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Abstract
The 2015 series of RIO Country Reports analyse and assess the policy and the national research and innovation system developments in relation to national policy priorities and the EU policy agenda with special focus on ERA and Innovation Union. The executive summaries of these reports put forward the main challenges of the research and innovation systems.

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Foreword

The report offers an analysis of the R&I system in Austria for 2015, including relevant policies and funding, with particular focus on topics critical for EU policies. The report identifies the main challenges of the Austrian research and innovation system and assesses the policy response. It was prepared according to a set of guidelines for collecting and analysing a range of materials, including policy documents, statistics, evaluation reports, websites etc. The quantitative data is, whenever possible, comparable across all EU Member State reports. Unless specifically referenced all data used in this report are based on Eurostat statistics available in February 2016. The report contents are partly based on the RIO Country Report Austria 2014 (Cuntz, 2015).

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Executive summary

The report offers an analysis of the R&I system in Austria for 2015, including relevant policies and funding, taking into account the priorities of the European Research Area and the Innovation Union. The report was prepared according to a set of guidelines for collecting and analysing a range of materials, including policy documents, statistics, evaluation reports, websites, etc. The quantitative and qualitative data is, whenever possible, comparable across all EU Member State reports. The report contents are partly based on the RIO Country Report 2014 (Cuntz 2015).

Context

The Austrian economy has weathered the financial crisis relatively well, but GDP growth has been stagnating until 2014. It picked up 2015 (0.9%)[1] and is forecast to reach 1.5% in 2016.[2] Although still rather low compared to other EU Member States, unemployment has risen between 2012 and 2014 from 4.9% to 5.6%.

In June 2014, the Austrian parliament adopted a package of measures with a net budget reduction effect totalling nearly €553m for the years 2014 to 2018. In March 2015, the Austrian federal government furthermore adopted a tax reform package intended to bring €5b in relief to workers subject to income tax. In connection with the tax reform, spending cuts totalling €1.1b were adopted with regard to grants/subsidies and administration expenditures. In addition to these budgeted cuts, the resolution or restructuring of nationalised and partly-nationalised banks remains a severe burden on the public budgets.

The policy fields of education and research have been least affected by the budget consolidation measures. Despite budget reductions for some funding agencies, RPOs and R&D appropriations in some federal ministries' budgets, total public R&D expenditures are planned to slightly increase in 2016 compared to 2015. Competitive funding to universities will increase from €300m to €750m, to universities of applied sciences from €265m to €282m, and the "research premium" tax incentive will rise from 10% to 12%. Austria thus largely followed principles of smart fiscal consolidation with respect to R&I expenditures, which is only the case for about half of all EU Member States.

Austria has a strong and well-developed R&I system. In 2013, the economy and science portfolios were merged into the new Ministry for Science, Research and Economy. This institutional change has been deemed largely beneficial by many stakeholders, in particular since R&I issues seem to be allocated increasing prominence in economic policy making.[3]

GERD increased steadily from 2.81% in 2012 to an estimated 3.01% in 2015.[4] Only three EU Member States (the innovation leaders Sweden, Finland and Denmark) show higher current GERD per GDP. BERD as a share of Austrian GDP stood at 2.11% in 2014, significantly higher than the EU-28 average (1.3%). Government intramural expenditure (GOVERD) and expenditure on higher education R&D (HERD) accounted for 0.13% and 0.73% of GDP in 2014 (EU-28: 0.25% and 0.47%, respectively). In terms of R&D financing, the Austrian private sector funded 46.6% of overall R&D expenditure in 2014 and an estimated 47.2% in 2015. The public share in funding of GERD was 37.7% in 2014 and an estimated 37.3% in 2015. The share of GERD financed from abroad was 15.2% in 2014 and an estimated 15.1% in 2015. It originated mainly from MNEs with Austrian subsidiaries, but also from EU funding sources.

[1] BMWFW 2015b
[2] European Commission 2015.
[3] Cuntz 2015.
[4] Statistik Austria 2015.

The foreign share of GERD financing has been slowly but steadily decreasing in relative terms in the last few years (2005: 18.0%). The Austrian EU2020 target for R&D intensity of 3.76% of GDP is considered ambitious despite the steady increase of GERD, especially given the limited economic growth forecasted for the coming years and the pressures on public budgets in terms of fiscal consolidation.[5]

Key developments in the R&I system in 2015 included:

- New guidelines for RTI funding (see section 3.4)
- Appointment of new members to the Austrian Council for Research and Technological Development and the Austrian Science Board
- Publication of Research Action Plan addressing issues such as promoting researchers' careers, facilitating private financing of research, and improving the innovation potential and entrepreneurial spirit of universities
- Kick-off of several RTI strategy processes (e.g. open innovation; RTI and bio-economy; strategy for humanities and social sciences)

Austria's research base performs relatively well in terms of excellence orientation, but still lags behind those of comparable countries like the Netherlands, Belgium or Switzerland. The country's share of publications in the top 10% most cited publications increased from 12% in 2000 (full count) to 15.62% in 2010 (EU: 12.25%). Austria's share of public funding allocated to transnationally coordinated research was slightly below 5% of GBAORD (2010), higher than the EU average of 4.27%. Austria's labour market for researchers is fairly open and characterised by a high institutional autonomy, in particular as regards HEIs and other public research organisations.

Knowledge and technology transfer as well as science-industry collaboration are well established in Austria, and a plethora of support measures exists to further improve cooperation, with a particular focus on involving SMEs to a stronger extent. The share of public-private co-publications in Austria is 3.1% (EU-28 average: 1.8%). Several schemes support facilities where academic and industry researcher's work together and a publicly funded industrial PhD programme placed its first call in 2014.

The identified challenges for Austria's R&I system are:

(1) Moderate effectiveness of public support for business innovation

(2) Supply shortage of private equity, especially venture capital

[5] Rat für FTE 2015.

