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RIO Country Report 2017: Austria

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RIO Country Report 2017

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

Summary

Key findings

Despite tepid economic growth until early 2016, Austria remains a strong innovator country with 3.09% of GDP invested in R&D in 2016. The key role among "strong innovators" within the European Innovation Scoreboard was facilitated by a high level of investment in R&I and a strong level of human capital that exist within the Austrian economy, whereby 37% of enterprises in Austria provide ICT training to their personnel, compared to 22% in the EU (EIS, 2017). Economic growth prospects for Austria in 2018 are very promising, resulting in a declining unemployment rate (already in 2017), and good prospects for fiscal consolidation.

Challenges for R&I policy-making in Austria

Improve the relationship between innovation input and innovation output:

Although Austria has the second highest GERD in % of GDP ratio in the EU, the aspired structural change of the economy towards a more knowledge-intensive, innovative and high-tech oriented economy progresses only slowly, which is partially caused by Austria's industrial structure, administrative and regulatory barriers, low entrepreneurship education and promotion, and applied R&D programmes which are still very engineering-driven but lacking innovation orientation. The ongoing investment in upgrading the Austrian broadband network is an important step in the right direction.

Further increase equity capital supply for start-ups and scale-ups: Whereas access to finance is not a short-term concern for Austrian SMEs in general, supply of equity finance for young companies is still scarce. The situation is improving though. The start-up package announced in 2016 represents the first main step towards implementation of the "Gründerland" strategy from 2015. One of the core points of the package is the reduction of auxiliary salary costs for three-years to relieve innovative start-ups from the high social contributions to their employees. There are indications that the strong increase in public Venture Capital (VC) is starting to leverage private equity, especially from foreign sources, while private VC contributions generating from Austria are still very low.

Increase funding for competitive basic research: The national university development plan lists strengthening of basic research as a systemic goal. The 'research billion' promised, among other issues, additional budget for basic research to the Austrian Science Fund (FWF). However, it is not clear, if the FWF's focus on supporting projects of single applicants in person is sufficient to substantially contribute to the expected profiling of universities. If the promised research billion is not realized, the current Austrian funding mix risks to overemphasis applied research funding at the expense of basic research.

Reform of the Financing of the Higher Education System: To improve the financial situation for universities, the student-professor ratios and to increase financial transparency, the introduction of a study-placed financing system, which includes access restrictions for certain studies, has been planned since a couple of years. In July 2017, a significant budget increase for the universities has been adopted by the national assembly to make the transition to the new study-placed financing system financially feasible, but the bill on the actual study place financing system still lacks approval by the parliament. The change of the financing system alone, however, can only be a basis for an improved profiling of Austrian universities, which is severely aggravated by the structural composition of the Austrian higher education system.

Main R&I developments in 2017

- Digital Roadmap for Austria
- Start-up package launched
- Trade license act liberalised
- National IP Strategy launched
- SSH Strategy published
- New performance agreement with the Austrian Academy of Sciences for the years 2018-2020 concluded

Smart Specialisation

The Austrian Smart Specialisation approach is based on the national RTI strategy supplemented by regional strategies at the level of the federal states ("Bundesländer"). The "Bund" (i.e. national bodies) accounts for roughly 90% of the public spending in RTI. The "Länder" (i.e. regional) funding is heterogeneous. However, with 5.2% of GRP, Styria was Europe's region with the highest research intensity in 2017. In 2016, a policy framework was presented seeking to establish a common understanding of the interaction of the national RTI Strategy with the regional economic and innovation strategies of the "Bundesländer". Today, all "Bundesländer" have RTI strategies, budgets for financial assistance schemes and agencies that support the implementation of the strategies in place. An increasing number of regional R&I strategies has been drafted according to the S3 model. The S3 approach, however, did not significantly differ with earlier policy-making processes, which were also based on an active role of stakeholder engagement. While the national RTI strategy does not – by exception of a general emphasis on grand challenges - outline thematic priorities, the regional strategies prioritise a combination of certain sectors, technology domains and scientific fields. Transnational value chains are partially taken into account, but financially hardly substantiated. All S3 strategy implementation processes have monitoring and reporting mechanisms in place, but they vary from region to region and summative analytical work is still missing.

Foreword

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

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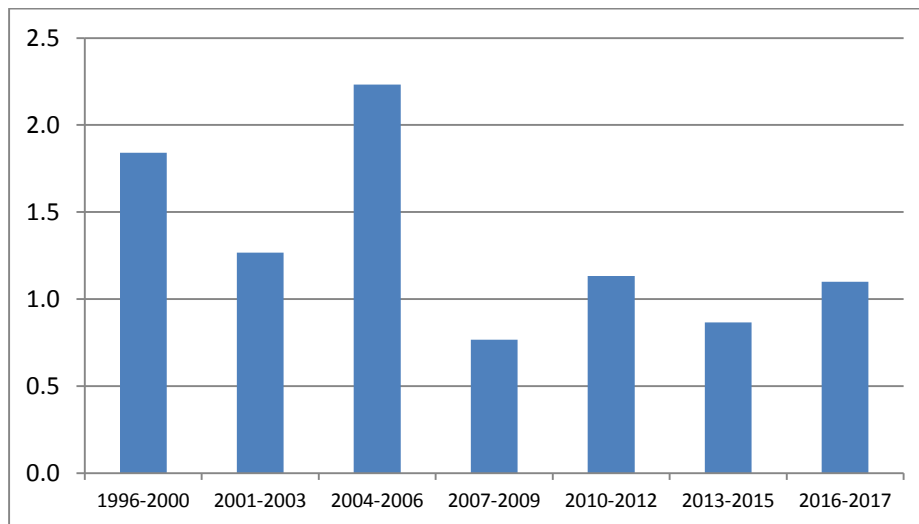
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1 Economic context for R&I

GDP in Austria amounted to €340b and thus accounted for 2.3% of the EU's total GDP in 2015¹. With a GDP per capita of €40,400 in 2016 the country was well above the EU-28 average of €29,100 (see Factsheet at the end of this report). After the fast recovery from the financial crisis experienced in the years 2010 and 2011, GDP growth slowed down to a level below the EU average in 2015 (EU: +2.3%; Austria: +1.1%). This relatively tepid economic progress was also the major reason for the rising unemployment rate, which increased from 4.9% in 2012 to 6.0% in 2016, but which came to halt in 2017.

Labour productivity increased significantly from 103.3 in 2014 to 105.3 in 2015 but decreased to 104.8 in 2016 (Index, 2010 = 100). Thus, labour productivity dynamics were lower in Austria than in the EU-28 (2014: 104.1; 2015: 105.5; 2016: 106.1; Index, 2010 = 100). Over the long-term, figure 1 shows that labour productivity in Austria was averaging about 1.8 percent during the period 1996-2000. It increased in 2004-2006 to about 2.2 percent. It declined in 2007-2009 and picked up in 2010-2012, slightly dropped in 2013-2015 and picked up again in 2016-2017.

Figure 1. Real Labour productivity per hour worked



Source: Eurostat, National Account Indicator (ESA 2010)

2016 is considered as economic turning point, leaving behind a period of subdued growth. The ECFIN Autumn 2017 forecasts a GDP growth rate of 2.6 % in 2017². Significant pick-up of equipment investment and private consumption became the main growth drivers of the economy. It is expected that Austria's economic growth expands at almost the same pace in 2018 (2.4%). Positive business and consumer sentiment indicators suggest that domestic demand should remain the main driver. A slight slowdown in domestic demand in 2018 is expected to be partly offset by stronger external trade, as the outlook for the world economy in general, as well as that of Austria's East European neighbours should benefit Austrian exporters.

Government revenues fell in 2016 as a result of income tax reforms but are expected to gradually recover as the economy improves. This decrease in government revenues worsened the government headline balance from -1.1% of GDP in 2015 to -1.6% GDP in 2016. In 2017, the government headline balance is expected to improve to -1.0% of GDP thanks to stronger economic growth. In 2018, the positive economic outlook is expected

¹https://ec.europa.eu/info/strategy/european-semester/european-semester-your-country_en; accessed on 21 July 2017.

²https://ec.europa.eu/info/files/autumn-2017-economic-forecast-austria_en; accessed on 3 December 2017.

to further support the headline balance, which should reach -0.9% of GDP and -0.6% in 2019. Government debt peaked in 2015 at 84.3% of GDP, decreased to 83.6% of GDP in 2016 and is expected to decline at a relatively fast pace in 2017 and 2018 (DG ECFIN Autumn 2017 forecast)³. These projections are based on the assumption that the recent national elections will not lead to a policy change in respect of fiscal consolidation.

1.1 Structure of the economy

Austria has a comparatively broad manufacturing base, reflected in a value added of 18.2% in 2016 (which is above the last available EU-28 average of 15.48% in 2014). In general Austria's manufacturing sector is oriented towards medium-tech and medium-high tech manufacturing, with only few large high-tech enterprises but several specialised medium-sized and larger companies operating in niche markets or as second-tier suppliers. Ongoing trends do not reveal radical structural changes but rather incremental modernisation of existing businesses. Among them is a steady shift towards employment and added value in the service sector and a slight increase in value added of high and medium-high tech manufacturing as share of total value added. The latter increased since 2009 (7.85%) to 8.23% in 2016. Overall, employment in the productive sector continues to shrink, while it remained relatively constant in the high and medium-high tech manufacturing segment from 2012 to 2014. It even increased in 2015 to 5.04% as share of total employed and 5.07% in 2016 compared to 2014 (5.01%).

Austria is now predominantly a service-based economy. Table 1 demonstrates that in 2000 two thirds of value added was accounted for by services. The sector now accounts for more than 70 percent of the total value added. Interestingly, in 2016, knowledge-intensive sectors account for more than 33 percent of value added, and high and medium high tech manufacturing accounts for more than 8 percent. Although this statistics do not cover the whole economy, they may reflect the influence that ICT and innovation have on these two sectors.

Table 1. Contribution to value added differentiated by sectors and years in %

	2000	2005	2010	2015	2016
Private sector					
Manufacturing	20.52	19.69	18.50	18.56	18.20
Services	66.51	68.21	69.92	70.70	71.02
Knowledge intensive services	31.97	32.18	32.94	33.30	33.50
High and Medium High Tech manufacturing	7.71	8.04	7.87	8.13	8.23

Source: Eurostat, value added by industry as a percentage of total value added.

Table 2 disaggregates GDP by industry groupings. The sum of groupings' shares is 100⁴. Since 2000 'financial and insurance activities', 'industry' and 'manufacturing', 'construction' and 'agriculture, forestry and fishery' are among the declining industries in Austria. The stronger growing industries are 'real estate activities', and 'professional, scientific and technical activities; administrative and support service activities'.

³https://ec.europa.eu/info/files/autumn-2017-economic-forecast-austria_en; accessed on 3 December 2017.

⁴ Note: construction must be deducted, because it is already included in industry. Because of rounding, totals may not add up to 100%.

Table 2. Composition of GDP by industry grouping and years in %

	2000	2005	2010	2015	2016
Private sector	89.2	88.8	89.0	89.0	89.0
Financial and insurance activities	4.8	4.3	4.0	3.8	3.6
Real estate activities	7.1	8.1	8.2	9.0	9.2
Professional, scientific and technical activities; administrative and support service activities	6.1	7.1	7.9	8.4	8.4
Wholesale and retail trade, transport, accommodation and food service activities	20.4	20.3	20.8	20.4	20.4
Manufacturing	18.3	17.5	16.6	16.8	16.7
Industry (except construction)	21.5	20.7	19.7	19.5	19.2
Construction	6.7	6.3	5.8	5.7	5.8
Public administration, defence, education, human health and social work activities	15.6	15.1	15.9	15.5	15.6
Information and communication	3.0	3.2	2.9	3.1	3.1
Arts, entertainment and recreation; other service activities;	2.4	2.5	2.6	2.5	2.5
Agriculture, forestry and fishing	1.6	1.3	1.3	1.1	1.1

Source: Eurostat, Value added by industry as a percentage of Gross Domestic Product. Because of rounding, totals may not add up to 100.

