EU structural funds to improve the country's R&D infrastructure. So-called science valleys have been developed, integrating higher education institutions, research centers and businesses areas that work within specific scientific or technological areas. However, using this new research infrastructure efficiently remains a major challenge, and cooperation between industry and research organizations remains rather weak. The government has also supported the sector through financial incentives (in particular, an R&D tax credit for enterprises) and regulatory measures. Demand-side measures encouraging innovation are less developed. Excessively bureaucratic procedures are cited by the science and business communities as the main obstacles to research and innovation in Lithuania.

The 2012 to 2016 government developed a new smart-specialization strategy intended to focus resources in science and technology areas in which Lithuania can be internationally competitive, although it has been criticized for investing too heavily in the construction of new buildings and renovation of low-ranking universities' campuses. In 2016, the parliament approved new science and innovation policy guidelines, which were proposed by the president. The guidelines proposed restructuring the research and higher education systems, supporting innovation development, improving coordination of science and innovation policy, and monitoring science and innovation policy implementation. In June 2017, the parliament approved a resolution to optimize Lithuania's state universities. The plan proposed merging the existing state universities into two comprehensive universities in Vilnius and Kaunas, and regional science centers (branches of other Lithuanian universities) in Klaipėda and Šiauliai. However, the details of the plan were ambiguous. After intense lobbying by representatives of the existing universities, the initial plan was amended and the ambitions to reduce the number of higher education institutions scaled back. Nevertheless, the government still intends to move ahead with its consolidation efforts and increase financial incentives for universities to improve the quality of teaching and research. Though it remains to be seen if these reforms will advance significantly, and sufficiently consolidate funding and talent.

Citation:

The EU Innovation Scoreboard is available at http://ec.europa.eu/enterprise/policies/innovation/facts-figures-analysis/innovation-scoreboard/

COMMISSION STAFF WORKING DOCUMENT, country report Lithuania 2017: https://ec.europa.eu/info/sites/info/files/2017-european-semester-country-report-lithuania-en.pdf

See the Global Innovation Index 2015 at file:///C:/Users/Vitalis/Downloads/gii-full-report-2015-v6.pdf.
OECD, Review of Innovation Policy: Lithuania, Overall Assessment and Recommendations, June 2016.

United Kingdom

Score 7

The United Kingdom's tradition of being an active player in research and innovation dates back to the Industrial Revolution. The country's clusters of pre-eminent universities have for a long time played an important role in linking cutting-edge academic research with industries such as biotechnology or information and communications technology (ICT). Performance has been weaker in terms of overall R&D spending, which continues to fall well short of EU targets, as well as in the conversion of innovation into sustainable, large-scale production, which holds the potential for long-term profitability. However, it is important to emphasize that the UK economy does not have the industrial base to support a large-scale R&D effort, so it is necessary to look at other indicators, such as ICT spending (which matters more for service industries), to better understand trends in innovation in the United Kingdom.

Over the decades, attempts have been made by successive governments to improve this situation, for example, by targeting weaknesses in technical education on various levels. Recent government initiatives have focused on extending tax credits for R&D, setting up regional Technology and Innovation Centers (TICs), investing in digital infrastructure and new university research facilities, as well as establishing Innovate UK to promote economic growth through science and technology.

There is uncertainty about whether the United Kingdom will remain part of EU research programs after Brexit and the status of researchers who are EU nationals working in the United Kingdom. This could have an adverse effect on UK universities, although they are lobbying intensively to prevent a negative outcome. While the potential loss of EU funds is not huge, and it has to be recalled that the United Kingdom has always been a net contributor to the EU budget, researchers are more apprehensive about barriers to collaboration with counterparts in the European Union.

This all comes only a year after a debate about how best to attract highly skilled immigrants to the British science sector. For the moment, the divide in British academia over how to react to these developments reflects the nation's general divide over Brexit. But as long as the British government does not provide a firm and plausible perspective for a post-Brexit Britain, only guesses are possible about the true impact of the secession from the European Union on Britain's research policy.

United States

Score 7

The United States has traditionally invested heavily in research and development, but the recession and the country's problematic budget politics have compromised this support. U.S. innovative capacity is a product of funding from a mix of private and public institutions. Certain public institutions stand out, particularly the National Science Foundation, the several federal laboratories, the National Institute of Health, and research institutions attached to federal agencies. In addition, there is a vast array of federally supported military research, which often has spillover benefits. In recent years, total U.S. R&D stood at roughly $400 billion, or 2.75% of GDP, of which about one-third (.3 billion) was direct federal R&D funding.

Recent demands for spending cuts and the across-the-board sequester cuts have resulted in stagnating federal R&D spending, including in the area of basic science. U.S. government R&D spending has declined as a share of GDP and in comparison both to spending by other countries and by the private sector. Critics have particularly noted the modesty of government funding for energy research, which is critical to the goal of reducing carbon emissions. Since 2016, total U.S. R&D spending is at a record-high of around $500 billion, while the federal government share of R&D spending is at historic low, below $25%.

