Research and Innovation Report

Research and Innovation Policy

Sustainable Governance Indicators 2017

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.

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 2016 – 2017 (p. 61), Germany improves to rank 4, trailing less than 0.3 points behind leading nation Switzerland in the area of technological development, and product and process innovation. Furthermore, Germany ranked 7 out of 140 countries for patent applications per inhabitant, a one position deterioration over the previous year (Global Competitiveness Report 2016: 187).

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 €14.1 billion in 2014, €16 billion in 2015, and €17.6 billion in 2016, a record setting mark that exceeds 2015 by 7%.

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 has continued to pursue its so-called excellence initiative within the tertiary education sector, introducing a third stage 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. Over the past years, as Germany increased the research and education budget and pursued its excellence initiative within the tertiary education sector, the quality

of its scientific research institutions improved slightly. In the Global Competitiveness Report 2016 – 2017 edition (p. 187) Germany performs well in higher education and training. While maintaining its score of 5.6 (0.6 points behind leading nation Singapore), Germany improved by one position to 16th out of 138 countries.

Citation:
Global Competitiveness Report 2016-2017. World Economic Forum.

Bundesministerium für Bildung und Forschung - BMBF (2016): 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

Israel

Score 9

Israel's R&D sector is based on three pillars: scientific research performed primarily in academia, research conducted in government institutes, and research carried out by civil-industrial partnerships led by the Ministry of Finance.

In 2013, the Ministry of Science and Technology submitted a report that urges the government to allocate more public funds to R&D, arguing that private funding dominance prevents long-term and high-risk exploration. The report also pointed to the continued erosion in funding of R&D at universities. This decline is exhibited both in the declining share of contributions by universities to R&D activity over the years as well as in the reduced number of scientific publications per person compared to the 1990s. In 2014, the cabinet approved the establishment of an authority aimed to encourage technological innovation. Since the beginning 2016, the Ministry of Economy and Industry has provided financial support for technological innovation to private companies through a special fund. The fund prioritizes research carried out in underdeveloped areas in Israel as well as research in the field of biotechnology. However, recent budget cuts (of $300 million) to the Israel Innovation Authority, part of the Ministry of Science and Technology, may harm this effort at promoting innovation. In its 2016 report, the Israeli Innovation Authority highlights the shortage of skilled workers as well as the long-term infrastructure reforms necessary for the continued development of the Israeli innovation industry.

A large portion of Israeli 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 a signatory to some 29 bilateral R&D agreements and 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 in the Framework Programs, such as Horizon 2020, which are managed by the Israel-Europe R&D Directorate (ISERD).

Israel is also one of the main countries that develop and patent important new innovations, especially in the fields of science and technology. When Israel signed the Patent Cooperation Treaty, it also established a domestic patent office. In 2015, 1,075 patent request were submitted to this patent authority as well as checked by international authorities; of these, more than 50% were approved. Since it was established, the patent office has signed numerous cooperation agreements with foreign patent authorities.

Citation:
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"Aboutus", Israel Patent Office Website (Hebrew):
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"Annual Patent Report of 2015", Israel Patent Office
"2016 Israel Innovation Authority Report Presented to Prime Minister", 29.6.2016, http://www.imra.org.il/story.php3?id=70918

Netherlands

Score 9

In 2016, the European Innovation Scoreboard had the Netherlands as an innovation leader, ranked 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 the second most competitive economy in Europe. This achievement is attributable to, among other things, improvements in the country's innovation climate. 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, and intellectual aspects such as number of patents. Its weakness is in financial market development, with low scores for perceived efficiency, and confidence and trust in the financial sector. It is unclear whether his national R&D performance is really 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). However, the most recent figures, compiled by the Rathenau Institute, forecast a decrease in total government R&D expenditures to €5.5 billion, a decline of 7.7%, by 2019. Part of the budget for R&D in the Netherlands is shifting to the EU level, especially through the Horizon 2020 program.