1.2 Business environment

According to the 2017 SBA Fact Sheet — Austria⁵ published in November 2017, Austria's economy is characterised by a high degree of SMEs (99.7% of all companies), which employ 68.7% of the labour force (EU-28: 66.6%) and contribute 62.0% of value added (EU-average: 56.8%). In 2016-2018, moderate SME growth is expected to continue, with value added rising by 7.4 % and employment by 2.6 %, resulting in the creation of around 49,700 new jobs.

In terms of implementing the Small Business Act for Europe (SBA), Austria shows an overall competitive profile with above EU-average performances in four SBA areas: 'internationalisation', 'sustainability, environment and energy', 'skills and innovation', 'single market'. The report recommends improving entrepreneurship education in primary and post-secondary curricula, and to embrace the digital economy. As regards access to finance, it is recommended to create an ecosystem that fosters equity financing for SMEs, inter alia to enable fast-growing companies to scale up more successfully.⁶

A serious concern for the Austrian economy is the digital modernisation of businesses. According to the Digital Economy and Society Index (DESI), Austria is positioned in the midfield among all EU countries in 2017.⁷ It progressed in line with the EU average over the last year, and is ranked 10th position. It performs best in 'digital public services' where its strength lies in the improving quality of the online offer, followed by 'human capital'. On the 'integration of digital technology by businesses', Austria scores relatively less well, but still above average, while its connectivity score is exactly average despite very favourable broadband prices. Finally, the only dimension where Austria is scoring

⁵European Commission (2017c): <https://ec.europa.eu/docsroom/documents/26562>; accessed on 25 November 2017.

⁶ Ibid.

⁷ <https://ec.europa.eu/digital-single-market/en/scoreboard/austria>; accessed on 29 July 2017.

below average is the 'use of internet services', although online shopping and online banking is relatively wide spread.

In the E-Government Development Index Rank⁸, Austria is ranked on 16th position, which is a strong improvement compared to rank 20 in 2014. Also in terms of online availability of public services (measured in percentage of individuals having interactions with public authorities via Internet during the last 12 months), Austria is steadily improving from 51% in 2010 to 60% in 2016, which is far above the EU average (48% in 2016).

On 19 January 2017 the "Digital Roadmap for Austria", a national digital strategy including a comprehensive overview over current challenges as well as existing and planned measures to address these challenges was published⁹. It includes 12 action areas and 150 specific measures. Furthermore, at the end of January 2017 Austria also adopted its new government programme for 2017-2018 in which digitisation is identified as one of the key priorities.¹⁰ Since the plans of the newly elected coalition government, which is likely to take over power in December 2017 or January 2018, are not known in this respect, the strategy is further implemented for the time being. Thus, the BMVIT completed the second round of tenders for the broadband "Access" and "Backhaul" programmes in autumn 2017, which are part of the so called 'Broadband Billion Programme', awarding 80 million euros to 20 beneficiaries. In total, around €332m have been made available until November 2017 from the 'broadband billion'. One third of the planned budget by 2020 has already been spent.¹¹

In the World Bank's 2017 Doing Business Index, Austria ranks 19th (9th among EU Member States) in 2016, two positions better than in 2015. However, the country's position in several sub-indices has worsened since 2015, notably from 16 to 20 in resolving insolvency, from 52 to 62 in access to credit, and from 101 to 111 in starting a business. Austria remained strong, at the 10th place, in terms of the ease of enforcing contracts (World Bank, 2016). The low rank on starting a business seems to be driven by the relatively long time it can take for issuing a business premises permit ("Betriebsanlagengenehmigung"), which, however, is mandatory only for certain business facilities that could negatively impact the surrounding neighbours, environment, etc.

Whereas bankruptcy legislation in general is not very encouraging for entrepreneurship and risky innovation, there have been some improvements: the 'company start-up support law' was amended to reduce the waiting time to qualify for support for new start-up activities from 15 to 5 years after a failed entrepreneurial project. Moreover, previous business failures will not be considered anymore as a formal exclusion criterion to approve funding.¹² The Bankruptcy Law 2017 brings significant changes in the private bankruptcy law and provides for a reduction of the levy procedure to 5 years.¹³

In the Global Innovation Index 2017¹⁴, Austria remained unchanged on a good 20th position. This position is caused by a very good ranking in the category 'Human capital & research' and the sub-categories 'tertiary education' and 'regulatory environment'. In the category 'Market sophistication', Austria ranks only on 30st position caused by a mediocre rank in the sub-categories 'credit [accessibility]', 'investment' (especially due to the low market capitalization rate) and 'knowledge impact'. The latter is caused by low productivity increases measured as growth rate of PPP\$ GDP/worker and by low

⁸ <https://publicadministration.un.org/egovkb/en-us/Reports/UN-E-Government-Survey-2016>; accessed on 9 December 2017.

⁹ https://www.digitalroadmap.gv.at/downloads/digital_road_map_broschuere.pdf; accessed on 28 July 2017.

¹⁰ <http://archiv.bundeskanzleramt.at/DocView.axd?CobId=65201>; accessed on 28 July 2017.

¹¹ <https://www.bmvit.gv.at/presse/aktuell/nvm/2017/1126OTS0004.html>; accessed on 29 November 2017.

¹² Austrian Council, 2015.

¹³ <https://www.help.gv.at/Portal.Node/hlpd/public/content/171/Seite.1710866.html>; accessed on 20 October 2017.

¹⁴ Cornell University, INSEAD, and WIPO (2017): The Global Innovation Index 2017: Innovation Feeding the World, Ithaca, Fontainebleau, and Geneva.

dynamics in creating new businesses. Compared to the previous edition¹⁵, Austria improved considerably in the category 'infrastructure' (from place 24 to 16).

In the Global Competitiveness Index 2017-2018, issued by the World Economic Forum (WEF)¹⁶, Austria ranks on a good 18th position, which is an improvement compared to the two previous reports. The country ranks especially good in the sub-index C on 'Innovation and sophistication factors'. Like in the previous years it ranks only mediocre in the pillars 'market size', 'labour market efficiency' and 'financial market development'. The four most problematic factors in terms of doing business, according to the executive opinion survey of WEF from 2017, are - like in the previous year - firstly, restrictive labour regulations and in particular a low flexibility of wage determination, a negative effect of taxation on incentives to work and unsatisfactory hiring and firing practices; secondly inefficient government bureaucracy (especially in terms of procedures and time to start a business as well as efficiency of government spending); thirdly high tax rates and, fourthly, complicated tax regulations.

In 2016 and 2017 Austria received a country-specific EU recommendation to reduce administrative and regulatory barriers for investments in services, such as restrictive authorisation requirements and restrictions on legal form (European Commission, 2017b; European Central Bank, 2016). The recommendation argues that business creation is hampered by excessively regulated market access and administrative burdens. The later has been cautiously addressed by a rather 'light' reform of the trade license act ("Gewerbeordnung"), which passed the parliament in July 2017 and will become effective as of 1 May 2018¹⁷ (see Chapter 3, Main R&I policy developments in 2017).

The country-specific recommendation also claimed that financing options for SMEs and young innovative companies are limited. Although an emerging availability of venture capital is improving this situation, a lack of diversified financing options continues to remain a restraining factor for start-ups and scale-ups (European Commission 2017).

2 Main R&I actors

The design of R&I governance structures, which was fundamentally reshaped at the beginning of the century, has not changed significantly over the previous three years (see Figure 2 below).

R&I policy is relatively centralised at national level. The regions' R&I policies focus mainly on direct funding of applied R&D to foster science-industry relations, technology transfer and innovation support measures for regional economies. The main policy actors¹⁸ are the Federal Ministry of Science, Research and Economy (BMWFW), and the Federal Ministry of Transport, Innovation and Technology (BMVIT). BMWFW is responsible for tertiary education and for basic research, and to a lesser degree for innovation support, technology transfer and the promotion of entrepreneurship. BMVIT is mainly in charge of applied research. The Austrian Council for Research and Technological Development advises the government in all matters related to research, technology and innovation and regularly monitors progress of the implementation of the Austrian RTI strategy. The Austrian Science Council provides advice on the general progress of the science system, in particular the higher education sector (HES). The ERA Observatory Austria coordinates Austrian RTI activities with European policies, with an emphasis on the European Research Area and Horizon 2020.

At the operational level, most of the funding for R&D&I is managed by three agencies: the Austrian Science Fund (FWF) funds basic research, the Research Promotion Agency

¹⁵ ibd.

¹⁶ World Economic Forum (2017): The Global Competitiveness Report 2017-2018. Geneva.

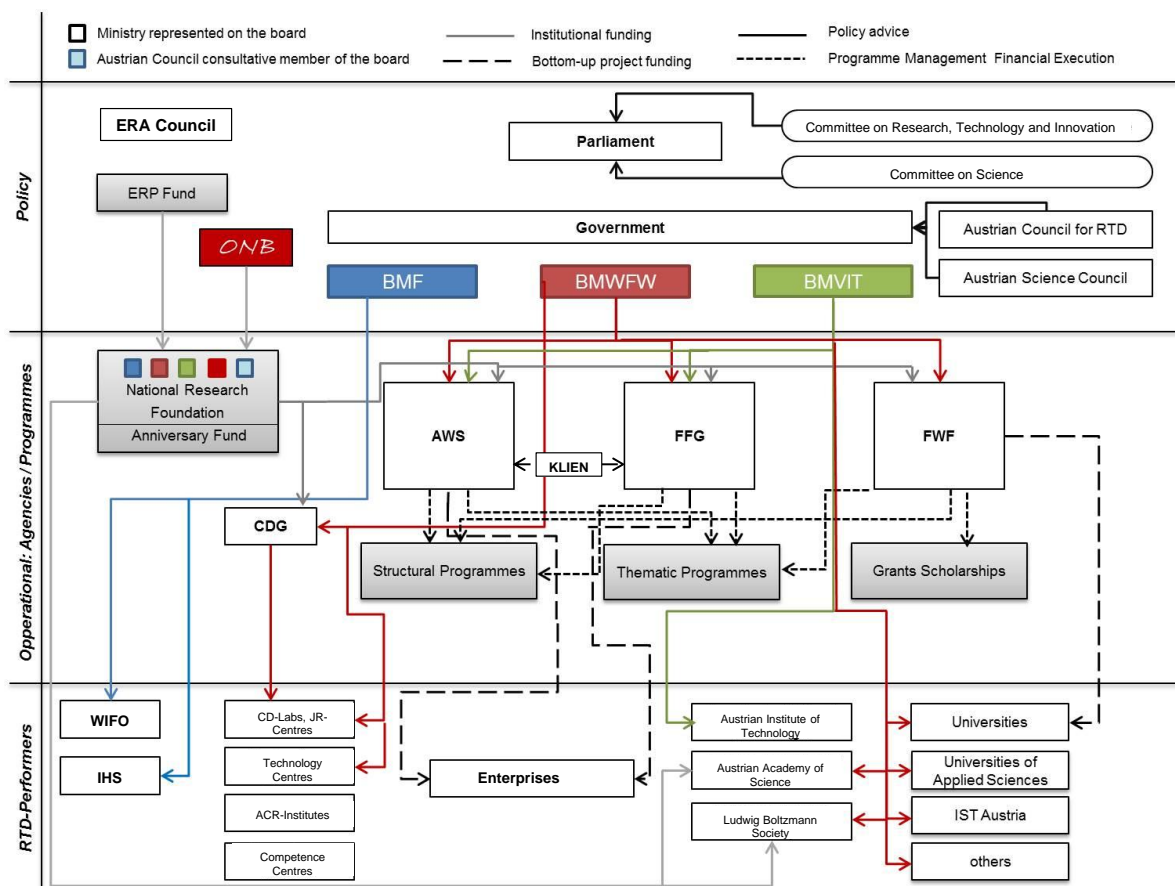
¹⁷ https://www.ots.at/presseaussendung/OTS_20170705_OT0143/gewerbeordnung-passiert-den-bundesrat; accessed on 7 August 2017.