The Trump administration's budget plans call for sharp cuts in federal research spending. In addition, it has already cut scientific and engineering personnel in environment- and natural resource-related agencies and withdrawn support for alternative energy development.

Citation:
Congressional Research Service (2017), Federal Research and Development Funding: FY 2018, https://fas.org/sgp/crs/misc/R44888.pdf

Belgium

Score 6

R&D policy is shared between the central government, which can offer tax incentives, and the subnational (regional and community) governments, which are responsible for managing European subsidies and supporting university R&D and related projects. This increases subnational accountability but hurts coordination and limits economies of scale. According to KPMG, a consultancy, Belgium has "increased its attractiveness as a prime location for companies involved in research and development activities and in the exploitation of patents." The country's location, transportation facilities and infrastructure offer considerable advantages to potential investors, KPMG says.

General investment levels have declined across the OECD since the onset of the financial crisis in 2007. Belgium withstood that negative trend comparatively well,

with investment as a share of GDP hovering around 23% (comparable to France and Austria, and three points above Germany or the Netherlands, according to IMF data). Specific R&D investment stands at 2.5% of GDP, which is lower than in Germany, Denmark and Austria, but ahead of France, the Netherlands or the EU average (Eurostat data).

In spite of this, Belgium still suffers from a chronic shortage of new and innovative enterprises. Dumont and Kegels (2016) write that "Belgium performed rather well in terms of net job creation over the period 2000 – 2014, in comparison with […] neighboring countries. […] However, our results underline the importance of the decrease in industry-level productivity growth as the main explanation of the aggregate productivity-growth slowdown. […] Belgium stands out unfavorably from other OECD countries, in its low entry of new firms. […] The specific tax benefit for young innovative companies, introduced by the Belgian federal government in 2006, and the Start-up Plan that was initiated in 2015, seem to be good practice in targeting tax incentives on young firms [… It] seems that access to finance is the major barrier for entrants and young firms in Belgium. […] Despite improved fiscal incentives, Belgium remains technologically considerably behind other European countries of a similar size such as Denmark and the Netherlands. While some indicators such as patent registration and monetary returns may be improving, the technological content of the country's exports is progressively eroding. Universities are chronically underfunded […]. This should not overshadow important exceptions; a highly skilled work force is present, and fiscal incentives have attracted some research-intensive firms in the chemical, pharmaceutical, and more recently computer-science sectors (such as Google, in the latter category)."

Citation:
Dumont and Kegels (2016): http://www.plan.be/admin/uploaded/201606240814370.WP_1606.pdf

Eurostat on R&D expenditures:
http://ec.europa.eu/eurostat/tgm/graph.do?tab=graph&plugin=1&pcode=tsc00001&language=en&toolbox=data

IMF for total investment:
http://www.imf.org/external/pubs/ft/weo/2017/02/weodata/weorept.aspx?pr.x=20&pr.y=14&sy=1998&ey=2022&scsm=1&ssd=1&sort=country&ds=.&br=1&c=122%2C124%2C138%2C132%2C134&s=NID_NGDP&grp=0&a

Czech Republic

Score 6

R&D spending in the Czech Republic has grown strongly under the Sobotka government and is expected to reach the EU average (relative to GDP) in 2017 and the EU's spending target of 2.5% in 2020. European structural funds have been the primary drivers of growth. Public R&D spending has suffered from a strong bias toward capital rather than current expenditure, meaning constructing research facilities rather than conducting research activities. Private R&D spending has also risen but remains dominated by foreign-owned companies, particularly in the automotive industry, which remain poorly integrated in the national innovation

system. More recently, R&D spending in ICT services and programming has been growing. In February 2016, the government approved a new medium-term strategy for research, development, and innovation, which puts more emphasis on support for applied research and the strengthening of public-private linkages. This reform has led to some changes during the period of review. In order to improve the allocation of research funding, a new evaluation methodology was introduced in 2017. The Technological Agency (TA ČR) established new competence centers aimed at fostering both research excellence and the application of research results. Finally, tax concessions have been extended to the purchase of R&D services from research organizations. However, this measure has mainly benefited large companies and not been complemented by specific measures for SMEs.

Citation:
Srholec, M., M. Sanchez-Martinez (2018): RIO Country Report: Czech Republic 2017. Luxembourg: European Union (https://rio.jrc.ec.europa.eu/en/country-analysis/Czech%20Republic/country-report).

Estonia

Score 6

Research, development and innovation (RDI) have been national development priorities, reflected in a sophisticated set of strategies and action plans. The outcomes, however, are very poor. Formerly stable levels of governmental and non-governmental RDI expenditures have been declining since 2015. This is partly explained by EU programming periods as well as the need to increase military expenditures but, crucially, also by the government's lack of a clear policy vision.

R&D policy measures have been much more successful in developing scientific research, as indicated by an increased number of highly ranked international publications and the improved international rankings of Estonia's major universities. Advances in the development of patents, high-tech products and services are noticeable but less prominent. Personnel engaged in research and development is increasingly concentrated in higher education and cooperation with businesses remains limited. Recent changes in research funding policy strongly motivate universities to establish R&D contracts with the private sector. However, this approach discriminates against the social sciences and humanities, which typically serve public and non-profit sector institutions.