R&I Challenges

Challenge 1: Improve effectiveness of public support for private-sector innovation

Description

The Austrian private sector is strong in R&D, with BERD having grown continuously in absolute terms from €5,520m in 2010 to €6,963m in 2014. The country is ranked 7th in business R&D expenditures.[6] Employment in medium- and high-tech manufacturing is comparatively high at 5.8% (Netherlands: 2.7%, Belgium: 4.7%, Ireland: 5.2%). Given these indicator values, the innovation performance of the private sector has been somewhat disappointing.[7] Austria ranks only 23rd in non-R&D innovation expenditures.[8] In the Innovation Union Scoreboard, Austria has slid down continuously from 8th to 11th rank between 2011 and 2015.[9] Turnover from innovation as percentage of total turnover has fallen from 13.6% in 2006 to 9.8% in 2012, a drop to which services contributed slightly more than industry. Lastly, Austria is in the lower third of countries in terms of sales of new-to-market and new-to-firm innovations (rank 22).

The negative trend of Austria's innovation performance is despite an array of public support instruments for private R&I which has been built up over the past two decades. There has been a proliferation in measures, supporting in particular SME innovation and cooperation between public research institutions and SMEs. This appears to have led to a certain degree of fragmentation, spreading available funding over a plethora of instruments. [10] Although most older measures have been evaluated and received favourable assessments individually, overlaps or potential synergies between them have mostly been left unexplored, and coordination between initiatives has been limited.[11]

Analysts have also speculated that modest efficiency could be a consequence of the substantial shift from direct to indirect support during the past decade.[12] The share of tax incentives for R&D expenditures in the policy mix has increased by 42% from 2006-2011 (latest available year).[13] In 2011, tax incentives were consolidated into a single unified tax refund instrument, the research premium ("Forschungsprämie"). Up to 10% of a company's R&D expenditure (including up to €1m for extramural research) can be deducted from taxable income, and carry-over and refund is allowed. Foregone tax revenue was €572m in 2012, €377m in 2013 and €495m in 2014.[14] The strong increase was partially at the expense of funds for direct support, which may have reduced the funding system's capability to respond flexibly to specific and changing needs. [15] Furthermore, 74% of indirect funding went to large enterprises in 2014 (77% in 2012), which has instilled a debate whether the instrument is effective in its main aim to increase R&D activity of SMEs.[16]

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[6] European Commission 2014.
[7] Ibid.
[8] Ibid.
[9] European Commission 2015b, 2014b, 2013, 2011. It should be noted however that there were slight changes in methodology between IUS issues, which may have had an influence on rankings.
[10] European Commission 2015c.
[11] Cuntz 2015.
[12] Cuntz 2015.
[13] OECD 2015.
[14] http://www.parlament.gv.at/PAKT/VHG/XXV/AB/AB_04890/imfname_442347.pdf; last accessed on 2 February 2016.
[15] Cuntz 2015.
[16] http://derstandard.at/2000021530709/Drei-Viertel-der-Forschungspraemie-geht-an-Grossbetriebe; last accessed 2 February 2016.

Policy response

To support private R&I activities broadly and indiscriminately, the research premium will be increased from 10% to 12% in 2016. The application procedure, which includes certification of the applicant firm by the Austrian Research Promotion Agency (FFG), has been further simplified in 2013 and 2014 to induce more SMEs with low administrative capacity to apply. An evaluation of the instrument's effectiveness had been postponed during 2015,[17] but is now likely to take place in 2016.

Direct support instruments have been streamlined to a certain degree over the past years. Common funding rates have been introduced, administrative procedures simplified and reporting requirements harmonised across instruments. On the other hand, although some measures that have reached the end of their budgeting period have been discontinued, FFG and AWS still manage a large portfolio of instruments that provide support for private R&D and innovation activities.

New initiatives in the past few years have increasingly focused on improving knowledge transfer and science-industry cooperation in order to boost private sector innovation performance. Several programmes have been expanded where companies conduct applied and fundamental research jointly with public research institutes (COIN, Christian-Doppler-Laboratories, Laura-Bassi-Centres). Additional Competence Centres for Excellent Technologies (COMET) are planned to be set up, a scheme which has received favourable evaluation results.[18] Their role is to facilitate knowledge transfer and cutting-edge private R&D through collaboration between science and industry in jointly defined long-term research programmes. In order to improve commercialisation of research results, regulation on IPR of publicly funded research is currently under revision. The development of a comprehensive national strategy on intellectual property is expected for 2016.[19]

The regional smart specialisation strategies of Austria's Bundesländer contain the Lead Institution Initiative, which aims to empower research institutes to become central nodes of regional innovation networks including business, regional policy makers, and civil society. The intention is to grow dense local or regional networks that are able to create and exploit synergies from the individual strengths of participants. The RIS3 process has been somewhat protracted in Austria. Whereas both the federal and Bundesländer governments have been quite active in contributing to peer reviews of other regions, no Austrian region has undergone a peer review to date. Unclear allocation of competences for strategy implementation and spending between the federal and the Land level has been an obstacle in the approval process, and has not yet been entirely resolved. The contribution of Structural Funds for the period 2014-2020 to the relevant Operational Programme that includes R&I is relatively low (€536m), and has decreased compared to the previous programming period.

Assessment

The mere fact that large companies received the biggest share of the research premium does not in itself mean that it fails to induce R&D investment in SMEs. However, the additionality of the scheme has never been assessed. A comprehensive evaluation of the instrument would be important to determine its effectiveness in boosting private R&D and whether the substantial shift from direct to indirect support was justified. However, the postponement of the evaluation to 2016 carries also the advantage of having produced further data points in a relatively short time series, which might allow for somewhat more robust results.

[17] Cuntz 2015.
[18] Cuntz 2015.
[19] Ibid.

The multiple instruments to support knowledge transfer and science-industry cooperation have received mostly favourable evaluations regarding their effectiveness,[20] but their comprehensive impact on Austria's private innovation performance has so far been modest. A stronger focus on innovation instead of R&D, as well as further consolidation and streamlining of direct support instruments, might advance the system's efficiency.

The regional smart specialisation strategies and the Lead Institution Initiative hold significant promise for addressing structural weaknesses in the country's R&I system. The latter was highlighted as a best practice for RIS3 implementation by an EC expert panel.[21] However, a clear definition and implementation of multi-level coordination and competences seems essential for the strategies' eventual impact on regional private R&I capacity. Moreover, indicators and mechanisms for monitoring RIS3 implementation still have to be developed.