¹⁸ Following the elections of Oct 2017 Austrian Ministries have changed (Feder Ministries' Act of 8 Jan 2018 <https://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=Bundesnormen&Gesetzesnummer=10000873>).

(FFG) funds applied R&D, and the national promotional bank AWS is specialised in financing start-ups and business innovation projects.

Within the HES, 22 public universities play the largest role as research performers, while private and semi-private higher education institutions (HEI) carrying out comparatively little research. In addition, the Austrian Academy of Sciences (ÖAW) and the Institute of Science and Technology Austria (IST Austria) engage primarily in basic research. The Austrian Institute of Technology (AIT) is the largest Public Research Organisation (PRO) in applied research. Moreover, there is a small group of regional institutes that mostly focus on applied research and technology development. Some of them belong to Austrian Cooperative Research, a network of non-university applied research institutes organised mostly as limited companies which perform industry-oriented R&D and provide R&D services for industry.

Figure 2. Structure of the Austrian Research System¹⁹



Legend: ACR-Institutes (Austrian Cooperative Research Institute), AWS (Austria Wirtschaftsservice), BMF (Ministry of Finance), BMVIT (Ministry of Transport, Innovation and Technology), BMWFW (Ministry of Science, Research and Economy), CDG (Christian Doppler Research Society), CD Labs (Christian Doppler Laboratories), FFG (Austrian Research Promotion Agency), FWF (Austrian Science Fund), IHS (Institute for Advanced Studies), IST Austria (Institute of Science and Technology Austria), JR-Centres (Josef Ressel Centres), KLIEN (Climate and Energy Fund), ÖNB (Austrian Federal Reserve), WIFO (Austrian Institute of Economic Research). Source: Schuch and Gampfer, 2017.

Although 3,611 enterprises were systematically involved in R&D in 2015, business R&D expenditure is highly concentrated in a few large companies, as is the case in most of the

¹⁹ Please note that after the elections of Oct 2017 Austrian Ministries have changed (8 Jan 2018).

EU.²⁰ 457 large companies accounted for 71.1% of BERD in 2015. The manufacturing sector accounted for 61.6% of all corporate R&D expenditures in 2015, of which 54.6% were made by foreign-controlled enterprises. In total the share of R&D expenditures across all sectors attributed to foreign controlled companies operating in Austria is 49.4%. This high share indicates that Austria is a preferred location in Europe for multinational companies' R&D activities (see also Section 3.2). The service sector accounted for 36.9% of total R&D expenditure in 2015, of which 42.6% was made by foreign-controlled enterprises. R&I activities of the private non-profit sector in Austria are of negligible size (0.5% in 2015).

3 R&I policies, funding trends and human resources

Main R&I policy developments in 2017

<i>Document title, hyperlink and date of publication/announcement</i>	<i>Short description</i>
"Digital Roadmap for Austria" ²¹	The roadmap gives an overview about the current challenges as well on existing and planned measures and activities. These are based on twelve guiding principles for the design of digitization in Austria. The roadmap includes 150 specific measures. The activities of all ministries in the field of digitalisation are for the first time bundled in one common strategy paper of the federal government.
Start-up package launched ²²	<p>The start-up package announced in 2016, with a financial endowment of €185m,²³ represents the first main step towards implementing the "Gründerland" strategy²⁴. One of the core points of the package is the reduction of auxiliary salary costs for three years as of 2017. This support, for which a total of € 100 million will be provided, is designed to relieve innovative start-ups from the high social contributions to their employees.</p> <p>Further core points of the new startup package are:²⁵</p> <ul style="list-style-type: none"> • Start-up fellowships for students and researchers • Increase the AWS business angel fund by doubling the investment of business angels in tech companies • AWS seed and pre-seed funding: 20 million for start-ups by 2018 • Increase of AWS guarantees: 300 million euros for bank guarantees per year • Subsidy to the risk capital premium:

²⁰http://www.statistik.at/web_de/statistiken/energie_umwelt_innovation_mobilitaet/forschung_und_innovation/f_und_e_in_allen_volkswirtschaftlichen_sektoren/index.html; Statistik Austria; accessed on 17 November 2017.

²¹https://www.digitalroadmap.gv.at/fileadmin/downloads/digital_road_map_broschuere.pdf; published on 19 January 2017

²²<https://www.bmfwf.gv.at/Wirtschaftspolitik/Standortpolitik/Seiten/Start-up-Paket-st%C3%A4rkt-Gr%C3%BCnderland-%C3%96sterreich.aspx>; accessed on 8 December 2017.

²³<https://investinaustria.at/de/blog/2017/03/startup-paket.php>; accessed on 10 August 2017.

²⁴https://www.bmfwf.gv.at/Presse/Documents/BMFWF_Land_der_Gruender_NEU.pdf; accessed on 9 December 2017.

²⁵<http://www.foerderportal.at/foerderungen/>; accessed on 10 August 2017.

	investment contributions to young companies are refunded up to 20% of the investment amount to investors (max. 250,000 euros)
Trade license act ("Gewerbeordnung") liberalised ²⁶	Due to this reform, the number of regulated business will decline from 80 to 75. Until now partially regulated businesses will become mostly free businesses. The reform also contains some facilitation in the field of business plant approval process, which will no longer cause costs. Moreover, ancillary rights are extended in regulated as well as in free businesses. In the regulated businesses, 15% of a contract can be carried out in other regulated businesses, without the need for an additional business license. In the free businesses up to 30% of the annual turnover can come from another free business. In the future, also the registration of businesses as well as the issuing of extracts from the business information system will be free of charge.
New performance agreement with the Austrian Academy of Sciences for the years 2018-2020 concluded ²⁷	The Austrian Academy of Sciences will receive additional 30m euros for the next three years, totalling around 363m euros. The global budget thus increases by 8%. A priority in the new period is the promotion of young talent. New interdisciplinary 'thematic platforms' should intensify the networking of humanities subjects with each other and with the natural sciences. Furthermore, the Innovation Fund 'Research, Science and Society', created in 2015, will continue to promote exceptionally inventive research projects.
National IP Strategy launched ²⁸	The IP strategy pursues the mission to better use both formal industrial property rights and informal protection strategies to increase the competitiveness of Austria. To achieve this mission objective, five fields of action with specific objectives have been defined.
SSH Strategy published ²⁹	The strategy focuses on five areas: <ul style="list-style-type: none"> • Free space for research • Quality and performance measurement • Internationalisation • Alternative networking spaces • Development of young talent <p>In addition to a few new measures, existing funding, advisory and support services will be further developed in some areas. The measures will be implemented in the period 2017/18 and beyond and will be accompanied by a monitoring group of the BMWFW.</p>
339.4m euros for a medical research	The new campus becomes operational in 2025/2026.

²⁶ <https://www.help.gv.at/Portal.Node/hlpd/public/content/171/Seite.1710834.html>; accessed on 8 December 2017.

²⁷ https://www.oeaw.ac.at/fileadmin/NEWS/2017/PDF/OEAW_LV_2018-2020_final_barrierefrei.pdf; accessed on 2 December 2017.

²⁸ BMVIT (2017): Intellectual Property Strategy für Österreich. BMVIT: https://www.patentamt.at/fileadmin/root_oepa/Dateien/Presse/20170214_IP_Barrierefrei_.pdf; accessed on 19 September 2017.

²⁹ BMWFW (2017): Geisteswissenschaften, Sozialwissenschaften, Kulturwissenschaften. Beitrag zur strategischen Weiterentwicklung der Rahmenbedingungen. BMWFW. https://www.bmwfw.gv.at/Ministerium/Documents/GSK-Bericht_Barrierefrei_v01.pdf; accessed on 26 October 2017.

and teaching campus in Vienna ³⁰	Researchers will be brought together in one location and the campus is moving closer to the university hospitals in Vienna. In addition to lecture halls, seminar rooms and skills labs for students, a new, centralized research infrastructure for large-scale facilities will be made available to all participating centres.
Funding Program "Start-ups in the Country Side" ("Gründung am Land") ³¹	The BMWFV and the Ministry of Agriculture, the aws together with the European Agricultural Fund for Rural Development (EAFRD) , are promoting innovative business start-ups in rural areas: business ideas that are in line with the regional concept can receive up to €50,000. The focus is on supporting preferably technically innovative investment projects. The programme is part of the Austrian Gründerland strategy.
'Pilot factories Industry 4.0' of the Vienna Technical University started ³²	<p>Pilot factories are RDI-infrastructures to foster the development and transfer of new technologies, innovative methods and procedures.</p> <p>The first pilot factory at the Vienna University of Technology is now starting its operative phase. The investments and the ramp-up are supported by by BMVIT, industrial partners, FFG and the Vienna Business Agency. The Ministry supports the pilot factory with two million euros. The Vienna University of Technology invests the same amount together with industrial partners. The building is provided by the city of Vienna.</p> <p>The grants for two additional pilot factories have been provided to Linz University and Graz University of Technology. Each of the pilot factories receives two million euros from the Ministry and doubles this amount with investments from industrial partners.</p>
Silicon Austria kicked-off ³³	The aim of this research initiative is to bundle the Austrian competences in electronic based systems and provide a worldclass RTD ecosystem for this strategic industry The three locations of Silicon Austria are set up in Graz, Linz and Villach and have different focuses. In total, around €280m will be invested in the research centre in Graz. The federal government contributes €70m, the federal states of Styria, Carinthia and Upper Austria together the same amount. The industries will double that amount to €140m euros over the next five years.
Council for Robotics implemented ³⁴	The Council for Robotics is an advisory body for technical, economic, ethical and social issues. Chair of the Council is Professor Sabine Köszegi from the Vienna University of Technology. The Council consists of a team of eight international and national experts - from the research on labour to computer science and ethics.

³⁰https://www.bmfwf.gv.at/Presse/AktuellePresseMeldungen/Seiten/339_4-Millionen-Euro-f%C3%BCr-die-medizinische-Forschung-und-Lehre-in-.aspx; accessed on 2 December 2017.

³¹<https://www.aws.at/richtlinien/programmdokumente/programmdokument-gruendung-am-land/>; accessed on 19 September 2017.

³²<https://www.bmvit.gv.at/presse/aktuell/nvm/2017/1019OTS0130.html>; accessed on 20 October 2017.

³³https://www.ots.at/presseaussendung/OTS_20170919_OTS0038/silicon-austria-herzstueck-des-forschungszentrums-fuer-mikroelektronik-kommt-in-die-steiermark; accessed on 22 January 2018.

³⁴https://www.ots.at/presseaussendung/OTS_20170824_OTS0052/digitalisierung-oesterreich-bekommt-einen-roboter-rat; accessed on 22 January 2018.