Iceland

Score 6

Combined public and private research and development (R&D) expenditure in Iceland totaled 3% of GDP in 2006, one of the highest levels among OECD members. About 40% of this expenditure was provided by the government. This high level of R&D investment reflects the ongoing transformation from an economic focus on agriculture and fisheries toward manufacturing and services. In particular,

this has included the creation of new private firms in biotechnology, pharmaceuticals, and high-tech manufacturing. The economic collapse in 2008 affected this for sure and R&D expenditure decreased to 1.8% of GDP in 2013. The ratio increased to 2.2% in 2015, but remains far below the pre-collapse level. More recent figures are not available.

Citation:
https://hagstofa.is/talnaefni/atvinnuvegir/visindi-og-taekni/rannsoknir-og-throun/

https://www.rannis.is/starfsemi/arsskyrslur/

Malta

Score 6

Given Malta's finite natural resources, the country's business R&D sector continues to require substantial development. Public funding must also be boosted. Malta has one of the lowest invest levels in the EU; currently only 0.7% of GDP is spent on research, far below the EU average of 2%. Though in real terms spending has doubled from €31 million (2006) to €61 million (2016), in percentage terms spending has dropped (0.61% of GDP, 2016). The National Strategic Plan for Research and Innovation 2011-2020 highlights the challenges that hinder growth in this area, mainly the relatively low percentage of science and technology graduates. The European Innovation Scoreboard 2017 describes Malta as a Moderate Innovator with weaknesses related to linkages, finance and support, and sales impacts. The 2017 European Commission Staff Working Document however notes that "[i]mportant steps have been taken to strengthen the research and innovation (R&I) system. R&I performance has improved, leading to a narrowing of the innovation gap with the EU average," and an increase in intellectual property licenses signals a rise in innovation. Nonetheless, the document also highlights that the country's public R&D expenditure and scientific output are significantly low. As a response to this situation, government has devised a rolling R&I action plan that aims to reduce fragmentation and overlap. Esplora, Malta's Interactive Science Center, aims to instill a broader interest in science and innovation. Other significant actions include the FUSION program, which focuses on the analyses of companies' or researchers' ideas for commercial viability purposes, the introduction of research clusters (e.g., Malta Marittima), the research framework administered by the Malta College of Arts, Science and Technology, the MITA Innovation Hub, and a newly established migration hub.

Citation:
https://ec.europa.eu/research/openvision/index.cfm
National Strategic Plan for Research and Innovation 2011-2020 (Draft for Public Consultation - 2011) p.9, p.12, p.13
European Innovation Scoreboard 2017 p.59
Commission Staff Working Document Country Report Malta 2017 SWD (2017) 83 final p.26
http://esplora.org.mt/
Malta National Reform Program 2017 p.39
Times of Malta 01/12/17 "Very little being spent on research despite surplus"
Malta Independent 02/12/17 Malta holds position as one of lowest spenders on R&D in the EU

New Zealand

Score 6

New Zealand policy regarding research and development (R&D) strategies and expenditure, high-technology employment and patent indicators is deficient, a situation criticized by the OECD. The OECD strongly recommends a coherent policy that makes more use of incentives for enterprises to invest in R&D and that steers and funds public infrastructure with regard to basic and applied research institutions. The problem does not seem to result from cumbersome bureaucratic procedures, but mainly has to do with New Zealand's size and the geographical isolation, as well as the lack of large companies operating at an international level.

According to Statistics New Zealand's Business Operations Survey, business spending on R&D has grown by more than 29% from 2014. While the government has increased spending on tertiary training in the fields of engineering and science, domestic expenditures on R&D as a percentage of GDP place New Zealand well down the list of OECD countries, including its closest economic partner, Australia. New Zealand spent 1.3% of GDP on R&D in 2016; the OECD average is 2.4%. Funds have been provided for the establishment of privately led regional research institutes, agricultural and biological research partnerships, and natural-hazards projects. In October 2015, New Zealand's first national science strategy, National Statement of Science Investment (NSSI), was launched. The statement aims to establish a long-term strategy for government investment in science. Despite these initiatives, government spending on R&D falls far short of levels in many other OECD countries.

Citation:
Research and Development Survey: 2016. Statistics New Zealand. 29 March 2017. (http://www.stats.govt.nz/browse_for_stats/businesses/research_and_development/ResearchandDevelopmentSurvey_HOTP2016.aspx) (accessed 22 September 2017).
Callaghan Innovation: http://www.callaghaninnovation.govt.nz/ (accessed December 1, 2016).
First National Science Strategy launched. 5 October, 2015(https://www.beehive.govt.nz/release/first-national-science-strategy-launched) (accessed 13 September, 2016).