Challenge 2: Increase supply of private equity, especially venture capital

Description

In comparison with other Member States of similar innovation capacity, Austria's equity financing system is underdeveloped.[22] The VC market is small with a total investment volume of €65m in 2013. This represents an increase from 2012 (€43m), but is still not back at 2011 levels (€94m).[23] Total private equity investments in 2013 stood at 0.09% of GDP, which is far below the EU average (0.28%), and considerably lower than in other innovation followers like the Netherlands (0.48%), Ireland (0.28%), or Belgium (0.24%).[24] The IUS 2015 puts Austria at 28% of the EU median in VC investments, a decrease of 3.6% from 2014. Business Angel investments in 2013 were also low (€2.9m) compared to the Netherlands (€9.8m), Ireland (€13.2m) or Belgium (€10m).[25]

The low supply of private equity is not particularly pertinent for the scale-up phase (which is often perceived to be the most problematic one in Europe), but affects all development stages of young companies. The distribution of total PE investment in 2013 was 20% for seed/start-up, 42% for growth/scale-up, 27% for exit and 11% for replacement.[26] Difficult equity financing conditions are only partially counterbalanced by bank lending: The share of firms with a demand for credit that did not get a bank loan increased from 20% in 2013 to 27% in 201.[27]

These public initiatives are able to leverage private VC only to a very limited extent, partially due to unfavourable regulatory framework conditions. Regulation for retail investment imposes considerable obligations on the equity issuer concerning information disclosure and investor protection. [28] Administrative processes for IPOs are also cumbersome,[29] which reduces the attractiveness of public listings as exit opportunity for VC investors.

Policy response

In 2015 the Ministry for Science, Research and the Economy issued the "Land of Founders" ("Gründerland") strategy stating the ambitious goal to turn Austria into the most attractive location for start-ups in Europe. Stakeholders from the entrepreneur and venture capital communities heavily contributed to formulating the strategy.

[20] Ibid.
[21] European Commission 2014c.
[22] European Commission 2015c.
[23] Cuntz 2015.
[24] EVCA 2015.
[25] EBAN 2014.
[26] AVCO 2014.
[27] OECD 2015b.
[28] Jud et al. 2013.
[29] Cuntz 2015.

A new law on crowdfunding passed in 2015 has significantly liberalised and clarified regulation of retail investment. Legal reforms are also planned to simplify IPOs. In 2014, the Austrian federal promotional bank AWS established AWS Equity Finder, a capital brokerage platform, to facilitate contact between business angels, venture capitalists and crowdfunding and crowd-investment platforms.

Aside from improving framework conditions, the Austrian government also provides direct support to boost venture capital supply. Two public venture capital funds have been launched by Austria Wirtschaftsservice Gesellschaft (AWS) in 2013 to facilitate market creation and leverage private VC investment. They focus on early-stage ("Gründerfonds", €65m) and later-stage investments (€45m). Since 2013 AWS also runs a semi-public fund that co-finances business angel investments with a 1:1 ratio (total public capital €22.5m). This initiative includes also the provision of know-how and networking opportunities to business angels. For the early stages in the start-up process of technology-oriented (potential) companies, AWS administers the instruments "Seedfinancing" and "PreSeed".

Assessment

There seems to be strong political will to further improve framework conditions for equity financing, as shown for example by the Land-of-Founders strategy, which sets ambitious goals and identifies areas for action. Nevertheless, concrete measures still have to be derived from the strategy. It is still too early to assess the impact of the new crowdfunding law.

Early signs for the public (-private) venture capital funds are positive: The project volume of the AWS "Gründerfonds" increased from €1.6m in 2013 to €26.2m in 2014. The AWS business angel fund raised fresh venture capital of more than €20m. In 2014, 10 pre-seed and 17 seed-financing projects with thematic priorities in ICT, physics and life sciences were funded with €12.5m. However, these instruments are still too young to assess their impact in terms of the longer-term survival rate of companies that have received investment.

1. Overview of the R&I system

1.1 Introduction

Austria is one of the small and rich EU Member States. GDP in Austria amounts to €329bn[30] and thus accounts for 2.36% of the EU's total GDP in 2014. Its total population of 8.5m[31] represents only 1.7% of EU's total population (2013), but with a GDP per capita of €38,500 (2014) the country is well above the EU-28 average (2014: 27,400). Economic growth has slowed down since 2012 and the Austrian economy remained close to zero GDP growth in 2013 and 2014 (+ 0.3% resp. + 0.4%). Even though the economy experienced a fast recovery in early crisis years 2010 and 2011, the overall situation has worsened since then and fell below the EU average in 2014 (EU: +1.3%; Austria: +0.4%).

Compared to the Eurozone Austria showed a relatively better economic development until 2012. In 2013, the economic development of the country did not largely differ from the overall worrying state of the Eurozone, but has worsened compared to the Eurozone in 2014. The low economic dynamic is also the major reason for the rising unemployment rate, which increased from 4.9% in 2012 to 5.6% in 2014.

Recent calculations by the Austrian Institute of Economic Research (WIFO) project a low dynamic of the Austrian economy in 2015 with a growth rate of only 0.8%[32], evidently below the expected growth in the Eurozone of 1.5%[33]. It forecasts a growth rate of 1.7% in 2016 caused by demand-side induced expenditures for refugees, an increasing intra-European trade, a low value of the Euro compared to the Dollar which boosts extra-European exports and a positive development of domestic consumption due to the tax reform concluded in 2015, which becomes effective in 2016.