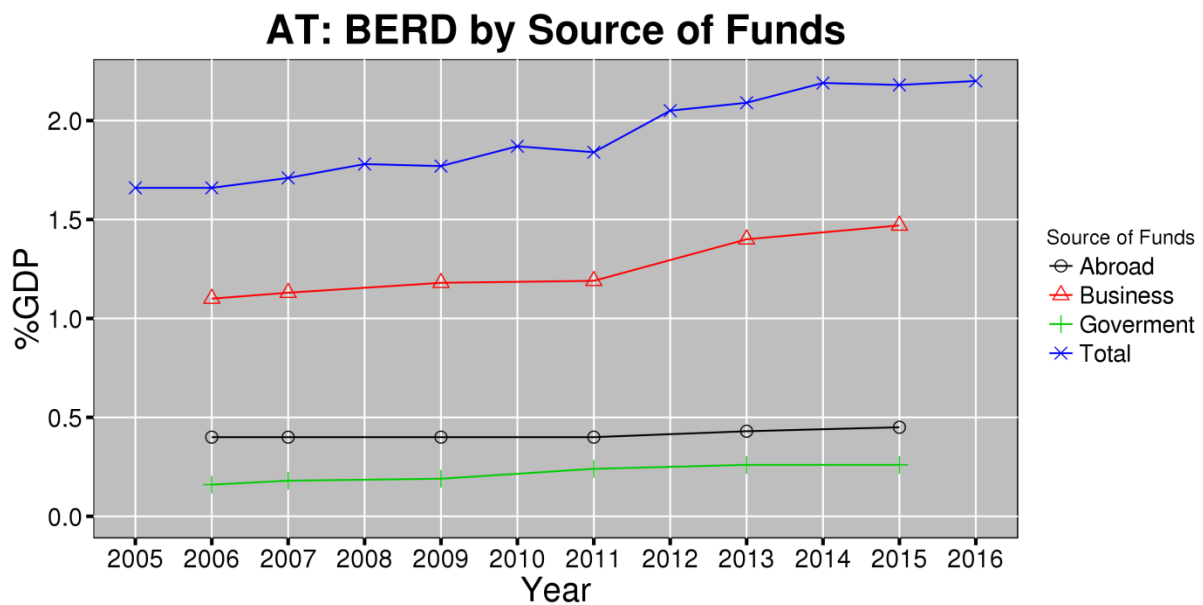
Together with the BMVIT, the Council will develop a strategy for the use of robotics and artificial intelligence. They will work out how domestic companies can make better use of the given opportunities and what measures are needed in research funding to become leaders in robotics. The Council will prepare recommendations for politics, business and the public. The budget of the Council is around €1m per year.

R&I funding trends

Austria's Europe 2020 R&D headline target is to reach an R&D intensity of 3.76% of GDP, based on a public versus private split of 1-to-2. With 3.05% in 2015 and estimated 3.09% in 2016 and 3.14% in 2017³⁵, the country is moving in the right direction and is ranked 2nd among all EU countries in terms of GERD/GDP ratio. Total GERD in Austria was €10,499m in 2015 and €10,906m in 2016.

R&D financed by BES was 1.52% of GDP in 2015 and 1.65% in 2015. R&D financed by abroad (as % of GDP) was 0.5% in 2015 and 0.48% in 2016, which to a very large extent was allocated the BES. The share of financing from abroad is one of the highest in the EU. R&D funded by GOV (% of GDP) was 0.99% in 2015 and 0.95% in 2016. R&D expenditure by the private-non-profit sector (PNP) was 0.02% in 2016 and R&D funded by PNP was only 0.01%. In figure 3 we highlight R&D intensity performed by business enterprise sector by source of funds: business sector, government sector, abroad and all sectors. We note that while R&D intensity funded by BES has increased from 2011 to 2015, R&D intensity funded by GOV and abroad has been positive through modest.

Figure 3. Trend of R&D intensity by source of funds



Source: Eurostat

³⁵ Values for 2015 and 2016 are from Eurostat. The value for 2017 is an estimation from Statistik Austria: http://www.statistik.at/web_de/statistiken/energie_umwelt_innovation_mobilitaet/forschung_und_innovati on/globalshaetzung_forschungsquote_jaehrlich/index.html; accessed on 3 December 2017.

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

Most of governmental R&D funding is allocated to the HES. R&D performed by HES and funded by public (GOV) (% of GDP) was 0.72% in 2015 and 0.73% in 2016. R&D performed by GOV (% of GDP) was 0.14% in 2015 and 2016. In total, Government and HES R&D expenditure was 0.86% of GDP in 2015 and 0.87% in 2016.

A relatively large share of public funding is allocated to the business enterprise sector in Austria (0.26% of GDP in 2015), whereas R&D performed by HES and financed by private sectors (BES and PNP) in % of GDP was only 0.05% in 2015.

EU funding of R&D in Austria is comparatively small. In 2015 its share accounted for only 1.9% of the overall total R&D funding in Austria.³⁶

The budget plan for 2017 reveals a total increase of 2.66% in public R&D expenditures compared to 2016 (BMF 2016). This is caused by the measures for strengthening start-ups introduced in July 2016, for which additional budgetary means for the foundation of innovative and growth-intense enterprises (seed-financing) as well as for start-up fellowships (academic spin-offs) and subsidies to cover auxiliary wage costs for innovative start-ups were earmarked. In addition, the National Foundation for Research, Technology and Development (so called "Nationalstiftung") has received another €100m, to be distributed over a couple of years. This money is endowed by means of the Stability Pact for banks.

In addition to direct R&D funding, indirect R&D funding in the form of the Austrian 'research premium' ("Forschungsprämie"), a refund-based thematically open 'tax' incentive, is increasing steadily. €502m were subsidised by this instrument in 2015 (€493m in 2014). The 'research premium' was raised to 12% of R&D expenditures as of 1 January 2016. The premium can be deducted or claimed on intramural as well as extramural R&D expenditures. In early 2017 a further increase to 14% was decided by the government, which will become effective as of 1 January 2018. Already before the increase to 12%, Austria was with a ratio of 0.13% of GDP for indirect R&D funding in the midst of OECD countries, ranking 10th out of 28 OECD countries in 2014 (BMWFW and BMVIT, 2017).

The recently finished evaluation of the research premium³⁷ concludes that it was used by around 75% of research-based companies in Austria. The evaluation confirms that in terms of funding volume the research premium benefits mostly larger companies from research-intensive industries. The largest companies with a turnover of more than €50m received more than two-thirds of the premium in all economic years. In relation to the number of applicants, however, the overwhelming share is attributable to SMEs.

According to the evaluation, the companies seem to be quite satisfied with the design and the procedures of the research premium. They claim that the research premium contributes to Austria as location for R&D as well as to the relocation of R&D activities, particularly of internationally active, research-intensive companies. It also contributes to investing in infrastructure and carrying out more risky research projects. The evaluation also shows that the research premium is particularly supportive of research-intensive and already regularly R&D-driven companies. An incentive to expand R&D in companies with so far low or no R&D, on the other hand, could not be observed.

Since the financial year 2012, FFG has been tasked to examine whether the content requirements are met with regard to the R&D activities for which a research premium is applied for. The introduction of this examination had the effect that more than 1,500

³⁶http://www.statistik.at/web_de/statistiken/energie_umwelt_innovation_mobilitaet/forschung_und_innovation/f_und_e_in_allen_volkswirtschaftlichen_sektoren/index.html; Statistik Austria; accessed on 9 December 2017.

³⁷ Ecker et al. (2017): *Evaluierung der Forschungsprämie*. Technischer Bericht. Wien. <https://repository.fteval.at/274/>; accessed on 9 December 2017.

companies do not apply anymore. It is assumed that the examination carried out by the FFG contributed to the reduction of windfall effects.

By taking together indirect and direct financial support, Austria allocates a high proportion of its public funding to private R&D. 25.8% of total public R&D funding went to the BES in 2015.³⁸ Public funding covers in general the entire R&D&I process from fundamental research to market innovation. More recently, missing links in this process are being addressed. For example, funds are allocated to prototype research to support the commercialisation of university (basic) research results. In addition, a wide range of policy instruments to foster knowledge and technology transfer have been launched in the past decade to ensure a high degree of connectivity among major actors in the R&I system (Schuch and Gampfer, 2017).

According to the federal budget proposition of the Austrian Ministry of Finance for 2017 most of the main public research performing organisations and research funding organisations receive a little bit more or almost the same budget than in 2016 (BMF 2016). In general, the fields of education and research have been least negatively affected by budget consolidation measures during the last couple of years.

By virtue of the performance agreement concluded for the years 2016-2018, the total university budget is more than €9b. This amount consists of the basic budgets for the universities and an amount for the competitively awarded "Hochschulraumstrukturmittel" ('higher education structural funds'). The distribution of these "Hochschulraumstrukturmittel" is based on indicators and performance, for example on the number of examination-active studies at a university or its graduates or of the acquired third party funds. Universities receive in addition several other public subsidies, e.g. for construction of buildings and for research projects competitively awarded by the FWF. Since 2009, the year of the abolition of the tuition fee, the universities also receive the enrolment contributions for those students who are exempt from them.

In July 2017, a total budget for the universities at the amount of around €10.3b has been adopted by the national assembly for the years 2019-2021, which is a plus of 1.35b compared to the previous performance agreement period (2016-2018). Originally, the coalition government intended to combine these increases with a study place financing model which would have resulted in de facto more strict access rules. But due to the collapse of the government coalition in late spring 2017, the budget increase was decided by a coalition of the social democratic party SPÖ, the liberty party FPÖ, the green party and the liberal NEOS party. The bill required, however, that a new study place financing model must be in place until 31 January 2018. Especially the conservative people's party (ÖVP), which formed together with SPÖ the outbound coalition government, argued that a pure financial commitment will not contribute to a quality improvement of the universities. The Austrian Rectors Conference welcomed the decision to increase the university budget, but regrets that the design of the study place funding remained fuzzy.³⁹

In early August 2017, Science Minister Harald Mahrer (ÖVP) sent a draft bill for the conversion of university funding to a study place based financing into parliamentary appraisal. The issue, however, will be treated by the new government, which is supposed to become active in late 2017 or early 2018. The draft bill provides both nationwide access restrictions and also access restrictions per individual university. According to this draft bill, only about half of the current freshmen could be admitted in jurisprudence, foreign languages and educational sciences.

The key measure for the future distribution of the budget is the number of students who are active in exams. Like now, universities should also receive a global budget in the future whose usage can be decided by themselves. However, the composition of the

³⁸http://www.statistik.at/web_de/statistiken/energie_umwelt_innovation_mobilitaet/forschung_und_innovation/f_und_e_in_allen_volkswirtschaftlichen_sektoren/042166.html; accessed on 25 November 2017.

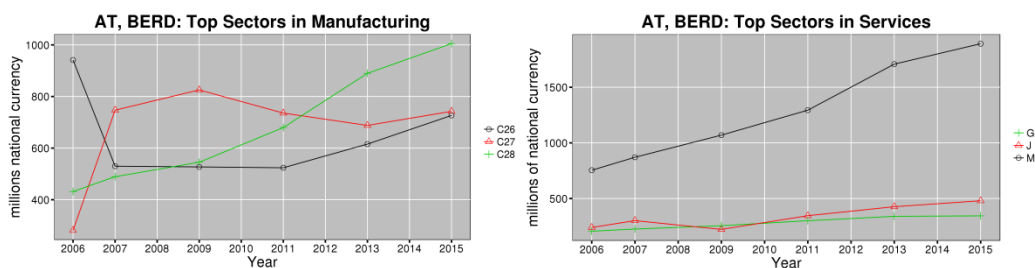
³⁹<http://derstandard.at/2000060074019/Nationalrat-SPoE-will-bei-Uni-Finanzierung-gegen-OeVP-stimmen>; accessed on 18 July 2017.

global budget, which should in the future consist of three distinct parts for teaching, research and infrastructure / strategic development, should change. The central indicator for the partial amount for teaching is the place of study - hence also the expression 'study place financing' ("Studienplatzfinanzierung"). A Bachelor's, Master's or Diploma course is defined as a place of study, which is operated with a study performance of at least 16 ECTS points per academic year ("examination-active study"). The minimum number of study places to be offered should be determined between the state and the university and endowed with a certain funding rate.

3.2 Private R&D expenditure

In terms of R&D expenditure, the BES showed the highest value in Austria with 2.18% of GDP in 2015. BERD is composed of the domestic financing of R&D by the BES, the inflow of R&D financing from abroad, and relatively high allocations from public funding to private R&D. The BES is also the largest financial contributor to R&D in Austria, financing 1.52% of GDP in 2015 and 1.65% in 2016. Moreover, contributions from abroad (0.5% of GDP in 2015) are made up largely of foreign multinational companies (or their subsidiaries) that conduct R&D in Austria. BERD has followed an upward trend in the past nine years apart from a slight slowdown in 2011. The size of this increase was around 0.45 percentage points, putting Austria on par with innovation-leading Member States.

Figure 4. BERD top sectors in manufacturing and services



Source: Eurostat. Top sectors: manufacturing (C26: manufacture of computer, electronic and optical products; C27=manufacture of electrical equipment; C28=manufacture of machinery and equipment n.e.c). Top sectors: service (G=wholesale and retail trade, repair of motor vehicles and motorcycles, J=information and communication, M=professional, scientific and technical activities).