Poland

Score 6

The Polish system for research and development (R&D) has been significantly restructured since 2010. Science and higher-education reforms in 2010 and 2011 spurred significant changes, including a move toward more competitive funding, the creation of two R&D agencies respectively for applied and basic research, and efforts to tackle fragmentation by focusing funding on the best-performing institutions. In July 2012, the first six national leading scientific centers (KNOW) were selected. In its first year in office, the PiS government initiated further measures to foster research at Polish universities and stimulate cooperation between

universities and business. In its second year, the government's focus rested on expanding tax incentives for R&D and startups, and on simplifying patent procedures. The amount of tax-deductible R&D spending was has increased to 30-50% depending on the size of the company. In addition, the period in which companies may deduct these costs was been expanded from three to six years. In May 2017, Minister of Science and Higher Education J. Gowin announced the creation of a National Institute of Technology (NIT), which will bundle the work of 35 existing research institutes. Despite these changes, R&D spending in Poland, both public and private, is still relatively low. Partnerships between universities and business have grown, but are still highly dependent on EU funds and personal connections.

Austria

Score 5

Public research in Austria is mainly university centered. However, this is a challenging environment, as universities are overburdened by high numbers of students, while researchers in some disciplines are overwhelmed by teaching obligations. The Austrian Academy of Sciences is plagued by insufficient funding. The Austrian Science Fund (Fonds zur Förderung der Wissenschaftlichen Forschung) is tasked with coordinating academic research but has shown only partial success in this task. Research funded by private corporations has little tradition in Austria, and at least in the near future, offers little hope of improving this situation. The deficiencies in public-funded research cannot be counterbalanced by privately funded operations. The whole sector is in acute need of more funding, but the budgetary situation and the growing shift of public funds from the young toward older generations, a trend driven by demographic change, make the outlook quite dire. The government seems to be aware of this critical situation and some steps have been taken to improve the financial situation of universities.

The strong dependence on government funding implies that any new orientation of the incoming government could be decisive. As a consequence of the October 2015 general elections, a new government alliance is to be formed. There is an expectation that innovation policy may significantly change. But, at the moment, the focus of the new government seems to be oriented first and foremost to balancing the budget. This could mean that there will be no significant increase in spending on innovation and research.

This does not prevent excellent research from being conducted in some fields. Important and significant innovations in disciplines such as biological science and medical research are still possible in Austria. The consequences of Austria's membership in the European Union and the European Single Market is opening Austrian universities and other research institutions to non-Austrian scholars. Step by step, this provides a more transnational attitude to research and innovation.

More broadly, links between industry and science are sound, and a high share of public research is funded by industry. In contrast to basic research, industry-sponsored research is mostly aimed at the applied sciences and does not necessarily affect universities. Integration within international networks is strong, and a high share of the labor force is occupied in science and technology-related occupations. Business R&D is particularly strong in niche markets, often performed by specialized small and medium-sized enterprises (SMEs). Other pillars of Austrian business research include large companies, affiliates of foreign corporations, and the medium- to low-tech manufacturing sector. Although Austria does not feature any of the world's top 500 corporate R&D investors, there are – according to OECD data – some dynamic startups on the Austrian market. These startups, however, are not a direct result of Austrian research policy.

Chile

Score 5

Research and development (R&D) expenditure as a share of GDP is very low in Chile compared to other OECD countries, and most of this expenditure is undertaken by the government rather than the private sector. But Chile has shown that it is aware of shortcomings regarding the necessities of technological innovation, especially for its future economic and social development. Significant reforms have been put in place to raise R&D funding, including earmarked taxation (a royalty tax on mining), higher government expenditure, and the improvement of tax incentives for private R&D. Although results have to date been disappointing – in large part because of bureaucratic hurdles to the approval of private and public projects – Chilean institutions show good results at least in the area of basic research. But the steps necessary to transform this good basic research into applied research are almost never taken. Universities are often not prepared to support research that operates at the interface between basic research and industrial development. This is reflected in the comparatively low number of patents registered per year on a per capita basis, whereas the number of scientific publications is relatively high. In general, access to the limited public funds available for research tends to be quite difficult due to high bureaucratic barriers. Despite these facts, a slight improvement regarding innovation policy and scientific cooperation can be observed. According to the latest version of the Global Innovation Index (2017), Chile was ranked 46th out of 128 countries. When compared with the previous year, when it was ranked 44nd out of 128 countries, the country's innovation performance appears to be stable.

Citation:
http://www.expansiva.cl/media/en_foco/documentos/17032010150429.pdf
http://www.scidev.net/america-latina/innovacion/noticias/tres-paises-lideran-innovacion-en-latinoamerica.html
https://www.globalinnovationindex.org/

Italy

Score 5

In recent years, Italian governments' research and innovation policies have been weak, underfunded and not strategically coordinated. The current government has not been able to make much headway in this regard given the tight budgetary context. In spite of complaints from universities, which are severely underfunded compared to other European countries, public funding for universities and R&D has not been increased. The existing policy to link university funding to the quality of research outputs has been continued and slightly strengthened. This policy is intended to incentivize universities to generate more quality research. Fiscal policies to promote investment in technological innovation in industry, introduced in 2016, gained momentum in 2017. The "Piano Nazionale Industria 4.0" program for 2017 to 2020 is an attempt to catch up with the rate of economic innovation in other OECD countries. As a result, there has been growing awareness of the strategic importance of R&D across society, in the media and among some politicians.