Table 1: Main R&I indicators 2012-2014

Indicator	**2012**	**2013**	**2014**	**EU average**
GDP per capita	37,600	38,100	38,500	27,300 (2014)
GDP growth rate	0.8	0.3	0.4	1.4 (2014)
Government debt as % of GDP	81.6	80.8	84.2	86.8 (2014)
Budget deficit as % of public budget	-2.2	-1.3	-2.7	-3.0 (2014)
Unemployment rate as % of the active population	4.9	5.4	5.6	10.2 (2014)
GERD in €m	9,149	9,571	9,833	283,009 (EU28 total)
GERD as % of the GDP	2.89	2.96	2.99	2.03 (2014)

[30] http://www.statistik.at/web_de/statistiken/wirtschaft/volkswirtschaftliche_gesamtrechnungen/index.html; accessed on 20 September 2015.
[31] http://www.statistik.at/web_de/statistiken/menschen_und_gesellschaft/bevoelkerung/index.html; accessed on 20 September 2015.
[32] Ederer, S. 2015.
[33] BMWFW 2015b.

Indicator	2012	2013	2014	EU average
GERD (EUR per capita)	1088.1	1132.4	1155,9	558.4 (2014)
Employment in high- and medium-high-technology manufacturing sectors as share of total employment	5.8	5.8	5.9	5.7 (2014)
Employment in knowledge-intensive service sectors as share of total employment	36.7	37.6	37.9	39.8 (2014)
Turnover from innovation as % of total turnover	9.8	NA	NA	11.9 (2012)
Value added of manufacturing as share of total value added	29.3	28.2	NA	26.2 (2012)
Value added of high tech manufacturing as share of total value added	2.1	2.2	NA	2.5 (2012)

Source: Eurostat

General public consolidation efforts in the wake of the financial and economic crisis have led to a first budgetary stability agreement launched in mid-2012. This became necessary due to public debt limit laws established on national level at the end of 2011 and a stability agreement signed among regional federal state ("Bundesländer") governments within Austria in May 2012. Both, even though not constitutionally fixed, request balanced public budgets on all government levels by 2016/2017. Hence, these efforts also put pressure on specific budgets dedicated to R&D, especially in terms of a drastically reduced level of discretionary spending normally used for innovative and experimental initiatives and measures, which reduces the scope for policy-making. The likelihood to reach a balanced budget in the next few years has considerably dropped because of two main developments:

1. Higher than expected deficits of the HETA Asset Resolution AG, whose objective is to effectively utilise the defaulted parts of the nationalised Hypo Alpe Adria Bank;
2. A tax reform agreement concluded in 2015 which relieves mostly taxes on wages and salaries as of 1 January 2016, thus reducing the tax income of the state.

Taking this into account as well as the slow economic recovery, the goal to realise a balanced household was postponed until 2019[34], but a strong political consensus is in place to comply at least with the structural deficit specifications stipulated at European level.

In 2014, the government debt increased to 84.2% of the GDP compared to 80.8% in 2013 causing new borrowing of -2.7% in 2014, of which around 55% is caused by covering the debts of HETA, compared to -1.3% in 2013.

With regard to the availability of R&D funds, the GDP share of gross domestic expenditure on R&D (GERD) in 2012 stood at 2.89% (EU-28: 2.01%), in 2013 at 2.96%[35], in 2014 at 2.99% and an estimated 3.01% for 2015[36]. This constitutes a steady increase since 2011. Only very few Member States among the innovation leaders show higher current GERD per GDP percentages, namely Sweden, Finland and Denmark.

By performing sectors, business expenditure on R&D (BERD) as a share of Austrian GDP stood at 2.11% in 2014. This is significantly higher than the EU-28 average (2014: 1.3%). Businesses performed around 70% of total GERD in Austria in 2013 and 2014. Government intramural expenditure (GOVERD) and expenditure on higher education R&D (HERD) accounted for 0.13% and 0.73% of GDP in 2014. The comparison with EU-28 yields relatively higher rates for GOVERD (0.25%), but lower average rates for HERD (0.47%) in 2014.

In terms of R&D financing, the Austrian private sector financed 46.6% of overall R&D expenditure in 2014 and an estimated 47.2% in 2015. This corresponds to 1.39% of the GDP in 2014 (EU-28: 1.12% in 2013). The public share in GERD financing is 37.7% in 2014 and an estimated 37.3% in 2015.[37] This corresponds to 1.13% of the GDP in 2014 (EU-28: 0.66% in 2013).

The share of GERD financed from abroad is 15.2% in 2014 and estimated 15.1% in 2015, and originates especially from multinational enterprises (MNEs) with Austrian subsidiaries but also from EU funding sources. This foreign share of GERD financing is significantly higher than the EU-28 average, but has been slowly but steadily decreasing in relative terms in the last years (2005: 18.0%). The share of GERD financed from abroad was 0.46% of the GDP in 2014 (EU-28: 0.2% in 2013).

In sum, the last three years did not provide evidence on a major shift from private to public R&D sources of finance or vice-versa. Very moderate growth of the overall economy may limit the availability of public funds in the next years and will make it difficult to achieve the R&D goals outlined in the national R&I strategy and the national reform programme for Europe 2020, e.g. the national GERD aim of 3.76% of GDP by 2020.[38]

[34] http://orf.at/stories/2304223/, last accessed on 19 September 2015.
[35] According to BMWFW und BMVIT (2015) the GERD/DP ratio stood at 2.95% in 2013.
[36] Figures for 2014 and 2015 from BMWFW und BMVIT (2015).
[37] More specifically, the estimated public contribution in 2015 breaks down to €3.21bn spent at national level (roughly 85% and on similar level as in 2013 and 2014), a total of €0.44bn spent by regional governments and €0.11bn spent by other public entities (local governments, professional chambers or social security institutions). Source: BMWFW und BMVIT (2015).
[38] Rat FTE (2015b).

Average turnover from innovation by Austrian businesses stood at 9.8% (EU-28 in 2012: 11.9%) according to the Community Innovation Survey (CIS) in 2012 (2010: 11.9%; 2008: 11.2%; 2006: 13.6%). This means a loss of close to 4 percentage points compared to 2006, mainly due to significant losses among small and medium sized firms in both manufacturing and service sectors.[39] This relatively low level of turnover from innovation corresponds to the modest value added of high-tech manufacturing in Austria (2.2% in 2013; EU: 2.5% in 2012), although the country has a comparatively broad industrial base producing a value added of 28.2% of total added value in Austria in 2013 (which is slightly above the EU-28 average of 26.2% in 2012). In general the productive sector is more oriented towards medium-tech and medium-high tech manufacturing, with only few very large high-tech enterprises but several specialised medium-sized and larger companies operating in niche markets or as second-tier suppliers.