The manufacturing sector's contribution to total BERD was roughly double as that of the service sector for most of the past decade, due to a concentration of most R&D activities in a few high-tech manufacturing firms. However, the gap has been narrowing with service sector BERD rising more rapidly than manufacturing BERD. But also the manufacturing sector increased its R&D intensity from 1.19% in 2006 to 1.3% in 2013. Only Germany, Finland and Sweden outrank Austria within the EU-28 in this regard. R&D intensity in the service sector rose significantly from 0.48% to 0.78% between 2006 and 2013. Here, Austria ranks second after Denmark. The comparatively large increase in R&D in services is due to the expansion of companies providing professional, scientific and technical activities (see Figure 4).

In 2014, the biggest R&D spenders in Austria measured in terms of R&D expenditures in percentage of net turnover were Infineon (24.6%), Boehringer Ingelheim (22.3%), Robert Bosch (20%), followed by AMS, Frequentis, Bernecker+Rainer, Anton Paar, Epcos, FACC and Kapsch (ABA, 2015). In terms of R&D expenditure volumes, Voestalpine (industrial metals and mining) is in the lead, followed by AMS (technology hardware and

equipment), borealis (chemicals), Novomatic (travel and leisure), KTM industries (transport) and Zumtobel (lighting solutions and components).⁴⁰

34% of all international companies, which have a subsidiary company in Austria, have their headquarters in Germany, followed by USA (18.4%), Switzerland (7.1%), France (4.2%), Italy (3.9%), Japan and Sweden (each 3.6%), UK (3.2%), Canada and The Netherlands (each 2.9%) (ABA, 2014). In terms of inward BERD, 47% of foreign-controlled enterprises conducting R&D in Austria have their headquarters in Germany, 15% in the USA, around 27% in other non-EU countries (including a high share of Switzerland and a sharply increasing share of China) and around 11% in other EU countries. The remaining third has its headquarters in adjacent as well as other European countries (Iversen et al. 2017).

More than 300 international companies have their regional headquarters in Austria. International companies such as Baxter, BMW, Bosch, Novartis, Siemens, Magna, and Infineon have bundled R&D activities and competence centres in Austria. Infineon was the most research-intensive company in Austria in 2013 and 2014. Another example is Borealis, which decided in 2006 to turn its Austrian site, located in Linz, into the centre of its entire international research activities. Nevertheless, although growing in absolute terms, the share of funding from abroad has continuously decreased as a percentage of GERD from its highest level of 21.4% in 2002.

3.3 Supply of R&I human resources

In 2015, 85% of the Austrian population have secondary education at minimum, which is rank 15 out of 35 countries ranked by OECD and number 10 in the EU⁴¹, which counts 79% at average. 31% of the Austrian population have a completed tertiary education, which is slightly below the EU average in 2015. The share of population aged between 25-34 with completed tertiary education (ISCED 5-8) was 39.7% in Austria in 2016 and thus slightly above the EU average of 38.2%, which proves the efforts of Austria to increase this share in the last few decades. The employment rate of the population with 25-64 of age with completed tertiary education was 86.2% in 2016 (EU average: 84.8%).

Human resources in Science and Technology (HRST) have a higher share in Austria than in the EU. 36.4% of total employment was in knowledge-intensive activities, which is around the EU28 average of 36%, but below innovation leaders and other strong innovators such as Sweden (44.4%) or Belgium (42.2%). The R&D labour market is one of the most dynamic in the country. The share of scientists and engineers in the age group 25-64 as % of active population was 6.6% in Austria in 2016 (compared to 3.8% in 2010), but lower than the EU average of 7.4% in 2016.

In 2016 70.7% of R&D personnel were employed in the BES, 24.77% in the HES, and 3.7% in the government sector (see table 3). The share of female researchers is low (29.49% in 2015) compared to the EU average (33.44%). When differentiating between the sectors of performance, the HES shows a considerably better gender balance than the BES.

The rate of new doctorate graduates (ISCED 6) per 1000 population aged 25-34 continuously declined since 2010 (1.62%) to 1.39% in 2015, which, however, remains clearly above EU-average (1.07 in 2013), but – with exception of Finland (1.26% in 2015) - below the European Innovation Scoreboard leader countries.

The number of graduates from HEI was 53,937 in 2014/2015 (BMFWF 2016). 35.15% of the 34,539 graduates from universities in 2014/2015 graduated in social sciences and law, 16.45% in humanities, 10.05% in pedagogics, 5.46% in medicine and social services, 14.70% in natural sciences, mathematics and informatics, and 14.11% in

⁴⁰ JRC (2017): The 2017 EU Industrial R&D Investment Scoreboard.

<http://iri.jrc.ec.europa.eu/scoreboard17.html>; accessed on 5 December 2017.

⁴¹ BMFWF 2016.

engineering, which indicates a shift towards natural sciences and engineering compared to 2012/2013.⁴² The rest graduated from private universities and universities of applied sciences.

Table 3. Research and innovation skills in Austria and the EU

	Austria	EU28
Human Resources in Science and Technology 25-64 year-olds (HRST, %)	49.1	46.0
R&D personnel (% of total)		
Business enterprise sector	70.78	55.02
Government sector	3.75	12.69
Higher education sector	24.77	31.39

Source: Eurostat, 2016

The rate of new graduates in STEM disciplines per 1000 population grew from 2% in 2010 to 2.85% in 2015 (2.98 in 2014), which is amongst the highest in the EU.

The average public expenditures of Austria on education as % of GDP (5% in 2015) and in particular on higher education (0.8% in 2015), are close to EU average (4.9% respectively 0.7% in 2015).

With 12.1% in 2015, the share of tertiary degree mobile graduates from abroad was the highest in the EU after Luxembourg, UK and The Netherlands.

In general the skills level of the Austrian work force is good although education outcomes depend considerably on the socioeconomic background as confirmed by the 2015 OECD PISA results⁴³. Vocational adult training is well established in Austria. On average 22% of enterprises in the EU provide ICT training to their personnel, while this share is in Austria 37% and highest in the EU (EIS, 2017). The labour market potential of women, however, is underused, partially caused by a high share of part-time employment, which – among other issues – results in a high gender pay gap.

As shown in table 4, the employment rate in Austria is higher than in EU28 and the unemployment rate comparatively lower. Due to the strong economic activity in 2017 the unemployment rate in Austria is expected to decrease to 5.6% in 2017 and to fall further to 5.4% in 2019 (DG ECFIN Autumn 2017 forecast).

Table 4. Labour market key indicators

	Austria	EU28		Austria	EU28
Employment rate for 15-64 year-olds (%)	71.5	66.6	Unemployment rate (age 15 and over) (%)	6	8.6
Men	75.4	71.9	Youth (age 15-24, %)	11.2	18.7
Women	67.7	61.4	Long-term unemployed (1 year and over, %)	1.9	4
			Tertiary education attainment 25-64 year-olds (%)	31.4	30.7

Source: Eurostat, 2016

⁴² Own calculations based on BMWF 2015a: Statistisches Taschenbuch

⁴³ <http://www.oecd.org/austria/pisa-2015-austria.htm>; accessed on 8 December 2017.

The inflow of persons who fled to Austria from the crisis zones in the Middle East and North Africa was extra-ordinarily high in 2015 and continued to be high in 2016. Most of these refugees, however, have low formal education levels, although this varies considerably according to country of origin. The situation is aggravated by the fact that the general education results of pupils with a migrant background are considerably worse than those without one. Labour market integration of people with a migrant background, in particular women born outside the EU and job seeking refugees, remains a challenge, partly because of missing language and other basic skills.

Formal integration of researchers among refugees into the Austrian system was so far very weak, due, first, to lengthy procedures to validate both their residence status and their formal education.

4 Policies to address innovation challenges

4.1 Challenge 1: Improving the relationship between innovation input and innovation output

Description

According to the European Innovation Scoreboard (2017)⁴⁴ Austria is positioned among the upper part of the so called “strong innovators”. Although Austria is aspiring to become an innovation leader by 2020, as stipulated by the Austrian RTI strategy published in 2011, it clearly lags behind the innovation leaders in terms of innovation output and performance. Although Austria had the second highest GERD in % of GDP ratio in the EU in 2016 with 3.09% and an R&D intensity in the business sector above 2.2% of GDP (EU average: 1.31%), which was only excelled by Sweden, the innovation output and performance of Austrian companies is lagging behind the R&D expenditure levels. EIS 2017 lists as relative weaknesses of the Austrian innovation system the employment impacts and the relatively low sales impacts (in terms of sales of new-to-market/new-to-firm innovations as % of turnover, and knowledge-intensive services exports). Also employment in fast-growing enterprises in innovative sectors shows a rather humble development. While the average employment share in fast-growing firms of innovative sectors in the EU was 4.8% in 2014, it was slightly below 3% in Austria (EIS, 2017).

In terms of the indicators clustered by the EIS to measure innovation-friendly environment, composed of the indicators broadband penetration and opportunity-driven entrepreneurship, Austria has had the highest rate of decrease in performance (-50.75%) between 2010 and 2016, while the EU in general increased by 14.3% in this time period (EIS, 2017). Especially the take-up of high-speed broadband is particularly low and Austria has clear deficits in covering rural areas with broadband connectivity.

The proliferation of instruments and programmes during the last 15 years, in particular for supporting engineering based R&D cooperation between public research institutions and SMEs, appears to have led to a high degree of fragmentation, spreading available funding over a plethora of instruments. In 2016 the Austrian court of audit recommended among other things that programmes with low cost-effectiveness should be identified and streamlined (Rechnungshof 2016). According to this report, especially many funding instruments on federal states level (i.e. Bundesländer) are not very effective due to their insufficient volumes.

Policy response

Austria has introduced many R&D programmes during the last 15 years, which are benefitting the BES, by facilitating applied R&D and improving the flow of knowledge between science and industry (e.g. COMET centres; thematic R&D programmes). The share of SMEs collaborating with others in their innovation activities is more than 20% in Austria and thus among the highest in the EU. Austria also counts to the three top EU-countries, whose performance has increased most in this indicator (EIS, 2017). On the other hand, private co-funding of public R&D expenditures, usually applied to serve the shorter-term research needs of the BES, is below EU-average in Austria and has not increased in performance since 2010 (EIS, 2017).

Further significant financial public support for R&D activities of the BES is provided through the Research Premium, an indirect R&D subsidy measure, and the so called general programme of the FFG, the main direct R&D support instrument for companies.

⁴⁴ http://ec.europa.eu/growth/industry/innovation/facts-figures/scoreboards_de; accessed on 5 August 2017.

To a certain degree the direct support instruments have been streamlined over the past years. Common funding rates have been introduced, administrative procedures simplified and reporting requirements harmonised across instruments.

In the last couple of years more attention was directed on framework conditions for innovation with a focus on liberalising the trade license act in 2017 and increasing start-up activities based on the "Gründerlandstrategie"⁴⁵. In 2017 the start-up package was endowed with substantial financial means.

As of late 2015, Austria is also implementing an ambitious funding scheme to increase NGA coverage aiming to achieve an almost universal ultra-high speed internet access by 2020. Moreover, in November 2016, a new initiative was launched by the Austrian government, proclaiming that the country should become one of the most advanced 5G countries in the EU in the future.

Assessment

Although the public sector invests significantly in business R&D if compared to most other EU countries, the aspired structural change of the economy towards a more knowledge-intensive, innovative and high-tech oriented economy progresses only slowly.

The overall *input-output transfer weakness* is also emphasised by the Global Innovation Index (Cornell University et al., 2017), in which Austria ranks only 40th (out of 128 countries) with respect to knowledge impact (new businesses, ISO 9001 certificates, productivity) compared to UK [6th], Sweden [10th], Germany [27th], Denmark [30th], Finland [32nd]. In total, Austria ranks 20th in the Global Innovation Index and far below the European innovation leaders Sweden [2nd], UK [5th], Denmark [6th], Finland [8th], and Germany [9th].