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, Totale investeringen in Wetenschap en Innovatie, www.RATHENAU, 2015

European Commission, Innovation Union Scoreboard 2016 (ec.europa.eu, accessed 1 November 2016)

World Economic Forum,The Global Competitiveness Report 2016 (reports.weforum.org, accessed 1 November 20916)

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. Public spending on research has substantially increased in recent years, totaling almost 1% of GDP in 2014 – the second-highest such level in the OECD. The Park Geun-hye's Creative Economy initiative is a good example of this trend. The newly formed Ministry of Science, ICT and Future Planning will spend a total of KRW 8.5 trillion (.1 billion) over the next five years to promote R&D in the information- and communications-technology (ICT) sector, a key target sector for the creative economy. However, the ever-increasing dominance of large business conglomerates (chaebol) impedes the rise of small and medium-sized enterprises (SMEs) and start-ups, which are often the source of new innovations (as opposed to incremental ones). Other weaknesses include a lack of high-quality basic research, which is difficult to commercialize in the short run but might facilitate scientific breakthroughs in the long run. In recent years, there has been an increasing focus on applied (natural) sciences, while basic research and the social sciences have taken a back seat. This is troubling because most observers would agree that basic and social-science research is already trailing in international comparison. South Korea has experienced a steady increase in the annual number of published scientific articles and patents, although the catching-up process remains slow. Despite the very substantial government expenditure on R&D, the country needs to overhaul its R&D systems across the corporate, public and academic sectors, going beyond the strategy of seeking to catch up with advanced economies in key manufacturing sectors.

Citation:
OECD, OECD Review of Innovation Policies Korea 2009
Institute of Basic Science, http://www.ibs.re.kr
OECD, Industry and Technology Policies in Korea, May 2014
"President stumbles on 'Choi Soon-sil gate'," The Korea Times, October 24, 2016
http://www.koreatimes.co.kr/www/news/nation/2016/10/180_216712.html

Sweden

Score 9

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.

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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Switzerland

Score 9

Switzerland's achievement in terms of innovation is considerable. It spends 3% of its GDP on research. 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 Institute of Technology Zurich (Eidgenössische Technische Hochschule Zürich) is one of the top-ranked universities in the world and the universities of Basel, Bern, Geneva, and Zurich regularly appear on the list of the 200 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.

France

Score 8

Having improved since 2007, France performs well in research and development policy. According to the EU Innovation Scoreboard 2015, France is ranked tenth (among 28 EU countries) with respect to innovation capacity; in the report's global innovation index, France performs slightly above the EU average but is ranked in the group of "innovation followers," behind the group of "innovation leaders." Overall spending on research and development represents 2.23% of GDP, below the OECD average and far from the EU target of 3%. Whereas public spending is comparable to the best-performing countries, private spending is low but growing thanks to the fiscal incentives put in place by the Sarkozy government and maintained by the Hollande administration. 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.

The government has recently taken several measures to facilitate and promote innovation. Fiscal rebates for companies and citizens have been introduced; a public bank (Banque Publique d'Investissement) has been created to finance innovative small and medium firms; major projects have been financed; private funds have been mobilized through the creation of foundations; a €30 billion public loan was offered to support "innovative" ventures; the creation of start-up companies has been

facilitated through various legal and tax incentives and capital risk channeled toward these innovative sectors; regional clusters have been supported by local and state authorities and cooperation between universities and companies has been encouraged. Infrastructure investment has also been made. This has 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.

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. 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; France demonstrates a positive dynamic for startup creation. However, the key issue remains the capacity of these young companies to develop and grow in an environment which remains insufficiently business-friendly.

In general, the mediocre profitability of French companies is an obstacle toward more research and development spending. Existing fiscal and regulatory rules with "threshold effects" (sharply rising charges when the number of employees reaches the threshold) create barriers to the growth of small firms. Uncertainty over legal and fiscal rules is also a major problem, as shown by the company revolt in the wake of the proposal of the Socialist-led government under President Hollande to raise taxes on profits resulting from the sale of young companies.

Citation:
Quote EY reports on startups.

United Kingdom

Score 8

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 UK.

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 Centres (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 also a current debate about the degree to which the United Kingdom should seek to attract highly skilled immigrants, which has been muddied by a broader attempt to curb immigration that is having some effect on the willingness of foreign students to come to the United Kingdom.

There is an ongoing debate about the degree to which the UK should seek to attract highly skilled immigrants and some fears have surfaced about whether this will deter highly qualified researchers. Universities have expressed concerns about future access to EU funding and participation in collaborative research projects, but there has been no clear message from government about whether the UK will continue to participate in EU programs after Brexit. Public science budgets have, nevertheless, been largely protected.

While the optimism expressed in the Innovation and Research Strategy, launched in 2011, and the sums involved are considerable, a long-term perspective and indifferent results from previous initiatives necessitate caution.

United States

Score 8

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.