According to the most recent CIS 2012 data the overall rate of innovating firms in Austria is fairly stable around 54% in 2012 (EU-27: 51%; 2010/2008: 56% in Austria), and is mainly driven by concentrated innovation activities of larger companies in manufacturing. Notably, the national policy target of a 10% increase of R&D active companies by 2013 proposed in the national R&I strategy has been achieved and the monitoring data of the Austrian Council for Research and Technological Development supports the assumption that Austria will also achieve its long-term goal in this respect, namely to increase the number of companies with systematic R&D activities by 25% in 2020 compared to 2010[40].

According to the CIS 2012 corporate R&D expenditure has increased in absolute terms but not in relation to the total turnover compared to CIS 2010. Also the identifiable decline in terms of product and process innovation could only be partly compensated by organisational and marketing innovations. The overall share of innovative companies decreased from 56.5% according to CIS 2010 to 54.0% according to CIS 2012[41].

Employment in high-tech and medium-tech manufacturing in % of total employment remains stable at 5.8% (2012-2013) respectively 5.9% (2014), which is close to the EU average of 5.7% in 2014. Although continuously rising during the last 10 years from a relatively low starting level, the Austrian employment in knowledge-intensive service sectors in % of total employment was with 37.9% still below the EU average of 39.8% in 2014 and far below the European Union's leading innovation countries (e.g. Sweden: 52.5%; Denmark: 49.5%; Finland: 44.9%).

1.2 Structure of the national research and innovation system and its governance

1.2.1 Main features of the R&I system

R&I policy and public financing in Austria is relatively centralised at national level. Only 9.4% of the public R&D investments are financed by the regions (i.e. "Bundesländer" or federal states) and a mere 0.2% by the municipalities. The regions' R&I policies are mainly focussing on direct funding of applied R&D to foster science-industry relations, technology transfer and innovation support measures for the regional economies.

The system of research in Austria is dominated by private R&D. The domestic business enterprise sector in Austria financed slightly below 50% of the R&D expenditures in 2013, while the public sector accounted for slightly above a third. In terms of R&D performance, however, the BES consumed by far the largest share (70.8% in 2013), because the vast majority of funding from abroad (14.7% of R&D financing in 2013) financed almost exclusively this sector in Austria.

[39] http://www.bmwfw.gv.at/Innovation/Publikationen/Documents/Europ%C3%A4ische%20Innovationserhebung%20-%20CIS%202012.pdf; accessed on 26 October 2015.
[40] Rat für FTE (2015b).
[41] Statistik Austria (2013).

But also 25.9% of the public financing of R&D are consumed by the BES in Austria in 2013. Although the number of companies which conduct R&D on a systematic basis is continuously increasing, corporate R&D is strongly dominated by multinational companies which account for more than 50% of corporate R&D expenditures.[42] Among the large enterprises, Infineon Technologies Austria AG was on top with a R&D quota of 24.61% in 2014, followed by Boehringer Ingelheim RCV GmbH & Co KG (22.32%), ams AG (16.59%), STIWA Holding GmbH (15.06%) and Bernecker + Rainer Industrie-Elektronik GmbH (13.46%).[43]

Next to the corporate sector, higher education institutions (HEI) belong to the most important research performers in terms of volume. They also receive the majority of (institutional) public funds available.

Other main R&D performers financed by public sources include a few from the non-university sector, such as the Austrian Academy of Sciences (ÖAW), the Institute of Science and Technology Austria (IST Austria) or the Austrian Institute of Technology (AIT).

1.2.2 Governance

The main actors in research and innovation governance are to be found at the state level, namely the Federal Ministry of Science, Research and Economy (BMWFW), and the Federal Ministry of Transport, Innovation and Technology (BMVIT). In early 2014, the BMWFW was established as a merger between the former Federal Ministry of Economy, Family and Youth (BMWFJ) and the former Federal Ministry of Science and Research. Despite this merger, 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 Fig. 1).

Next to BMWFW and BMVIT, also the Federal Ministry of Finance (BMF) is an important stakeholder at federal level, even though it is not directly responsible for the Austrian R&I policy. It governs the allocation of financial resources and sets framework standards for design, implementation and monitoring of programmes. The science part within BMWFW is responsible for tertiary education and for basic research, i.e. for universities, universities of applied sciences and for non-university research institutions such as the ÖAW, IST Austria and the Ludwig Boltzmann Society (LBG). It is also responsible for the Austrian Science Fund (FWF) and represents Austria at the European level on issues related to research and university education. The industrial and economic oriented R&D part within BMWFW is in general responsible for innovation support, technology transfer and the promotion of entrepreneurship. The BMWFW holds 50% of the Austrian Research Promotion Agency (FFG) and the Austria Wirtschaftsservice Gesellschaft (AWS) and it supports the Christian Doppler Research Association (CDG). The BMVIT is mainly in charge of applied research. It also holds a 50% stake in the AWS and in the FFG, to which it contributes the majority of application-oriented research funding. It is the majority shareholder of the Austrian Institute of Technology (AIT). The R&D activities of other, sectoral ministries (e.g. for agriculture and environment or health etc.) are comparably small and basically focused on contracting research required by the respective ministry for the fulfilment of its policy-field responsibilities.

The Austrian Parliament wields legislative power. In the current government period, two committees deal with research related matters: the Committee on Science and the Committee on Research, Innovation and Technology[44]. In practice, the policy debate and the development of new policy measures in S&T takes place outside the parliament to a large extent and the main drivers are the ministries in charge.

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[42] http://www.advantageaustria.org/international/zentral/business-guide-oesterreich/investieren-in-oesterreich/forschung-und-entwicklung/fe-landschaft.de.html; accessed on 31 January 2016.
[43] http://industriemagazin.at/rankings/industriebetriebe; accessed on 31 January 2016.
[44] http://www.parlament.gv.at/PAKT/AUS/; accessed on 27 September 2015.