The observable structural changes seem to rather follow incremental modernisation paths of existing businesses. This is partially caused by Austria's industrial structure, which makes the emergence or creation of, for instance dynamic lead markets relatively unlikely, since Austria's most innovative companies are highly specialised suppliers further upstream in global value chains. In addition, most of the many R&D funding programmes which are benefiting the BES are designed as quite engineering-focused applied R&D programmes, whose innovation orientation seems not in focus.

The quite 'narrow' and light liberalisation of the trade license act ("Gewerbeordnung"), which was concluded in 2017, will enter into force in 2018. Its outcome will be shown in the coming years but it seems necessary to further reduce administrative and regulatory barriers, increase entrepreneurship education and promotion, facilitate market entry and company growth (for the last issue see Challenge 2).

Although the structural change of the economy is tenacious, the investments in R&D and the executed structural reforms within the system of R&I, as stipulated by the Austrian RTI Strategy, seem to be an appropriate and indispensable input for change-making to yield fruits in the future.

The ongoing investment in upgrading the Austrian broadband network is an important step in the right direction. In general, however, Austrian business is still lagging behind in the integration of digital technology in their business processes and models and in providing high-end internet services.

⁴⁵ https://www.bmfwf.gv.at/Presse/Documents/BMFWF_Land_der_Gruender_NEU.pdf; accessed on 9 December 2017.

4.2 Challenge 2: Further increase equity capital supply for start-ups and scale-ups

Description

Whereas access to finance is not a short-term concern for Austrian SMEs in general, with only 7% of SMEs reporting it as difficult (European Central Bank 2016), supply of equity finance for young companies is still scarce, although the situation is improving (Schuch and Gampfer, 2017). In particular, this scarcity holds back the emergence of more fast-growing innovative companies with larger investment volumes, since these often have to rely to a large extent on equity, and thus worsens the outlook for longer-term employment and productivity growth dynamics. Venture capital is especially important during the scale-up stage of such 'gazelles'. According to the European Innovation Scoreboard (EIS, 2017), average venture capital investments in the EU are 0.063% of GDP and thus higher than in Austria (around 0.05%). Compared to 2010, the performance of this indicator has, however, increased substantially in Austria (6th highest increase among EU-28 countries).

The distribution of total private equity investment in 2013 was 20% for seed/start-up, 42% for growth/scale-up, 27% for exit and 11% for replacement (AVCO 2014). Although no detailed breakdown is available, a comparison between investments received by Austrian companies and investments made by Austrian VC firms shows that most VC comes from foreign investors, in particular from Germany (BMFWF 2015), and from public VC instruments.

Policy response

In 2015 the BMFWF issued the 'Land of Founders ("Gründerland") strategy' (BMFWF, 2015). A new law on crowdfunding ('alternative financing law')⁴⁶ was adopted by the Parliament in 2015. It significantly liberalised and clarified regulation of retail investment. Legal reforms are planned to simplify IPOs. In 2014, the AWS established AWS Equity Finder, a capital brokerage platform to facilitate contacts between business angels, venture capitalists and crowdfunding/crowd-investment platforms.

Aside from improving framework conditions, the Austrian government also provides direct support to boost venture capital supply. This is done by four specific instruments operated by AWS. The AWS Venture Capital Initiative funds private VC investment in Austrian technology firms, especially in clean technologies, life sciences and ICT, in the start-up or early-growth stage (volume of €34m). The Business Angels Fund (€45m in total out of which €15m are financed by AWS, €7.5m by EIF and the rest by the Business Angels) matches Business Angels' investments with a 1:1 ratio. It also tackles the start-up and early-growth stages, but in a wider area of business sectors with usually lower capital requirements (e.g. IT). The "AWS-Gründerfonds" ('AWS-business start-up fund') targets technology-oriented innovative companies at the (early) scale-up stage with a funding volume of €68.5m. Finally, the "AWS-Mittelstandsfonds" ('AWS SME fund') targets the scale-up phase of established technology firms with a volume of €80m.

The start-up package announced in 2016, with a financial endowment of €185m,⁴⁷ represents the first main step towards implementation of the "Gründerland" strategy. One of its core points is the reduction of auxiliary salary costs for three years as of 2017. This support, for which a total of €100m will be provided, is designed to relieve innovative start-ups from the high social contributions to their employees.

Further core points of the new start-up package are:⁴⁸

- Start-up fellowships for students and researchers

⁴⁶ <https://www.ris.bka.gv.at/GeltendeFassung.wxe?Abfrage=Bundesnormen&Gesetzesnummer=20009241>; accessed on 4 December 2017.

⁴⁷ <https://investinaustria.at/de/blog/2017/03/startup-paket.php>; accessed on 10 August 2017.

⁴⁸ <http://www.foerderportal.at/foerderungen/>; accessed on 10 August 2017.

- Increase the AWS business angel fund by doubling the investment of business angels in tech companies
- AWS seed and pre-seed funding: 20 million for start-ups by 2018
- Increase of AWS guarantees: 300 million euros for bank guarantees per year
- Subsidy to the risk capital premium: investment contributions to young companies are refunded up to 20% of the investment amount to investors (max. 250,000 euros)

Assessment

There are indications that the strong increase in public VC is starting to leverage private equity, especially from foreign sources. The VC investment received by Austrian companies in 2015 as a share of GDP represents an increase of around one third compared to the 2011-2015 average. The AWS Venture Capital Initiative seems to have a considerable impact on the development of fund-of-funds activities and the capturing of risk capital in Austria. Business angels' investments jumped from €2.9m in 2013 to €16.3m in 2015, placing Austria above e.g. the Netherlands, Belgium, Ireland or Switzerland (Schuch and Gampfer, 2016).

Whereas policy initiatives have had positive impact, the absolute number of supported companies remains low (Invest Europe 2016). The supply gap of private equity is particularly wide for the scale-up phase of 'gazelles'.

Private VC contributions generating from Austria are still very low. According to the "European Private Equity Activity Report 2016", a study by Invest Europe, Austria is in the last place in the European investment ranking. Austria's private equity investments account in the domestic market for a minimal 0.030% of GDP. Growth financing amounts to only 0.007% of GDP, which is caused by the fact, that since 2012 large capital investors, such as pension funds or insurance companies, have not provided any capital in capital raising of private equity or venture capital funds.⁴⁹ While funding for start-ups up to €0.5m from investors has improved in Austria due to a vivid business angel community, there is a clear gap to finance further growth, i.e. equity investments between €1m and €10m. Not only successful start-ups are affected by this, but also SMEs and "hidden champions".

Although the political commitment to improve framework conditions for venture capital financing has been substantiated by traceable activities such as the start-up package and the alternative financing law, AVCO, the Austrian Private Equity and Venture Capital Organisation, still considers the insufficient framework as major reason for the lack of domestic equity capital provision.⁵⁰

4.3 Challenge 3: Increase Competitive Funding for Basic Research

Description

With 72%, the share of institutional funding for publicly performed research is comparatively high in Austria (Jonkers and Zacharewicz, 2016), while the share of basic research funding with 19% of total R&D funding is significantly lower than in countries which the European Innovation Scoreboard classifies as international innovation leaders (Leitner et al. 2015). The available amounts for competitive funding of basic research projects by FWF dropped from €203.7m in 2014 to €183.8m in 2016 (FWF, 2017). On average, the budget of FWF was €22 per population (in 2016), while the comparative value was €99 for the Swiss National Fund, €54 for NWO in the Netherlands and €38 for DFG in Germany. It is supposed that the low overall level of basic research and the low

⁴⁹ <https://www.avco.at/news>; PE/VC Kennzahlen 2016, May 30, 2017; accessed on 10 August 2017.

⁵⁰ <https://www.avco.at/news>; PE/VC Kennzahlen 2016, May 30, 2017; accessed on 10 August 2017.

level of competition for basic research funding in Austria has negative impacts on research excellence.

Table 5 shows that Austria ranks lower than the European innovation leader countries in terms of the research excellence composite indicator. However, it is almost par in terms of high-level scientific output with these countries. Also in terms of the number of international scientific co-publications per million population, Austria ranks fairly good but still below comparable smaller leading European countries such as Switzerland, Denmark, Sweden, Finland, and The Netherlands (Schuch and Gampfer, 2017).

Table 5. Scientific performance indicators

Country	Austria	Denmark	Finland	Germany	Sweden	UK
Research excellence composite indicator (rank in 2014)	7	5	4	9	2	3
Scientific publications among the top 10% most cited publications worldwide as % of total scientific publications of the country in 2014	11,49	13,19	10,73	11,46	11,47	14,8

Source: Eurostat

The best ranked Austrian university in the Times Higher Education World University Ranking 2016/2017⁵¹ is on place 161 (University of Vienna) only. In total two are under the best 300 and six out of a total of 22 Austrian universities are under the best 500 universities. They are ranking especially low in the fields of biological sciences. This trend is also confirmed by the Academic Ranking of World Universities 2017, the so called Shanghai Rankings, which places four Austrian universities among the top 500.⁵²

The allocation of funding through performance agreements tends also to result in relatively equal allocations to researchers within universities, which does not incentivise excellence (Janger 2016). This is likely to impede the emergence of excellent research groups in specific fields which can muster a critical capacity, which in turn would enable universities to build up distinct profiles (Schuch and Gampfer 2016).

Policy response

The national university development plan 2016-2021 lists strengthening of basic research as a systemic goal. A share of the 'research billion' announced by the government in late 2016 is envisaged to fund high-risk frontier research, which may impact positively on basic research excellence.

The 'research billion', which was reaffirmed in the new coalition work programme for 2017 in January 2017, stipulates that €281m should be additionally budgeted to FWF for the years 2018 to 2021, which would gradually increase the budget of FWF from currently €184m to €290m in 2021⁵³. However, since the coalition government collapsed in May 2017, the practical fate of the announced billion is unclear, because its financial coverage should only be fixed by the next Federal Financial Law.⁵⁴

⁵¹https://www.timeshighereducation.com/world-university-rankings/2017/world-ranking#!/page/0/length/25/locations/AT/sort_by/rank/sort_order/asc/cols/stats; accessed on 10 August 2017.

⁵² <http://www.shanghairanking.com/ARWU2017.html>; accessed on 4 December 2017.

⁵³ <https://www.fwf.ac.at/de/news-presse/news/nachricht/nid/20170131-2227/>; accessed on 5 August 2017.

⁵⁴ <http://diepresse.com/home/bildung/universitaet/5225809/Forschungsmilliarde-nicht-dem-Wahlkampf-opfern>; accessed on 6th August 2017.

Assessment

The current Austrian funding mix risks to overemphasis applied research funding at the expense of basic research. However, basic research is likely to benefit from the increased funding made available to universities in particular since 2016. Especially given growing constraints on overall public budgets in Austria, this expansion represents a step in the right direction. It remains to be seen whether those additional funds can be concentrated on individual recipient units to a sufficient degree to constitute a critical mass for fostering the emergence of top research in specific fields (i.e. "profiling").

Competitive funding for basic research channelled through the Austrian Science Fund, however, was comparatively low in 2016 resulting in a funding rate (in term of funded projects) of 23.27% (FWF, 2017). The FWF's focus on supporting individual projects of single applicants in person might also be insufficient to substantially contribute to the expected profiling of universities.

The realisation of the "research billion", which was announced by the coalition government, which collapsed in May 2017, and which earmarked substantial fresh money for risky fundamental research, partially to be distributed competitively by FWF, is not yet fixed. The main Austrian STI advisory councils and the major research organisation thus plead in an open letter to the government⁵⁵ for a quick realisation. Otherwise a massive imbalance in research funding to the detriment of basic research is expected.

4.4 Challenge 4: Reform of the Financing of the Higher Education System

Description

Austria's universities have a dedicated research orientation by law. However, this can only be insufficiently verified empirically because a thorough separation of teaching and research budgets is lacking. Contrary to public financing of R&D in the BES, which is taking place in Austria at a comparatively high level, public financing of R&D in the HES is not only too low to catch-up with countries of comparable ambitions and structures, but also too much fragmented across 22 public universities (Leitner et al. 2015). In order to increase transparency, improve the financial situation for universities and the student-professor ratios, the introduction of a study-placed financing system has been planned since a couple of years.