President Obama set a goal of raising total R&D spending to 3% of GDP. But these ambitious plans have fallen by the wayside. The 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. As of November 2016, Congress had not completed action on a proposed Innovation Act designed to prevent "patent trolls" from using unwarranted patent claims to extract payments from innovative companies.

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. The newly elected government has made innovation a central theme in its drive to boost the economy and is scheduled to roll out the specifics of its "Innovation Agenda" later in 2016. The federal budget earmarked CAD 2 billion for university labs and research facilities. 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.

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Denmark

Score 7

Public R&D spending relative to GDP puts Denmark in seventh position among OECD countries. If we look at the total number of researchers in relation to population, Denmark is number three among the OECD countries (after Israel and Finland). Finally, if we look at patent applications, Denmark comes in at seventh place (after Sweden, Switzerland, Finland, Japan, Israel and Germany). These factors suggest that Denmark may improve its competitiveness in the future if it can deal with the current problems, including relatively high labor unit costs.

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 current Liberal government (since June 2015) has set a target of 1% of GDP for publicly funded research.

As part of the Fiscal Bill the government is implementing expenditure cuts on research and education. Reductions in 2016 have been implemented, and further cuts are announced for 2017-2020. There is a vivid debate on these cuts and how they relate to the overall aim to strengthen productivity and competitiveness.

Denmark scores quite high in international comparisons on competitiveness. Denmark is ranked 12th in the latest 2015-2016 Global Competitiveness Index (being 3rd in 2008, and 15th in 2013-14). Denmark continues to score reasonably well on its higher education and training system (10th) and labor market flexibility (12th).

Citation:
World Economic Forum, The Global Competitiveness Report 2014-2015, http://www.weforum.org/issues/global-competitiveness (accessed 17 October 2014).

World Economic Forum, The Global Competitiveness Report 2015-2016. http://www.weforum.org/reports/global-competitiveness-report-2015-2016 (accessed 7 October 2015).

World Economic Forum, The Global Competitiveness Report 2016-2017. http://www3.weforum.org/docs/GCR2016-2017/05FullReport/TheGlobalCompetitivenessReport2016-2017_FINAL.pdf (Accessed 23 October 2016).

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Produktivitetskommissionen: www.produktivitetskommissionen.dk

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. Its lead in computer technology and Internet access has been somewhat less. Finland had the EU’s highest R&D intensity in 2014, followed by Sweden and Denmark; indeed, in Finland, R&D expenditure totaled 3.2% of GDP. However, this position has declined; in 2015, the R&D expenditure totaled only 2.9% of GDP, which is the lowest level this figure has reached in Finland since 1998. 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 hasrepeatedly carried out dramatic cuts in government spending for education and higher learning. In the long run, given the dependence of applied research on basic-research developments, the heavy bias in favor of applied research will in fact 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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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

In the second half of the 20th century, Japan developed into one of the world's leading nations in terms of research and development (R&D). Science, technology and innovation (STI) has continued to receive considerable government attention and funding. Current policies are based on the new Fifth Science and Technology Basic Plan (2016-2020), approved in December 2015. The government has determined to spend one percent 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 independence and autonomy.

The government and outside observers realize that the strong position of Japan among the world´s top five technology nations is slowly declining (by 12% since 2012 according to the Nature Index 2016). One major issue is the unstable position of young researchers, 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. The relative position of Japan and other established top STI nations is being challenged by rising contenders like China.

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 authorities and clout. The LDP-led government has changed that by installing the CSTP as a think tank above the ministries, and providing it with budgetary power and increased personnel. For instance, program directors are appointed to oversee various measures. While the recent, somewhat bewildering, variety of measures introduced has made this move plausible, it's

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

Nicky Phillips, Nature Index 2016 Japan, Nature, Vol. 531, Issue 7594. March 2016, p. S97, http://www.nature.com/nature/journal/v531/n7594_supp_ni/full/531S97a.html

Lithuania

Score 7

Lithuania's economy is characterized by a low level of innovation. As assessed by the EU Innovation Scorecard, the country performs below the EU average, falling into "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. 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. This was a high priority for European Regional Development Fund support in the 2007 – 2013 period whose investments contributed to increasing Lithuania's R&D intensity. 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 recently 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, parliament approved new science and innovation policy guidelines, as 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. However, the effectiveness of the reform will depend on reducing inefficiencies in the higher education and research sectors, and consolidating education and research institutions to focus funding.

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 2016: http://ec.europa.eu/europe2020/pdf/csr2016/cr2016_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.