Citation:
https://www.crui.it/images/documenti/2016/DM_programmazione_triennale_16_18.pdf
http://www.sviluppoeconomico.gov.it/images/stories/documenti/Industria_40%20_conferenza_21_9

Norway

Score 5

Despite its high GDP per capita, Norway spends comparatively little on research and development (R&D), even compared to its Nordic neighbors. The low level of spending is partly due to limited government funding but also due to the fact that Norwegian industry and business spend less on research. However, government spending has increased slightly in recent years. Research policy is nonpluralistic, government-led and has historically not been strongly oriented toward enterprise or innovation. The country's strength lies in applied economic and social research rather than in basic and hard science research. However, there are some excellent research groups and networks in the so-called STEM subjects. Research funds are mainly public, distributed through a single research council, and recent reforms have moved in the direction of adopting a center of excellence approach.

In international comparison, the country's private sector provides little in the way of research funding. This low aggregate investment level is reflected in the relatively low number of patents that are granted. It is also interesting to note that the share of degrees granted in science and technology is low, and that Norwegian children have fared especially poorly in scientific knowledge, at least in relative terms, in the OECD's Program for International Student Assessment (PISA) study. However, the international rankings of some of the country's most important universities have improved in recent years. The country would certainly benefit from a higher absolute level of investment in R&D. However, the research council's centralized allocation of funds and state subsidies, with only limited participation by private donors, has

also been criticized as a model. The council's selection of priorities has often been too narrow. There is thus ample scope for increasing investment in academic and basic research, as well for promoting more involvement by private- and public-sector actors.

Portugal

Score 5

Portugal's rank in the World Economic Forum's Global Competitiveness Report 2017 – 2018 increased by four positions to 42nd out of 137 countries, as compared to 46th place in the previous year's report. Moreover, its overall score reached 4.57 (up from 4.46), returning the country to the competitiveness rating achieved in 2006, long before the bailout. The European Union's 2017 Innovation Scoreboard classifies Portugal as a "moderate innovator," the second-lowest category (out of four). However, it also shows that Portugal's position has declined in relation to the EU average in 2016, inverting the trend of the previous two years. Overall, this report indicates that "performance has declined by 2.4% relative to that of the EU in 2010."

Out of the 10 dimensions considered by the 2017 scoreboard, Portugal is above the EU average in three – human resources, attractive research systems and an innovation-friendly environment.

The government is placing a great deal of emphasis on research and innovation. At the beginning of review period, from 8-10 November 2016, Lisbon hosted the Web Summit, the largest tech conference in the world, dubbed by Bloomberg as "Davos for geeks." The 2017 Web Summit was also hosted in Lisbon, beginning on 6 November 2017. Moreover, Lisbon was named by influential tech magazine Wired as one of the hottest startup cities in Europe in 2016, an accolade repeated in 2017.

However, the Innovation Scoreboard results suggest that these tech results and initiatives are not yet percolating fully through to the economy more generally.

Citation:
https://www.weforum.org/reports/the-global-competitiveness-report-2016-2017-1

"European Innovation Scoreboard 2017 – Portugal." Available online at: https://ec.europa.eu/docsroom/documents/23935/attachments/1/translations/en/renditions/native

Spain

Score 5

Research and technology policy remained a weak point during the period under review, as evidenced by the low number of patents registered, the relatively poor international ranking of universities and the decreasing level of spending on R&D. Indeed, in 2017, approximately 1.8% of GDP will go to research and development,

compared with an EU average of more than 2% (which was the Spanish target for 2010). All indicators of public or private support for innovation in Spain are far below those in the advanced-economy leaders; for example, the country is ranked 16th among the 28 EU member states in R&D spending and 17th on the EU Innovation Scoreboard. Although over time performance has declined by 1.8% relative to the EU average in 2010, the European Commission underlines the relative strengths of the innovation system: human resources, the innovation-friendly environment and attractive research systems. However, relative weaknesses remain in innovators, linkages, and finance and support. Spanish universities and research centers underline the need for higher spending in R&D and less bureaucratic rules which endanger the continuity of research projects.

According to the Cotec Report on Technology and Innovation, some positive signs regarding R&D investment were evident in 2016, largely thanks to European Commission funding and private investment (which accounts for more than half of Spain's total R&D spending). Spain also came out relatively well in the latest Nature Index (published in 2016), which tracks the affiliations of high-quality scientific articles published in 68 science journals; in this, Spain was the 11th most prolific country worldwide (although with a small decline as compared with the previous year in which it ranked 10th).