Policy response

In April 2017, the former Minister of Science, Reinhold Mitterlehner, agreed a model with the Assembly of Universities (i.e. Universities' Conference) to base university financing as of 2019 on budgeting of study places instead of the current practice of allocating a comprehensive global budget to the universities, which made up 90% of public university funding. In the future the budget would consist of three distinct budget lines for infrastructure, teaching and research.

The 'All Austrian University Development Plan' ("Gesamtösterreichischer Universitätsentwicklungsplan"⁵⁶) will become full effective for the performance contract period 2019-2021. €1.35b have been promised by the government for this change of the financial system.⁵⁷ This budget is composed of around €840m for a kind of index-linked further development of the previous funding volume and €510m for extra personnel

⁵⁵https://www.ots.at/presseaussendung/OTS_20170529_OTS0060/offener-brief-an-die-entscheidungstraegerinnen-und-entscheidungstraeger-der-republik; accessed on 6th August 2017.

⁵⁶BMWFV (2015b): https://wissenschaft.bmwfw.gv.at/fileadmin/user_upload/wissenschaft/publikationen/2015_goe_UFP-Lang.pdf; accessed on 6 December 2017.

⁵⁷ <http://science.orf.at/stories/2839123/>; accessed on 11 August 2017.

resources associated with the system changeover, e.g. to introduce better student-professor ratios. The model also includes access restrictions for certain study programmes, which is heavily opposed by the national union of students, the populist Liberty Party and parts of the Social Democratic Party.

In July 2017, a total budget for the universities at the amount of around €10.3b has been surprisingly adopted by the national assembly for the years 2019-2021, including the additional 1.35b compared to the previous performance agreement period (2016-2018). One month after this decision, the new Minister of Science, Harald Mahrer (ÖVP), submitted a draft bill on the study place financing system to the parliament for appraisal. The ballot about this bill (or a modified version) will most likely be done by the new coalition government, which is supposed to enter into power late 2017 or early 2018.

Assessment

The envisaged separation of the university budget in research, teaching and infrastructure, for which different criteria, indicators and weights are defined, follows an international trend (Leitner et al., 2011). It would generate more clarity, transparency and accountability within the system of university financing, also related to the produced output. In any case the responsibility for the implementation of this new financing model for universities will be with the new government.

An optimal profiling of Austrian universities for Austria is, however, aggravated by the composition of the Austrian HES. Firstly, the number of public universities is quite high (22). Secondly, the composition is highly uneven as the needs and requirements of the University of Vienna as one of the largest in Europe and the largest in German speaking countries are hardly comparable and subsumable under one roof with those of the many rather medium and small-sized universities which dominate the HES in Austria. Thirdly, the division of labour between the universities and the universities of applied sciences is still disputed, although the government presented plans for a better coordination supposed to sharpen the profile of individual institutions' educational offer in 2016. Fourth, better student-professor-ratios, especially in the most demanded study programmes, cannot only be achieved with a one-time increase of financing, but requires sustainable development paths or clear-cut restrictions.

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

Austria employs a longer term perspective in working with the Smart Specialisation concept. With €65m which corresponds to 19.1% of its ESIF investments, the country belongs to those Member States with highest share of investment planned for TO1 (research and innovation) (European Commission, 2017). Within its Smart Specialisation approach, the federal government encourages its science and research institutions to realise their role as regional lead institutions for knowledge and innovation-driven structural change and in developing internationally competitive knowledge places.⁵⁸ Within the current performance agreements (2016-2018) between the federal government and the public universities, regional knowledge profiles are developed with the aim of establishing clustered habitats and critical mass of excellence. Based on such coordinated concepts, it is planned to steer aligned place-based infrastructure and thematic focus investments in the forthcoming performance agreement period (2019-2021).

In 2016, the annual Austrian Research and Technology Report (BMFWF and BMVIT, 2016) presented a mid-term report on the implementation of the Austrian RTI Strategy including a chapter on Smart Specialisation in Austria. This is in so far important, because the federal government's RTI strategy⁵⁹ was announced in 2014 to the European Commission as the core document for Austria's "Strategic framework for smart specialisation" for the purposes of fulfilling the ex-ante condition precedent to receive ESIF investments (ÖROK, 2015). The implementation of the RTI strategy and, thus, also of the main R&I component of Austria's smart specialisation strategy is professionally monitored by the Austrian Council of Research and Technology Development in cooperation with the Austrian Institute of Economy (WIFO).⁶⁰

In 2016, a group of national and regional government experts presented a policy framework for smart specialisation in Austria to establish a common understanding of the interaction of the national RTI Strategy with regional economic and innovation strategies of the states ("Bundesländer") (ÖROK 2016). This partnership was initiated in the context of the Austrian implementation process of the EU Structural and Investment Funds (STRAT.AT 2020). Communication on RTI policy matters between the federal government and the "Bundesländer" takes place within already established formats, specifically at the meetings of the Bundesländerdialog organised by the BMFWF and also within the ÖROK Subcommittee for Regional Economy, which deals with regional policy in the context of RTI.

The strategy and the interaction of the federal government and "Bundesländer" do not follow a major master plan, and asynchronous processing between the federal level and the "Bundesländer" level makes a systematic and regular overview of the status and implementation of the schemes and the development of common investigation and reporting standards difficult in Austria. Thus, a stronger focus on clearly measurable objectives with the corresponding indicators could serve as a foundation for a future generation of Smart Specialisation to achieve a structured overview and systematic monitoring (ÖROK, 2016).

Today, all "Bundesländer" have RTI strategies, budgets for financial assistance schemes and agencies that support the implementation of the strategies in place. All have monitoring and reporting mechanisms in place, but they vary from region to region and

⁵⁸ Presentation of Armin Mahr on Austria's Lead Institutions Initiative at public universities, 7th University Business Forum, 6 April 2017, Brussels;

https://era.gv.at/object/document/3253/attach/UBF_Bruessel_060417_mahr.pdf; accessed on 11 August 2017.

⁵⁹Federal Chancellery et al. (2011): Realising potentials, increasing dynamics, creating the future, Becoming an Innovation Leader. Strategy for Research, Technology and Innovation of the Austrian Federal Government. March 2011. <https://era.gv.at/object/document/3040>; accessed on 17 October 2017.

⁶⁰ Austrian Council (2017): Bericht zur wissenschaftlichen und technologischen Leistungsfähigkeit Österreichs 2017. Juni 2017. <http://www.rat-fte.at/leistungsberichte/articles/leistungsberichte.html>; accessed on 17 October 2017.

summative analytical work is still missing. An increasing number of regional R&I strategies (2015: Lower Austria, Vorarlberg, Vienna; 2016: Salzburg, Styria) is aligned to Austria's RTI Strategy and have been drafted according to the S3 model.

The thematic priorities outlined in the national RTI strategy are oriented along the grand challenges and thematic fields with sector strategies. The regional priorities⁶¹, shown in table 6 in the annex, are identified on basis of political processes, which differ in terms of stakeholder participation (Leitner et al. 2015). Stakeholders are usually included in the development phase of measures but not in the priority setting phase.

Overall, the following thematic priorities relate to smart specialisation until 2020 (BMFWF and BMVIT 2016):

- i. Information and Communication Technology,
- ii. Life Sciences,
- iii. Material sciences and smart production,
- iv. Bio-economy and sustainability,
- v. Humanities, social sciences and cultural studies (including social innovation),
- vi. Climate change
- vii. Energy use and handling scarce resources
- viii. Securing quality of life in view of demographic change (including urbanisation, mobility and migration).

As regards the use of investment and structural funds for the regional strategies, it has to be taken into account that the ERDF contribution for implementing the Operational Programme "*Investment in Growth and Employment*" is comparatively low (€536m for 2014-2020 in total) in Austria and has even decreased compared to the previous structural funds period. It is expected that the available ERDF contributions can leverage around €2b of private and national funds in total. The new programme period (2014-2020) concentrates 90% of the available budgetary resources on three priorities:⁶²

- (1) R&D and innovation;
- (2) enhancement of the competitiveness of SMEs and
- (3) transition to a low carbon society.

These three priority intervention areas are complemented by the lower-ranking intervention areas "sustainable city development" and "city-hinterland-development and community-led local development". Within the total of these five ERDF intervention areas, 22 measures are implemented. Out of these, 11 are directly addressing R&D and innovation support (see table 7 in the annex).

€57m (ERDF and public co-funding) are earmarked for the development of R&D infrastructures (such as science and technology parks; laboratories; measurement and testing centres) in Vorarlberg, Tyrol, Carinthia, Styria, Lower Austria and Burgenland. Another €8m (ERDF and public co-funding) are earmarked to establish shared research facility centres, which should also include the business enterprise sector, for the benefit of sustainable urban development and as a contribution to increase employment in public research sectors in Vienna (ÖROK 2015).

As regards the participation in one or several of the three thematic smart specialisation platforms (TSSP) on energy, agri-food and industrial modernisation which have been created under the S3 Platform to facilitate cooperation and joint actions in the implementation of RIS3 areas across EU, only Upper Austria is engaged in partnership in the fields of high performance production through 3D-printing, and industrial modernisation in sport industries by now.

⁶¹ See also Gruber, M. and Handler, R. (2016).

⁶² The following paragraphs including Figure 2 are taken from Schuch, K. and Gampfer, R., 2016.

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Abbreviations

AIT	Austrian Institute of Technology
AT	Austria
AWS	Austria Wirtschaftsservice GmbH (Austria Business Service)
BERD	Business Expenditure for Research and Development
BES	Business Enterprise Sector
BMF	Bundesministerium für Finanzen (Austrian Federal Ministry of Finance)
BMVIT	Bundesministerium für Verkehr, Innovation und Technologie (Austrian Federal Ministry of Transport, Innovation and Technology)
BMWFJ	Former Austrian Federal Ministry of Economy, Family and Youth
BMWFW	Bundesministerium für Wissenschaft, Forschung und Wirtschaft (Austrian Federal Ministry of Science, Research and Economy)
EC	European Commission
EIF	European Investment Fund
ERA	European Research Area
ERDF	European Regional Development Funds
EU	European Union
EU-28	European Union including 28 Member States
FFG	Österreichische Forschungsförderungsgesellschaft mbH (Austrian Research Promotion Agency)
FP	Framework Programme
FWF	Fonds zur Förderung der wissenschaftlichen Forschung (Austrian Science Fund)
GBAORD	Government Budget Appropriations or Outlays on R&D
GDP	Gross Domestic Product
GERD	Gross Domestic Expenditure on R&D
HEI	Higher Education Institution
HES	Higher Education Sector
HRST	Human Resources in Science and Technology
IP	Intellectual Property
IPO	Initial Public Offering
IST Austria	Institute of Science and Technology Austria
MS	Member State
NGA	Next Generation Access broadband
ÖAW	Österreichische Akademie der Wissenschaften

	(Austrian Academy of Sciences)
PRO	Public Research Organisation
R&D	Research and Development
R&I	Research and Innovation
RI	Research Infrastructure
RTI	Research, Technology and Innovation
S3	Smart Specialisation Strategy
S&T	Science and Technology
SME	Small and Medium Sized Enterprise
VC	Venture Capital
WEF	World Economic Forum
WIFO	Wirtschaftsforschungsinstitut (Austrian Institute of Economy)
ZSI	Zentrum für Soziale Innovation (Centre for Social Innovation)