Luxembourg

Score 7

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, with 0.7 to 0.9 percentage points of this 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 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 should create synergies between public research and industry. However, in the Global Innovation Index 2016, Luxembourg dropped 3 places and is now ranked 12 out of 128 countries.

The new Belval campus, designed for 7,000 students, 3,000 researchers and 6,000 inhabitants, is one of the largest urban conversion projects in Europe. In 2016, more than 1,600 employees and 3,000 students were teaching, learning and working in this modern location. In its 2016 evaluation, the OECD recommends better impact control and further investments in the Belval campus.

Citation:
2015 Rapport et Bilan. Société Nationale de Crédit et d'Investissement, 2015. www.snci.lu/files/69735.pdf. Accessed 21 Feb. 2017.

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Jill.lu, www.jll.lu/luxembourg/en-gb. Accessed 21 Feb. 2017.

"Luxembourg." Heritage, www.heritage.org/index/country/luxembourg. Accessed 21 Feb. 2017.

OECD Reviews of Innovation Policy - Luxembourg 2015. OECD Publishing, 2015. www.innovation.public.lu/fr/brochures-rapports/o/ocde-luxembourg-innovation-2015/ocde-luxembourg-innovation-2015.pdf. Accessed 21 Feb. 2017.

OECD Reviews of Innovation Policy - Luxembourg 2015. OECD Publishing, 2015. www.innovation.public.lu/fr/brochures-rapports/o/ocde-luxembourg-innovation-2015/ocde-luxembourg-innovation-2015.pdf. Accessed 21 Feb. 2017.

Schwab, Klaus. The Global Competitiveness Report 2015 – 2016. World Economic Forum, 2015. http://www3.weforum.org/docs/gcr/2015-2016/Global_Competitiveness_Report_2015-2016.pdf. Accessed 21 Feb. 2017.

Thill, Marc, et al. "Die Debatte um den Artuso-Bericht." Luxemburger Wort, 14 Dec. 2015, www.wort.lu/de/politik/streitgespraech-die-debatte-um-den-artuso-bericht-566e9cd90da165c55dc4f8a4. Accessed 21 Feb. 2017.

"The University of Luxembourg Booklet." Le portal de l'actualité gouvermentale, cedies.public.lu/fr/publications/guides-pratiques/faq-uni-lu/luxembourg/guidance-booklet-for-faq-and-concerns.pdf. Accessed 21 Feb. 2017.

"World University Rankings 2015 - 2016." Times Higher Education, www.timeshighereducation.com/world-university-rankings/2016/world-ranking. Accessed 21 Feb. 2017.

"Xavier Bettel présente l'initiative "Digital Lëtzebuerg"." Le portal de l'actualité gouvermentale, 20 Oct. 2014, www.gouvernement.lu/4103901/20-digital-letzebuerg. Accessed 21 Feb. 2017.

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 much for potential investors, KPMG says.

Since the onset of the financial crisis in 2007, investment has generally been declining. Belgium stands out as having withstood the shock rather well, with investments as a share of GDP higher than in France, Germany or the United States (according to IMF data). Likewise, Belgium has increased its R&D spending (according to Eurostat data). While still below its 3% of GDP target, it closed half the gap between 2008 and 2014.

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, despite the assistance provided by the regions to help them monetize their discoveries in the form of spin-offs and improved links with businesses. 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/statistics-explained/images/3/32/Gross_domestic_expenditure_on_R%26D_%28R%26D_intensity%29%2C_by_country%3B_2008_and_2014.png

Czech Republic

Score 6

From 2010 to 2015, R&D expenditure grew by two thirds, almost reaching the average EU level (relative to GDP). European structural funds have been the main drivers of growth. Public R&D spending has suffered from a strong bias towards capital rather than current expenditure, meaning construction of research facilities rather than conduct of research activities. Private R&D spending has also risen, but is still dominated by foreign-owned companies, particularly in the automotive industry, which are still 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.

Citation:
Srholec, M., C. Benedetti Fasil (2017): RIO Country Report: Czech Republic 2016. 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 relatively sophisticated set of strategies and action plans. The outcomes, however, are very poor. Former stable levels of governmental and non-governmental RDI expenditures began to decline in 2015 and 2016. This is largely explained by the end of the EU programming period, since EU structural funds have been an important source of national R&D budget.