Citation:
European Commission, European Innovation Scoreboard 2017
http://ec.europa.eu/growth/indust ry/innovation/facts-figures/scorebo ards_es

Cotec, Informe para la innovación 2017
http://cotec.es/media/INFORME -COTEC-2017_versionweb.pdf

Natur e Index for innovation, 2017
https://www.natureindex.com/c ountry-outputs/Spain

Australia

Score 4

Since the Abbott government was elected in September 2013, government support for research and innovation has been reduced considerably. Australia continues to provide significant public financial support for research and development, but the results continue to be quite disappointing. The Abbott government cut funding to the Australian Research Council scheme, which funds non-medical university research, and abolished the Australian Renewable Energy agency, which acted to support renewable energy projects in their start-up and early stages. Also telling was the fact that there was no science minister under the Abbott government, for the first time since 1931. However, with the replacement of Abbott with Malcolm Turnbull as prime minister in September 2015, a new cabinet was formed that included a science minister, but no new policy announcements have been made. The Australian Academy of Science has suggested a ten-year plan for enhanced research in agricultural science. While Australia will be able to benefit from growing consumer

demand in Asian societies, research in agriculture will be important for maintaining Australia's good competitive position in agriculture.

Citation:
Australian Government, 'Powering Ideas: An Innovation Agenda for the 21st Century,' 12 May 2009: http://www.innovation.gov.au/innovation/policy/pages/PoweringIdeas.asp x

Australian Government Department of Industry, Innovation, Science, Research and Tertiary Education, 'Australian Innovation system Report 2012': http://www.innovation.gov.au/Innovation/Policy/AustralianInnovationSystemReport/AISR2012/index.html

Australian Academy of Science, A Decadal Plan for Agricultural Sciences, Juni 2017, available at https://www.science.org.au/support/analysis/decadal-plans-science/decadal-plan-agricultural-sciences-2017-2026

OECD, Economic Survey Australia 2014, Paris: OECD, 16 December 2014.

http://www.smh.com.au/business/federal-budget/federal-budget-scientists-push-for-more-research-funding-20160411-go3uaa.html

Cyprus

Score 4

Cyprus research and development programs mainly started with the creation of the country's first university in 1992, along with other tertiary-education institutions. These institutions receive EU funds. The share of R&D expenditure performed by higher education (49.6%) remains larger than that performed by businesses or state-owned research centers, in contrast to the higher business-funded share EU-wide.

A National Council for Research and Innovation, established before 2010, composed by ministers and chaired by the president is the highest body of research. However, no information is available on either this body or its advisory Cyprus Scientific Council. With regard to capacity for innovation, the Global Competitiveness Index ranks Cyprus very low, 110th among 137 countries, while it is in 53rd position on the general innovation indicator. The EU notes the very low expenditure (as a percentage of GDP), with the private sector's investment in R&D placing Cyprus last in the EU28.

Despite a problematic situation hindering development, Cyprus's R&D target for 2020 remains 0.5% of GDP. This is the lowest in the EU, offering few prospects.

Citation:
1. Global Competitiveness Index 2017-8, Cyprus, Innovation, http://reports.weforum.org/global-competitiveness-index-2017-2018/competitiveness-rankings/#series=GCI.C.12
2. EUFORI study Cyprus Report, 2015, http://euforistudy.eu/wp-content/uploads/2015/07/Cyprus.pdf
3. EU Commission Cyprus Economy Semester Report, February 2017, https://ec.europa.eu/info/sites/info/files/2017-european-semester-country-report-cyprus-en.pdf see page 49

Greece

Score 4

In the period under review, Greece continued to rank below the OECD average for public and private expenditure on research. However, despite the economic crisis, remarkable efforts have been made in recent years by both the previous and the current government to preserve and even increase public investment.

Greece lacks large corporate investors in R&D. Links between academia and the private sector are weak reflecting institutional weaknesses and cultural resistance to public-private collaboration. There is little private demand for R&D and innovation, and the corresponding supply from universities and public research institutions is small, as shown by the relatively small number of patents filed by universities.

Over the last six years, universities saw their funding (based on the state budget) decline. Nevertheless, despite economic adversity, there are clear "islands" of excellence at universities in areas such as biology, IT and computer science, economics, engineering, archaeology and history. And the number of international scientific co-publications per million population has increased (from 389 in 2009 to 549 in 2015) showing that the Greek Research & Innovation system is increasingly internationalizing. However, the public R&I system continues to perform below the EU average.

However, Greek researchers, the number of which is disproportionately high compared to the levels of public and private expenditure on research, actively participate in international research consortia. For instance, the National Technical University of Athens actively participates in international projects, as does the Heraklion-based Institute for Technology and Research. Individual researchers from Greece frequently participate in international forums.

A very positive step has been the establishment of the Hellenic Foundation for Research and Innovation (HFRI), a new public body funded by the Greek state and the European Investment Bank (EIB). Law 4429/2016, passed in 2016, provided €240 million for the funding of the HFRI for a three-year period, while the relevant open calls for research proposals have been launched.