Factsheet

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
GDP per capita (euro per capita)	34500	35400	37000	37800	38200	39000	39900	40400		
Value added of services as share of the total value added (% of total)	69.77	69.92	69.87	69.68	69.95	70.23	70.7	71.02		
Value added of manufacturing as share of the total value added (%)	18.36	18.5	18.62	18.77	18.51	18.57	18.56	18.2		
Employment in manufacturing as share of total employment (%)	15.27	14.93	14.92	14.91	14.82	14.67	14.64	14.56		
Employment in services as share of total employment (%)	71.65	72.13	72.3	72.62	72.87	72.91	73.32	73.56		
Share of Foreign controlled enterprises in the total nb of enterprises (%)	3.02	3.04	3.16	3.2	3.12	3.16	3.25			
Labour productivity (Index, 2010=100)	98.5	100	101	102.1	102.7	103.3	105.3	104.8		
New doctorate graduates (ISCED 6) per 1000 population aged 25-34	1.55	1.62	1.58	1.62	1.46	1.46	1.39	1.39		
Summary Innovation Index (rank)	6	9	9	8	8	9	9	7		
Innovative enterprises as a share of total number of enterprises (CIS data) (%)				54.4		59.5				
Innovation output indicator (Rank, Intra-EU Comparison)			11	11	10	11				
Turnover from innovation as % of total turnover (Eurostat)		11.9		9.8						
Country position in Doing Business (Ease of doing business index WB)(1=most business-friendly regulations)						20	21	19	19	22
Ease of getting credit (WB GII) (Rank)						48	53	55		
Venture capital investment as % of GDP (seed, start-up and later stage)	0.012	0.01	0.008	0.008	0.008	0.008	0.008			
EC Digital Economy & Society Index (DESI) (Rank)						13	9	10	10	
E-Government Development Index Rank		24		21		20		16		
Online availability of public services – Percentage of individuals having interactions with public authorities via Internet (last 12 months)	49	51	51	53	54	59	57	60	62	
GERD (as % of GDP)	2.6	2.73	2.67	2.91	2.95	3.07	3.05	3.09		
GBAORD (as % of GDP)	0.75	0.77	0.78	0.77	0.8	0.79	0.8	0.81		
R&D funded by GOV (% of GDP)	0.91	1.04	0.95	1.1	0.99	1.1	0.99	0.95		
BERD (% of GDP)	1.77	1.87	1.84	2.05	2.09	2.19	2.18	2.2		
Research excellence composite indicator (Rank)	6	7	6	7	7	7				
Percentage of scientific publications among the top 10% most cited publications worldwide as % of total scientific publications of the country		11.33	11.09	10.8	11.8	11.49				
Public-private co-publications per million population	59.39	64.66	66.86	62.44	60.46	67.59	57.6			
World Share of PCT applications	0.78	0.79	0.81	0.76	0.69	0.71	0.81			
Global Innovation Index				23	20	18	20	20		

Data sources: various, including Eurostat, European Commission and International scoreboard data

ANNEX

Table 6. Strategic and thematic RTI-priorities in the Bundesländer based on current strategies⁶³

Bundesland	Strategic priorities/fields of action	Strategic R&D priorities and potentials
Upper Austria	1) Industrial production processes	Mathematic modelling; software architecture and steering processes; data protection; hardware; surface and material development; test and inspection systems; production technologies; process engineering and optimisation; energy and resource management
	2) Energy	Decentralised client-oriented systems (e.g. smart grids); grid load management and monitoring; renewable energies; building techniques
	3) Health, ageing society	Medical information systems and software (eHealth, virtual surgery; pattern recognition); apparel and materials; telemetry; personalised diagnostics; prevention and therapy
	4) Food and nutrition	Ingredients and modified food; packaging and materials; food quality and safety; testing and measurement; production technologies
	5) Mobility/logistics	Transport; logistics; supply chain management; motor vehicle technologies and propulsion technologies; light weight construction of structures
Styria	<i>Strategic economic priority themes</i>	
	1) Mobility	Clean mobility; niche technologies and products in aircraft and train system technologies
	2) Eco-Tech	Wood technologies
	3) Health-Tech	Food and health technologies
	<i>RTI thematic corridor priorities</i>	
	1) Mobility	Within these research fields also the potential of contributions of SSH and arts towards societal and economic challenges should be considered
	2) Energy/resources/sustainability	
	3) Materials	
	4) Health/biotech	
	5) Information society	

⁶³ BMWFV und BMVIT, 2015. Information about Vienna which published its strategy in September 2015 was added by Klaus Schuch.

Lower Austria	<i>RTI strategy</i>	
	1) Agricultural technologies for food and veterinary medicine	
	2) Society, culture	
	3) Health, medicine	
	4) Natural sciences, engineering sciences	
	5) Environment, energy, resources	
Carinthia	<i>General RTI strategy</i>	
	1) Human resources	In the field of engineering and natural sciences
	2) ICT	Interdisciplinary connections between ICT with SSH (e.g. Institute of Applied Research on Ageing); embedded system technologies
	3) Production technologies	e.g. Industry 4.0
	4) Sustainability	Renewable energies; sustainable construction
	<i>Strategic higher education goals</i>	
	1) University of Klagenfurt	To foster tertiary education in natural sciences and engineering sciences
	2) University of Applied Sciences Carinthia	To foster tertiary education in engineering and economy
Tyrol	<i>RTI future topics</i>	Mechatronics, digital transformation (Industry 4.0), tourism research
	1) Creative industries	
	2) Material sciences	
	3) Material engineering	
	4) Alpine space	
Burgenland	1) Sustainable technology	Construction material and technologies; energy efficiency; sustainable and renewable energies; smart grids/regional consumption systems
	2) Sustainable quality of life	Ambient assisted living; health competence and operational health promotion; prevention and recreation; mental health; product and process optimisation in food production; products and services in health, leisure time, culture and tourism

	3) Smart processes, technologies and products	Opto-electronics; mechatronics; smart application of materials
Vienna	<ol style="list-style-type: none"> 1) Creation of supporting framework conditions (including 'welcome culture'; start-up support; gender mainstreaming; focus on selected thematic areas [see right column); shared infrastructure facilities; regional cooperation in the "Greater Vienna Area"; innovation in education etc.) 2) Innovative city administration (incl. Living Labs, Policy Labs und Proof of Concept; innovation oriented public procurement etc.) 3) Creation of an innovative milieu 	Life sciences; ICT; creative industries; humanities, arts and social sciences; mathematics and physics; smart city technologies and innovative production technologies
Salzburg	<ol style="list-style-type: none"> 1) Broad understanding of RTI including RTI for competitiveness but also social innovation 2) Specialisation and cooperation 3) Internationalisation 4) Education (with a focus on MINT) and vocational training to prevent brain drain; creation of entrepreneurial spirit 5) Active governance for research and innovation 	<ol style="list-style-type: none"> 1) Life Sciences 2) ICT (smart data and services) 3) Materials 4) Smart building construction and settlement system 5) Creative industries and service innovations
Vorarlberg	<p>6 objectives</p> <ol style="list-style-type: none"> 1) Increasing awareness for RTI (1 action area; 6 dedicated measures) 2) Strategic development of the science and research location (3 action areas; 9 measures) 3) Increasing R&D expenditures (3 action areas; 9 measures) 4) Supporting HRD and qualifications for society and economy (3 action areas; 12 measures) 5) Further stimulating the R&I potentials of companies located in Vorarlberg (4 action areas; 8 measures) 6) Internationalisation (2 action areas; 4 measures) 	<ul style="list-style-type: none"> • Priorities in 2016/2017 on <ol style="list-style-type: none"> 1) New materials and production technologies 2) Service innovation and service engineering 3) Migration research 4) Textile composite materials

Table 7. Overview on ERDF funding areas in Austria (2014-2020) (ÖROK 2015b)

Main intervention area	Measure Number	Measure description	Potential beneficiaries	Regional coverage	Total funding budget foreseen (national public and ERDF) (2014-2020)
Fostering the regional competitiveness through research, technological development and innovation	M01	Research and technology infrastructure	HES, non-university R&D organisations incl. umbrella institutions; consortia of research organisations and enterprises	Burgenland, Carinthia, Lower Austria, Styria, Tyrol, Vorarlberg	€ 57,252,808
	M02	Cooperative and collaborative R&D projects and transfer competences	HES, non-university R&D organisations incl. umbrella institutions; consortia of research organisations and enterprises	Burgenland, Carinthia, Lower Austria, Upper Austria, Salzburg, Styria, Tyrol, Vorarlberg	€ 46,902,655
	M03	Single company R&D projects and technology transfer projects	Enterprises, working groups of enterprises or of enterprises and research organisations	Burgenland, Carinthia, Lower Austria, Upper Austria, Salzburg, Styria, Tyrol, Vorarlberg	€ 59,163,650
	M04	Innovation consultancy and funding	Enterprises, intermediary organisations, public corporations	Carinthia, Lower Austria, Styria	€ 12,905,556
	M05	R&D and technology-oriented investments	Enterprises	Burgenland, Carinthia, Lower Austria, Upper Austria, Salzburg, Styria, Tyrol, Vorarlberg	€ 52,965,000
	M06	Cluster/networks, regional location management	Intermediary organisations, cluster and network organisations, enterprise collaboration	Lower Austria, Tyrol	€ 19,250,000
Enhancement of regional competitiveness of SMEs	M07	Support measures for business start-ups	Intermediary organisations, business start-ups	Lower Austria, Vienna	€ 10,810,000
	M08	Support for knowledge-intensive start-ups	Intermediary organisations, incubation centres, business start-ups	Carinthia, Lower Austria	€ 5,000,000
	M09	Support for business growth	SMEs of the productive sector and production support services, enterprises in the field of tourism and leisure	Burgenland, Carinthia, Lower Austria, Upper Austria, Salzburg, Styria, Tyrol, Vorarlberg	€ 187,278,934

	M10	Consultancy services for SMEs	Regional organisations, mixed private-public organisations, public corporations and other	Upper Austria, Styria	€3,227,909
Support for reducing CO ₂ emissions in all branches of the economy	M11	Company investments in renewable energy and energy efficiency	Enterprises	Burgenland, Carinthia, Lower Austria, Upper Austria, Salzburg, Styria, Tyrol, Vorarlberg	€ 83,375,634
	M12	Consultancy for enterprises in the field of renewable energy and energy efficiency	Intermediary organisations resp. qualified consultants, enterprises	Carinthia, Lower Austria	€ 3,863,079
	M13	Local and regional strategies for energy efficient and sustainable mobility	Public corporations, intermediary consultancy organisations, public and private cooperations, enterprises, mixed corporations	Carinthia, Lower Austria	€ 6,788,889
	M14	Smart city Styria: Investment in renewable energies and energy efficiency	Public corporations, public and private cooperations, enterprises, mixed corporations	Styria	€ 10,000,000
	M15	RTI projects in CO ₂ relevant fields	Enterprises in the productive sector, business support services, non-university research organisations and HEI, working groups between research organisations, HEI and enterprises resp. public organisations such as communalities	Burgenland, Carinthia, Lower Austria, Upper Austria, Styria	€ 20,270,833
Sustainable city development	M16	Research and technology infrastructure	Public corporations, foundations and funds, HEI, non-university research organisations and umbrella organisations; cooperation of research organisations and enterprises; other	Vienna	€ 8,000,000
	M17	Innovation support services	Agencies of the City of Vienna and collaboration for innovation services; public corporations and their enterprises; foundations and funds, HEI, other	Vienna	€4,200,000
	M18	Resource and energy efficient sustainable city	Public corporations, public and private cooperations, foundations and funds,	Upper Austria, Vienna	€ 14,550,000

		development	HEI, other		
	M19	Optimizing locational and settlement structures in the context of Upper Austrian city regions	Public corporations, associations, public organisations, enterprises	Upper Austria	€ 9,600,000
	M20	Upgrading of disadvantaged city areas	Public corporations, public and private cooperations, foundations and funds, other	Vienna	€ 11,287,880
City-hinterland development and CLLD	M21	Initiation of endogenous growth impulses for employment in city regions	Public and semi-public organisations (such as regional management organisations, associations, etc.)	Styria	€ 12,500,000
	M22	CLLD Tyrol: piloting future-oriented applications of "Community-Led Local Development" (CLLD)	Natural persons; legal persons; public corporations	Tyrol	€ 7,761,180

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