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 increased international rankings of major national 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; in 2015 the number of researchers in higher education was two times higher than the enterprise sector and about six times the government sector. R&D contracts with enterprises compose only 4% of the annual volume of universities' RDI budgets.

Citation:
Statistics Estonia (2016). Statistical Yearbook of Estonia 2016, ch. Research & development. http://www.stat.ee/277639 (accessed at 01.11.2016)

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 had its impact on this and the expenditure rate was down to 1.8% of GDP in 2013 but has recovered to 2.2% in 2015 – still far below the 2006 level.

Citation:
Research, Development and Innovation in Iceland - 2014 edition. RANNIS - The Icelandic Center for Research https://www.rannis.is/media/utgafur-og-skyrslur/Research,-Development-and-Innovation—2014-edition-(2).pdf

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 15% from 1.25 billion NZD in 2014 to 1.44 billion NZD in 2015. 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 1.2% of GDP on R&D in 2014, down from 1.3% in 2012. 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 in New Zealand: 2014. Statistics New Zealand. May 2016.
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 have 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. These efforts have gradually shown their results. However, Poland continues to score poorly in the EU's Innovation Union Scoreboard rankings, and the Deloitte R&D Survey 2016 found that 44% of Polish companies do not implement an R&D strategy. Like its predecessor, the PiS government has emphasized its commitment to promoting research and innovation. Minister for Science and Higher Education Jarosław Gowin presented a new strategy for science and higher education with measures for fostering research at Polish universities and for stimulating the cooperation between universities and business in September 2016. The Ministry of Development's Action Plan for Responsible Development, adopted in February 2016, has called for further increases in R&D spending.

Citation:
Deloitte (2016): Corporate R&D report Poland 2016. Warsaw (https://www2.deloitte.com/content/dam/Deloitte/pl/Documents/Reports/pl_RD-2016-Poland-EN%20(1).pdf).
Klincewicz, K., K. Szkuta, M. Marczewska (2017): RIO country report Poland 2016. Luxembourg: European Union (https://rio.jrc.ec.europa.eu/en/library/rio-country-report-poland-2016-0).

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, but not much has been done to improve the financial situation of the universities.

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.

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

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 innovations, especially for its future economic and thus 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 (2016), Chile was ranked 44th out of 128 countries. When compared with the previous year, when it was ranked 42nd out of 141 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 Renzi 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, though some measures to foster start-up companies and sustain investments in technological innovation have been introduced. As a result, there has been growing awareness of the strategic importance of R&D across society, in the media and among some politicians. 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.
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.

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

Malta

Score 5

Innovation, research and development are regarded as key drivers for economic growth in the EU as reflected in the European Commission's recently launched 'Open Innovation, Open Science, Open to the World' strategy. Nonetheless, the business R&D sector in Malta still requires substantial development. 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 Union Scoreboard 2016 describes Malta as a Moderate Innovator with weaknesses related to venture capital investments, non-EU doctorate students and public-private scientific co-publications. The 2016 European Commission Staff Working Document also notes that a "relatively young and underdeveloped framework for research and innovation constrains the potential for knowledge-driven growth." The same document also highlights the fact that the country's public R&D expenditure is significantly low and a subpar level of scientific excellence. As a response to this situation government has devised a rolling R&I action plan that aims to reduce fragmentation and overlap in this area. This is complemented by the launch of the FUSION program focused on the analyses of companies' or researchers' ideas for commercial viability purposes, the introduction of the Reach High Scholars program for post-doctoral grants and the completion of the Malta Life Sciences Park.

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 2016 p.64
Commission Staff Working Document Country Report Malta 2016 COM (2016) 338 final p. 2, p.35
Malta National Reform Programme 2016 p.5

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. However, this spending has increased slightly in recent years. Research policy is nonpluralistic, government-led, and is not 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. Research funds are mainly public, distributed through a single research council, and are politically directed from above. Recent reforms have not been very successful, and the government is frequently criticized for insufficient investment in research. 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 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

The European Union's 2016 Innovation Union Scoreboard classifies Portugal as a "moderate innovator," the second-lowest of four categories. It notes that Portugal's position has improved in relation to the EU average in 2014 and 2015. This contrasts with Portugal's performance between 2009 and 2013 when it declined against the EU average. This increase was particularly evident in 2014. Out of eight criteria, Portugal is above the EU average in one: human resources. Portugal's good score on this dimension reflects the number of recent doctorate graduates, which is 1.7 times greater than the EU average.