Citation:
Data on research spending, number of researchers, intellectual property licences and patent applications are drawn on statistical tables provided by SGI on this platform. Information in English on the Greek HFRI is available from the relevant European Commission's Research and Innovation Observatory report: https://rio.jrc.ec.europa.eu/en/country-analysis/Greece/country-report

Hungary

Score 4

Hungary's research and innovation (R&I) sector is still fairly advanced but has suffered from chronic underfinancing and the emigration of many researchers and qualified workers. Public R&D spending has declined since 2008 and is among the lowest in the EU. From a comparative perspective, the country's capacity to attract and to retain talent is rather low. Under the second Orbán government, the public competencies for R&I were centralized, as the National Innovation Office (Nemzeti Innovációs Hivatal, NIH) was transformed into a more comprehensive National Research, Development and Innovation Office (Nemzeti Kutatási, Fejlesztési és Innovációs Hivatal, NKFIH) under the direct control of former Fidesz minister József Pálinkás and accountable only to the prime minister. The third Orbán government has sought to update the countries R&D strategy for 2013-2020 with the help of the European Commission but did not come up with a new strategy during the period of review.

Citation:
World Economic Forum (2017): The Global Competitiveness Report 2017-2018. Geneva (https://www.weforum.org/reports/the-global-competitiveness-report-2017-2018).

Latvia

Score 4

Research and development (R&D) expenditure in Latvia was equal to 0.62% of GDP in 2015, but fell to 0.44% of GDP in 2016. Investment into R&D from foreign sources in Latvia is significantly higher than the EU average. In 2013, the EU average was 9.9%, while in Latvia it was 44% in 2014 and 45% in 2015. In 2014 and 2015, private sector investment in R&D was 0.19% and 0.12% of GDP respectively, significantly below the EU average of 1.3% in 2014.

In the Union Innovation Scoreboard 2017, Latvia ranked 25th out of 28 EU countries in terms of innovation, up from 26th in 2014. Consequently, Latvia moved from the category of "modest innovators" to "moderate innovators."

The OECD has recognized Latvia for improving in its framework on research and development innovations, noting the consolidation of research institutions, introduction of quality-based financing models, and incentives to boost research. For example, a support program for the development of new products and technologies has been set up, managed nationwide by eight Competency Centers. The program seeks to attract at least €12.8 million in private sector investment for research and development. As of 1 September 2017, 150 projects had been launched.

Citation:
1. European Commission (2017), Union Innovation Score board 2017, Available at: http://ec.europa.eu/DocsRoom/documents/24829. Last assessed: 10.10.2017.

2. OECD (2017) Going for Growth-Latvia 2017. http://www.oecd.org/eco/growth/Going-for-Growth-Latvia-2017.pdf. Last assessed 19.11.2017

Romania

Score 4

Romanian governments have begun to grasp the importance of fostering research and innovation for realizing the economic spin-offs and for retaining an educated workforce with technical expertise. The country appears on track to meet the targets set in the National Research, Development and Innovation Strategy (SNCDI) 2014-2020, which has aimed at increasing public spending on research and innovation to 1% of GDP by 2020.

A new €41 million contract between the government and the Association of Romania's Industries has strengthened the ties between the public and the private sector. Growing confidence in the stability and capability of Romania's high-tech sector is evident in NOKIA's planned expansion of its Timisoara campus, making it the biggest research and development center in the country. However, the quality pf research has often remained low. The little gains made under the previous government in terms of boosting research, identifying and penalizing plagiarism, academic fraud and corruption, and creating a more transparent adjudication process have been scaled down little by little since the PSD formed the government. In the period under review, foreign scholars were kicked out of key Ministry of Education commissions adjudicating grants. This led not only to a blockage of the grant adjudication process, as fewer adjudicators had to review larger numbers of grant applications, but to a biased selection process (since adjudicators and applicants are no longer independent from each other). As a result, worthy applicants have been turned down without sound explanation, and relatives of various politicians, university presidents and ministry bureaucrats are awarded grants in the absence of strong research records.

Slovenia

Score 4

Slovenia's R&I activities have long been of both low quality and quantity. In the period under review, EU funds have declined in some areas of research, as Slovenia has experienced serious administrative difficulties in absorbing funds for R&I. After years of neglect, however, the Cerar government announced substantial increases in R&I spending when introducing the budgets for 2018 and 2019 to parliament in September 2017. The science budget, for instance, is set to grow by almost 20%.

Citation:
Bučar, M., A. Jaklič, E. G. Verdesoto (2018): RIO Country Report Slovenia 2017. Luxembourg: European Union (https://rio.jrc.ec.europa.eu/en/country-analysis/Slovenia/country-report).

Turkey

Score 4

During the review period, the government continued to strengthen the country's research and innovation capacity. The Scientific and Technological Research Council of Turkey (TUBITAK) is the leading agency for management, funding and conduct of research in Turkey. Yet, within university and private sector-led R&D, human resources, capacities and qualifications lack the necessary incentives to grow and develop.