Despite a comparatively high level of indifference among the Austrian population as evidenced by the Eurobarometer,[45] R&D continues to be considered as an acknowledged field of policy to shape the economic, social and environmental future of Austria across all political parties in Austria. Also the current coalition government between Social Democrats and the Peoples Party reaffirms the importance of R&D. This is evidenced by continuing the implementation of the Austrian R&I strategy *"Becoming an Innovation Leader: Realising Potentials, Increasing Dynamics, Creating the Future",* which has been published in early 2011.[46]

This strategy builds on exchanges of ideas among the most relevant stakeholders and an analysis of the innovation system as a whole based on the Austrian *"Research Dialogue"* (2008), the *"System Evaluation"* of the competitive R&D support and funding system (2009), and the strategic recommendations of the Austrian Council for Research and Technology Development (2009). [47] It introduces a coordinated vision across all ministries in charge of R&I.

In order to avoid duplication and to better address horizontal policies as well as to ensure the strategy's overall implementation, a task force of senior officials was installed in mid-2011. It has established a total of nine inter-ministerial working groups responsible for the coordination and implementation of the strategy, which are in operation since 2012.[48] These working groups include on a case-by-case basis different other ministries (e.g. the Federal Ministry of Europe, Integration and Foreign Affairs was partnering in the working group 7a, which dealt with the internationalisation of R&D). The task force works along the broad policy orientations provided by the Austrian R&I strategy and works on a multi-annual basis ensuring sustained and well-coordinated implementation of it. Occasionally, annual or multi-annual action plans are published to support certain activities thereunder, such as the "Action Plan for a Competitive Research Area"[49] published in early 2015.

Policy-making is supported by external policy intelligence through a number of measures, most importantly regular evaluation exercises (especially at R&D programme level; see section 2.2.1), and professional advisory bodies. Although budgetary policies are supported by macroeconomic models, the impact of R&I on economic growth is not directly included in these models.

[45] http://ec.europa.eu/public_opinion/archives/eb_special_419_400_en.htm; accessed on 27 September 2015.
[46] Rat für FTE 2009; http://www.bmvit.gv.at/bmvit/en/service/publications/downloads/austrian_rti_strategy.pdf; accessed on 26 September 2015.
[47] http://www.rat-fte.at/initiativen/articles/strategie-2020---forschung-technologie-und-innovation-fuer-oesterreich.html; accessed on 26 September 2015.
[48] See *"Status und Ausblick der Task Force für Forschung, Technologie und Innovation (FTI) für die Umsetzung der FTI-Strategie der österreichischen Bundesregierung"* as of September 2013, https://www.bka.gv.at/DocView.axd?CobId=49348; accessed on 31 January 2016.
[49] BMWFW 2015c.

The Austrian Council for Research and Technological Development *("Rat für Forschung und Technologieentwicklung")* advises as an independent R&I advisory body the government in all matters related to research, technology and innovation and regularly monitors progress of the Austrian RTI strategy's implementation and reports to the Parliament (National Council) on an annual basis. The Council members are nominated by the two Federal Ministers mainly in charge of RTI policy in Austria (BMWFW and BMVIT) and include eminent researchers, research managers and industrialists. In summer 2015, six new members (out of a total of eight) for the Austrian Council for Research and Technological Development were nominated by Minister Stöger (BMVIT) and Minister Mitterlehner (BMWFW).[50] These are Jakob Edler, Director of the Institute of Innovation Research at the University of Manchester; Sylvia Schwaag-Serger, Director for international Affairs of VINNOVA; Klara Sekanina, former director of the Swiss KTI ("Schweizerische Kommission für Technologie und Innovation"); Helga Nowotny, former president of the European Research Council; Sabine Herlitschka, Director of Infineon Austria and Hermann Hauser, physicist, entrepreneur and business angel. The council is headed by the two re-elected members Mr. Hannes Androsch (chairman) and Mr. Markus Hengstschläger (vice-chairman).

As regards policy advice on the general progress of the science system, in particular the higher education sector (HES), the Austrian Science Council was established as main advisory body in charge in 2004.

On 7 July, Minister Mitterlehner (BMWFW) nominated the new members of the Austrian Science Council [51] : Gabriele Kucsko-Stadlmayer, member of the Austrian Higher Education Conference; Antonio Loprieno, former rector of the University of Basel; Günther Meschke, University of Bochum, and Sybille Reichert, Chancellor of the University of Erlangen-Nürnberg. Mr. Rainer Blatt, Ms. Kerstin Mey, Mr. Manfred Prisching, Mr. Gerhard Riemer, Ms. Andrea Schenker-Wicki and Mr. Reto Weiler have been re-nominated. Mr. Guido Adler will finish his term in June 2016 and will be replaced by Mr. Martin Paul, President of the University of Maastricht.

In 2014, the *"ERA Observatorium Austria"* was established by the BMWFW to coordinate Austrian RTI activities with European policies, with an emphasis on the European Research Area and Horizon 2020. This Observatory is a system of dedicated measures, grouped under five pillars 1) *Communication* implemented by the *"ERA Portal Austria"*[52], 2) *support for Horizon 2020* e.g. the network of national NCPs for Horizon 2020, 3*) strategic advice for ERA* through the *"ERA Council Forum Austria",* which acts as advisory body to provide strategic intelligence regarding Austria's role in European R&I policy. The *ERA Council Forum Austria* is chaired by Professor Helga Nowotny. The other members are Hermann Hauser, Amadeus Capital Partners, United Kingdom; Jana Kolar, Head of Research and Founder of Morana RTD, Slovenia; Jürgen Mlynek, President of the Helmholtz Association, Germany and Reinhilde Veugelers, University of Leuven, Belgium.[53] 4) Support for structural change through the "ERA Policy Forum Austria" acting as an inter-ministerial steering committee, and 5) Monitoring Horizon 2020 and ERA.[54]

The bottom-up established 'Science Conference', which was founded by private, mostly non-profit research organisations to articulate and promote the interests of this sector in 2010, ceased its under-critical activities in 2015.