Most importantly, the government has redefined the National Innovation Agency, which has received substantial funding from the European Union to he promote research and innovation across a wide range of areas. The program is currently accepting applications for funding and it remains to be seen if there are important results.

Nevertheless, research and innovation has improved and with the new funding program it is likely that there will be significant progress.

Citation:
http://ani.pt/inovacao-em-portugal/o-novo-quadro-de-incentivos/
"European Innovation Scoreboard 2016 – Portugal". 13/07/2016. Available online at: http://ec.europa.eu/DocsRoom/documents/17852

Australia

Score 4

Successive governments have sought to introduce policies at various times to encourage innovation and to increase investment in business and industry. However, changes to the policy environment following the 2008 "Venturous Australia – Building Strength in Innovation" report were minimal under the previous Labor government, and since the election of the Abbott government 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. The new prime minister has emphasized the need to foster innovation, but has made no new policy announcements that would deliver this.

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

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 output and innovation, numerous companies have introduced innovations, with proportionally more enterprises receiving public funding for innovation-oriented activities than the EU average. However, the country's scores on basic indicators are among the EU's lowest. Generally, the private sector provides little opportunity and limited funding for R&D activities.

A European Commission report (2013) stated that businesses had limited demand for R&D and little propensity to innovate. The economic crisis has negatively affected project funding. Cyprus's R&D target for 2020 remains at 0.5% of GDP. It is the lowest in the EU, offering limited prospects.

Citation:
1. Eurostat, Research and Innovation Challenges, http://ec.europa.eu/europe2020/pdf/themes/2015/research_and_innovation.pdf
2. EUFORI study Cyprus Report, 2015, http://euforistudy.eu/wp-content/uploads/2015/07/Cyprus.pdf
3. Investment in Research and Innovation very low in Cyprus, Sigmalive, 2015, http://www.sigmalive.com/en/news/local/136537/investment-in-research-and-innovation-very-low-in-cyprus

Greece

Score 4

Even though Greece is not ranked in the bottom tier of OECD countries with regard to government spending on research and development, successive Greek governments have never considered research and development a priority policy sector. This problem is coupled by the reluctance of private business enterprises, even the largest, to devote funds to R&D. This is a factor of overall economic activity, institutional weaknesses, and cultural resistance to public-private collaboration.

In the period under review, as in the past, most research was conducted at state universities and state research institutions. However, such universities saw their funding (based on the state budget) decline in 2015, and again in 2016, as a result of the Syriza-ANEL government's harsh austerity measures. Despite economic adversity, there are clear "islands" of excellence at these universities in areas such as biology, IT and computer science, economics and various branches of engineering, archaeology and history.

Notably, Greek researchers who seek EU funding are often disproportionately successful in securing it. For instance, the National Technical University of Athens actively participates in international projects, as does the Heraklion-based Institute for Technology and Research.

Under "Europe 2020," Greece is committed to an unusually low target for research funding as a percentage of GDP (1.2% as opposed to the EU mean of 3%). Given that in 2014 the Greek government devoted only 0.45% of GDP to R&D, it will be difficult to attain even the aforementioned low target by 2020. In brief, Greek research and innovation policy during the review period has continued to be suboptimal.

A very positive step has been the establishment of the Hellenic Foundation for Research and Innovation, a new public body funded by the Greek state and the European Investment Bank (EIB), with additional funding from the EU National Strategic Reference Framework and the EU Horizon 2020 program. The Foundation will manage the evaluation and financing of research projects, academic positions and investment in scientific equipment in order to strengthen research financing in Greece and to ensure that research jobs can be created for young scientists and doctoral students, who might otherwise leave the country to seek opportunities elsewhere.

Citation:
Data on expenditure on research and development are on tables provided by SGI on this platform.

Hungary

Score 4

Hungary's research and innovation (R&I) sector is fairly advanced but chronically underfinanced. Under the Fidesz governments, the situation has worsened further, since public funding for universities and research has been drastically cut. With 1.4% of GDP, public spending on R&I in 2015 was below both the Hungarian (1.8%) and the EU target (3.0%). As for R&I, Hungary slid from 51 to 80 in the latest ranking of the World Economic Forum. The Hungarian Academy of Sciences (HAS) still suffers from the effects of a radical and politically motivated reorganization, and the severe lack of resources for scientific research. Both the natural and the social science institutes of HAS have been integrated into one large over-centralized organization without the necessary funding. The social science institutes have been removed from the Buda Castle area and have been put in a new building. The third Orbán government has transformed the National Innovation Office (Nemzeti Innovációs Hivatal, NIH) 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. The Hungarian authorities seem to be aware of the shortcomings of Hungarian R&I policy. They turned to the European Commission for advice, using the Policy Support Facility (Horizon 2020 program). The peer review report will produce suggestions for reform, so that some measures can be expected for 2017.