According to the Turkish Statistical Institute, total R&D spending by the public and private sectors as a fraction of GDP in 2014 was 1.01% and in 2015 the share was 1.06%. Commercial enterprises account for the largest share of R&D expenditures, at 50%. While universities accounted for 39.7% of spending on R&D, public institutions' share was 10.3%. In terms of financial contributions to R&D projects, commercial enterprises have the largest share with 50.6%, followed by public institutions with 27.9%, universities with 18.3% and other sources 3.2% of R&D. In terms of full-time employment, 190,784 people worked in the R&D sector in 2015, an increase of 5.1% compared with the previous year. The private sector employed 26.8% of R&D personnel, while 69.5% worked at universities and public institutions employed 3.7% of R&D personnel.

In 2013, Turkey adopted the Tenth Development Plan, covering the period 2014-18, aiming to improve science, technology and innovation, as one of the building blocks for innovative production and steady growth. In Turkey, the Supreme Council for Science and Technology (SCST) is the highest-ranking science and technology policymaking body in Turkey. In the last few SCST meetings, emphasis was placed on intensifying R&D efforts in the energy, health and biotechnology sectors, providing subsidies to R&D laboratories of multinational enterprises.

Bulgaria

Score 3

Bulgaria ranks among the lowest in the European Union in terms of spending on R&D, and the substantial increases in R&D outlays in 2014 and 2015 have not been sustained. Research and innovation have suffered from a strong separation of the public and the private sector, and a far-reaching institutional fragmentation. Participation in and implementation of EU-funded programs have been low. The new National Strategy for Development of Scientific Research 2017 – 2030 ("Better Science for a Better Bulgaria"), approved by parliament in June 2017, has sought to address part of these issues.

Citation:
Todorova, A., Slavcheva, M. (2018): RIO Country Report Bulgaria 2017. Luxembourg: European Union (https://rio.jrc.ec.europa.eu/en/country-analysis/Bulgaria/country-report).

Croatia

Score 3

Croatia lacks a coherent and integrated policy framework, companies have low technological capacity to support innovation, and technology-transfer mechanisms are inadequate. As a percentage of GDP, total gross domestic spending on R&D fell by almost a third from 2004 to 2016. The Plenković government has failed to address these problems, so that the country has fallen further behind in the field of innovation policy.

Citation:
Račić, D., J. Švarc, G. Testa (2018): RIO Country Report Croatia 2017. Luxembourg: European Union (https://rio.jrc.ec.europa.eu/en/country-analysis/Croatia/country-report).

Mexico

Score 3

Overall, national spending on research and development (R&D) continues to be very low in comparison with other OECD countries and is inadequate for an economy the size of Mexico. While public spending on R&D has increased in recent years, private sector spending on R&D has not, mostly relying on large companies across a small number of sectors. A very large number of "micro" firms have little or no institutionalized access to state R&D spending, while large and efficient firms undertake their own R&D spending. There is growing awareness of this problem within Mexico itself, but it still ranks below most OECD member countries on indices relating to R&D. The OECD has stated that R&D spending in Mexico is quantitatively and qualitatively inadequate.

In 2017, Mexico was ranked 49th out of 190 countries on the World Bank's Ease of Doing Business index, featuring low performance in components such as paying taxes, registering property, getting credit and having access to electricity. These conditions play against the attractiveness to create and fund startups in the new economy.

The 2016 election of Donald Trump and his anti-immigration policies motivated speculation about increased opportunities in Mexico for starting innovative businesses in the IT sector, offering the economic and political environment to attract startups and human capital. Though the number of venture capital institutions and other organizations have generally increased (especially in Guadalajara and Monterrey), most of the country has yet to see the potential benefits of IT investments.

Citation:
http://www.doingbusiness.org/data/exploreeconomies/mexico
https://www.ft.com/content/7fe8f64c-4c74-11e7-a3f4-c742b9791d43

Slovakia

Score 3

Slovakia has a weak and underdeveloped research and innovation policy. R&D intensity, the number of patent applications and levels of employment in knowledge-intensive activities are below the EU average. Expenditure on R&D, both public and private, has gradually risen, but has done so from a very low level and remains relatively low. The increased private sector investment in R&D has not been not sufficient to compensate for the state failure in managing R&D. Competencies have been divided between the Ministry of Economy, and the Ministry of Science, Education, Research and Sports, with each ministry managing its own network of agencies. Originally planned for 2017, the transformation of the organizations of the Slovak Academy of Sciences into public-law institutions, which aimed at facilitating cooperation between the academy and business, was eventually postponed. Weaknesses in the distribution of funds became manifest in summer 2017 when Minister of Education Peter Plavčan resigned following a scandal surrounding the misuse of EU funds for research. His successor, Martina Lubyová, scrapped the call of her predecessor and announced an action plan guaranteeing more transparency for the funding procedures in research.

Citation:
Baláž, V., K. Frank, T. Ojala (2018): RIO Country Report Slovakia 2017. Luxembourg: EU (https://rio.jrc.ec.europa.eu/en/country-analysis/Slovakia/country-report).

Ministry of Finance (2017): National Reform Programme of the Slovak Republic 2017. Bratislava, 10. (https://ec.europa.eu/info/sites/info/files/2017-european-semester-national-refo rm-programme-slovakia-en.pdf).

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