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[50] http://www.ots.at/presseaussendung/OTS_20150907_OTS0173/konstituierende-sitzung-des-rates-fuer-forschung-und-technologieentwicklung; accessed on 30 January 2016.
[51] http://www.ots.at/presseaussendung/OTS_20150707_OTS0151/wissenschaftsrat-neubestellungen-nach-auslaufen-der-funktionsperioden-durch-den-ministerrat-genehmigt; accessed on 30 January 2016.
[52] www.era.gv.at; accessed on 26 September 2015.
[53] https://era.gv.at/directory/168; accessed on 30 January 2016.
[54] https://era.gv.at/directory/166; accessed on 25 April 2016.

At the operational level, most of the funding for R&D and innovation is managed by three agencies on behalf of the ministries: the FWF is the most important body for the funding of basic research, the FFG funds applied R&D, and the AWS is specialised in funding start-ups (see also Section 5.2) and innovation projects in companies. Also the OeAD,[55] the Austrian agency for international mobility and cooperation in education, science and research, as 4th public agency in the field of science, research and innovation, implements some activities at the fringes of science and research in Austria, including the Commission for Development Research, the office for administering the bilateral inter-governmental science and technology agreement and several activities at the interface between science and society and mobility support.

Since the majority of public funds are distributed at the national level by the above mentioned agencies, the need for daily operational coordination of the vertical governance levels in Austria's Federal system is limited. However, as far as formal coordination of R&I policies on national and federal state levels occurs, it is organised as "Bundesländerdialog"[56], a semi-annual conference involving stakeholders on all levels. In addition, several ministries regularly meet with representatives from regional governments, or information exchange takes place on informal but regular basis. Enhanced commitment of Austrian regions to smart specialisation also helps to fine-tune and coordinate policies launched on multiple levels in the medium-term.

To support this alignment a dedicated administrative department dealing with "locational policy" was established at the BMWFW.

Public R&I policies in Austria are only marginally involving citizens or Civil Society Organisations (CSO) directly. Until recently, such involvement was – despite some approaches expressed in a few R&D programmes - mostly ad hoc (e.g. during a few dedicated public consultations). In late spring 2015, however, the BMWFW launched the nation-wide "Responsible Science Alliance"[57], whose aim is to inform citizens about science and to engage them for and in science as well as to promote responsible science approaches within the Austrian R&D community. In this context the promotion of citizen science and open innovation are considered as main fields of action. Signatories of the "Responsible Science Alliance" are the BMWFW, representatives of the Austrian Higher Education Sector, a few non-university research organisations such as the ÖAW, the AIT, Joanneum Research (JR) and the Centre for Social Innovation (ZSI), intermediary institutions such as the FWF or the Museum of Natural History, and a few CSOs such as the Red Cross or the "Naturschutzbund" ('Federation of Environmental Protection').

[55] https://www.oead.at/oead_infos_services/about_us/mission_tasks/EN/; accessed on 26 September 2015.
[56] http://wissenschaft.bmwfw.gv.at/bmwfw/forschung/national/standortpolitik-fuer-wissenschaft-forschung/bund-laender-kooperation/, accessed on 26 September 2015.
[57] http://www.bmwfw.gv.at/Presse/AktuellePresseMeldungen/Seiten/Start-des-oesterreichischen-Responsible-ScienceModells-.aspx; accessed on 26 September 2015.