Romania

Score 4

Years of mismanagement and underinvestment in the sciences and industries which drive research development have resulted in a brain-drain of innovators, educators and entrepreneurs. In line with the National Research-Development and Innovation Plan 2015-2020 adopted by the Ponta government, R&D spending has grown. Romania's research budget increased by one-third from 2015 to 2016 and was paired with investments and grants from various sources including the European Research Council, Norwegian Financial Mechanism, and Research and Innovation Center of the Ford Motor Company. The increased budget will close out existing projects and provide initial funding to new projects in research, development, and innovation, with particular attention paid to green industry. Romania's current status as an emergent high-tech and communications hub has driven private and public sector innovation. However, this increased funding might take some time before actually reaching interested researchers. UEFISCDI, the state authority in charge of disbursing research funds, has been very slow in organizing funding competitions and adjudicating applications. As in previous years, there is the danger that funding for winning applications might be considerably delayed.

Spain

Score 4

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 2016, just 1.22% of GDP went to research and development, compared with an EU average of more than 2% (which was the Spanish target for 2010). While the crisis is certainly responsible for the decline, the draconian cuts implemented in recent years have exacerbated a situation already needing attention. It is clear that the government's post-housing-bubble pledge to promote a new model of economic growth based on brainpower rather than construction has not been reflected in the budget. 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 18th among the 28 EU member states in R&D spending and 19th in the EU Innovation Scoreboard. Nevertheless, 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:
William Chislett. 2016. A New Course for Spain: Beyond the Crisis. Madrid: Elcano Institute European Commission, European Innovation Scoreboard 2016 http://ec.europa.eu/DocsRoom/documents/18062

Turkey

Score 4

The government continued to strengthen the country's research and innovation capacity during the review period. The Scientific and Technological Research Council of Turkey (TUBITAK) is the leading agency for management, funding and conduct of research in Turkey.

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%. Commercial enterprises account for the largest share of R&D expenditures, at 49.8%. While universities accounted for 40.5% of spending on R&D, public institutions' share was 9.7%. In terms of financial contributions to R&D projects, commercial enterprises have the largest share with 51.4%, followed by public institutions with 26.5%, universities with 18.6%, and other sources 3.4% of R&D. In terms of full-time employment, 213,686 people worked in the R&D sector in 2014, an increase of 8.8% compared

with the previous year. 34.5% of R&D personnel were employed by commercial enterprises, while 59% worked at universities, and public institutions employed 6.5% 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 EU in terms of spending on R&D. The country's R&I system suffers from a strong separation of the public and the private sector and a far-reaching institutional fragmentation. However, R&D outlays have risen since 2007 and have recorded significant increases by more than a quarter each year in 2014 and 2015. These increases have largely stemmed from increased spending by enterprises – in 2014 primarily through non-Bulgarian sources, though in 2015 most of this was financed by the Bulgarian enterprises themselves. A similar process of private funding replacing public funds has begun in the startup sector as well. These developments could signal a sustained increase in research and innovation activities.

Citation:
Todorova, A., Slavcheva, M. (2017): RIO Country Report Bulgaria 2016. Luxembourg: European Union (https://rio.jrc.ec.europa.eu/en/country-analysis/Bulgaria/country-report).

Croatia

Score 3

Croatia does not have a mature innovation system, and has fallen further behind in the field of innovation policy. The country lacks a coherent and integrated policy framework, companies have low technological capacity to support innovation, and technology-transfer mechanisms are inadequate. While budget outlays for R&D reach about the same proportion of GDP as the EU-28, the results in terms of overall expenditure on R&D are far weaker in Croatia. In 2015, overall spending on R&D stood at about 0.85% of GDP, compared to more than 2% in the EU-28. This was mainly due to the very low level of R&D expenditure by the private sector, which spent only 0.44% of GDP on R&D compared to 1.3% in the EU-28. Investments on R&D therefore still remain far below 1.5% of GDP (the target suggested by the EU's Europe 2020 framework). This also suggests that the private sector is over reliant on the government to fund R&D.

Like its predecessor, the Orešković government did little to use the newly available EU structural funds for modernizing and developing the innovation system. In its short term in office, it failed to prepare new strategic documents related to research and innovation. Unlike the Milanović government, it openly rejected the relatively comprehensive September 2013 Strategy for Education, Science and Technology, a 180-page document drafted by more than 100 experts, including R&I specialists.

Citation:
Račić, D., J. Švarc, H. Hristov, H. (2017): RIO Country Report Croatia 2016. Luxembourg: European Union (https://rio.jrc.ec.europa.eu/en/country-analysis/Croatia/country-report).

Latvia

Score 3

Research and development (R&D) expenditure in Latvia was equal to 0.69% of GDP in 2014, but fell to 0.62% of GDP in 2015. 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.

Public funding for research institutions fluctuates year to year. This creates an environment of uncertainty that discourages young people from entering the fields of science, technology and innovation, or encourages these young people to look for opportunities abroad. There are few links between industry and research institutions, a fact that further hampers the growth of the R&D sector. Furthermore, there is a persistent lack of public funding for the development of international research networks and collaborative projects.

In the Union Innovation Scoreboard 2016, Latvia ranked 25 out of 28 EU countries in terms of innovation, up from 26 in 2014. Consequently, Latvia has moved from the category of “modest innovators” to “moderate innovators.”

National industrial policy guidelines for the period 2013 to 2020, adopted in 2012, established a framework for public support of innovation. The Ministry of Economy and the Latvian Investment and Development Agency (Latvijas Investīciju un attīstības aģentūra, LIAA) initiated a range of innovation-support projects in 2013 to promote high value added business activity. The aim of these projects is to support new product design and technology development as well as to promote cooperation between the research and business sectors. A new framework document for science, technology and innovation support was adopted in 2013 for the period 2014 to 2020. The new framework aims to rebalance investment flows by increasing the share of domestic public and private investment.

Citation:
1. Ministry of Education and Science (2011), Development of Science and

Technology in Latvia, p.14, Available at: http://izm.izm.gov.lv/upload_file/Zinatne/zinatnes-un-tehnologiju-attistiba-Latvija-2011.pdf, Last assessed: 17.05.2013

2. European Commision (2014), Union Innovation Score board 2014, Available at: http://ec.europa.eu/enterprise/policies/innovation/files/ius/ius-2014_en.pdf, Last assessed: 01.11.2014.

3. Ministry of Economy, Guidelines on National Industrial Policy, Available at (in Latvian): http://www.em.gov.lv/em/2nd/?cat=30765, Last assessed: 21.05.2013

4. Ministry of Education and Science, Framework document on Science, Technology Development and Innovation 2014 - 2020 (in Latvian). Adopted 28.12.2013. Available at: http://polsis.mk.gov.lv/view.do?id=4608, Last assessed: 31.10.2014

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.

Slovakia

Score 3

Slovakia has a weak and underdeveloped research and innovation policy. R&D intensity, public expenditure on R&D, the number of patent applications and levels of employment in knowledge-intensive activities are below the EU average. Expenditure on R&D, which remains well below the EU average, has gradually increased in recent years, albeit from a very low level. The Fico government has focused on the use of EU funds and on tax incentives for R&D, but has failed to address structural problems such as the fragmented administrative framework, the lack of coordination and thematic concentration and the missing links between the multinational companies that dominate the Slovak economy and the country’s universities and research institutes. In July 2016, the third Fico government cut the Slovak Academy of Sciences’ budget.

Citation:
Baláž, V., K. Frank, J. Zifciakova (2017): RIO Country Report Slovakia 2016. Luxembourg: EU (https://rio.jrc.ec.europa.eu/en/library/rio-country-report-slovakia-2016).

Slovenia

Score 3

Slovenia's R&I activities have long been of both low quality and quantity. The Cerar government several times promised to prioritize R&I, but in reality placed little emphasis on it. It has failed to increase national funds available for R&I and to raise the share of EU funds devoted to the support of research and development. In some areas of research, EU funds have even declined, as Slovenia has experienced serious administrative difficulties in absorbing funds for R&I. After years of neglect, the Cerar government announced increases in R&I spending when introducing the budgets for 2017 and 2018 to parliament in September 2016.

Citation:
Bučar, M., E. González Verdesoto (2017): RIO Country Report Slovenia 2016. Luxembourg: European Union (https://rio.jrc.ec.europa.eu/en/country-analysis/Slovenia/country-report).

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