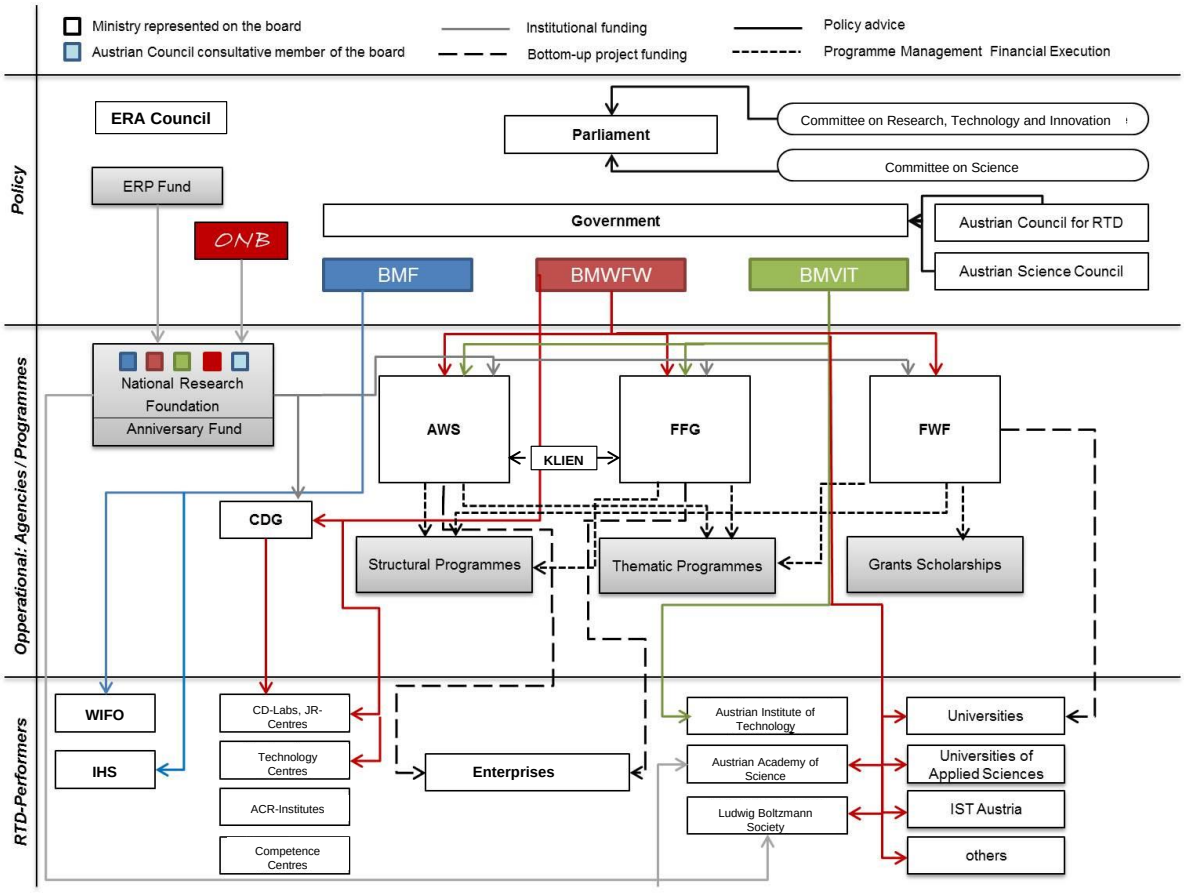

Figure 1: Structure of the Austrian Research System.
Legend: ACR-Institutes (Austrian Cooperative Research Institute), AWS (Austria Wirtschaftsservice), BMF (Ministry of Finance), BMVIT (Ministry of Transport, Innovation and Technology), BMWFW (Ministry of Science, Research and Economy), CDG (Christian 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-Centers (Josef Ressel Centres), KLIEN (Climate and Energy Fund), ÖNB (Austrian Federal Reserve), WIFO (Austrian Institute of Economic Research)

1.2.3 Research performers

The largest research performers in terms of volume are the 22 public universities and the corporate sector with 3,326 enterprises systematically active in R&D (2013). The latter group, however, is highly concentrated in terms of R&D activities as almost elsewhere in Europe. The number of enterprises systematically active in R&D has grown by 31.9% compared to the 2,521 companies in 2007. Together, they employed 70.1% of all researchers in Austria, i.e. 46,412 in terms of fulltime equivalents, which is a slight relative increase compared to 2007.

The corporate sector also contains 65 companies of the so called co-operative sub-sector, a group of non-university applied research institutes organised mostly as limited companies and, therefore, allocated to the corporate sector. They perform industry-oriented research and development and provide to various extents R&D services for industry. Together they account for approximately 8% of R&D performed in Austria (2013).

The higher education sector performed 24.3% of R&D in Austria in 2013. The ratio of public financing of the corporate sector vis-à-vis the higher education sector in Austria is 1:3 and one of the highest in favour of the corporate sector in the EU. The scope and share of research carried out by non-university research institutes has increased in recent years, whereas the private non-profit sector accounts for a very small share. The non-university state-owned research organisations' performance accounted for 4.4% in 2013 and the private non-profit sector 0.4%.[58]

Within the HES the 22 public universities (including the Danube University Krems for Continuing Education) play by far the largest role as research performers, consuming 88.3% of the sector's R&D budget in 2013; another 5.2% go to the Austrian Academy of Sciences (ÖAW) and 3.8% to the 'Fachhochschulen' (Universities of Applied Sciences). Compared to 2007 the ÖAW and the universities of applied sciences were able to marginally increase their relative importance within the higher education sector. The rest is allocated to private universities, pedagogical higher schools and other institutions in this sector.[59]

The ÖAW is the oldest and also largest public non-university research organisation in Austria. It focuses mainly on basic research, complementary to the research performed at Austrian universities. The Austrian Institute of Technology (AIT) is the largest non-university research institute working in the field of applied research. AIT is jointly owned by the Republic of Austria (with a share of slightly above 50%) and by a consortium of companies; its main task is to perform application-oriented R&D for / with companies. Moreover, there is a small group of research institutes with a strong regional focus, financed mainly by the regional government of the province where they are located. These institutes normally focus on applied research and technology development. The largest of these institutes is Joanneum Research, which is active beyond the regional level of Styria also in national and international cooperation; other, smaller players are Upper Austrian Research and Salzburg Research. These institutes are complemented by the 'Kompetenzzentren' (Centres of Excellence or Competence Centres) linking partners from science and industry in jointly defined long-term research programmes. The actual 'Centre of Excellence' is a legal entity (e.g. a limited company) and receives up to 60% of public funding.

The number of employees in R&D increased by 30% (2007-2013) to almost 117,043 (headcount). Drivers of this growth are the corporate and the university sector. The number of full-time equivalents reached 66,186 in 2013.

According to Statistics Austria[60] the productive sector is the most important corporate R&D sector. The 1,423 enterprises which are systematically conducting R&D in the productive sector account for 62% of all internal corporate R&D expenditures in 2013. The 358 foreign-controlled enterprises in this sector are responsible for 55.6% of all internal R&D expenditures in this sector.

The 1,763 enterprises which are systematically conducting R&D in the service sector account for 37% of all internal corporate R&D expenditures in 2013. The 212 foreign-controlled enterprises in this sector are responsible for 43.5% of all internal R&D expenditures in this sector.

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[58] http://www.statistik.at/web_de/statistiken/energie_umwelt_innovation_mobilitaet/forschung_und_innovation/f_und_e_in_allen_volkswirtschaftlichen_sektoren/index.html; last accessed on 30 January 2016.

[59] Ibid.

[60] Ibid.

Within the productive sector the most important branches in terms of internal R&D expenditure are 'machine building' (21.2%), 'electrical equipment' (16.4%), 'automotive industries' (11.0%) and 'electronic elements and semiconductors' (8.9%) in 2013. The latter two branches show a very high share of foreign controlled companies: 88.6% of all internal R&D expenditure in 'automotive industries' are generated by only 20 foreign-controlled enterprises; 82.1% of all internal R&D expenditure in 'electronic elements and semiconductors' are generated by only 10 foreign-controlled enterprises.

The shares of internal R&D expenditure by foreign-controlled enterprises in 'machine building' and 'electrical equipment' are 50.2% respectively 56.5%.

Within the service sector the most important branches are 'other R&D in natural sciences, engineering, agriculture and medicine' (27.9%) [61], 'architecture and civil engineering offices; technical, physical and chemical investigations' (23.0%), 'R&D in the field of biotechnology' (14.6%) and 'IT services' (10.9%) in 2013. R&D concentration in enterprises under foreign-control is in general not so evident in the service sector compared to the productive sector in Austria. However, a very strong concentration is found in the branch 'R&D in the field of biotechnology', in which 79.8% of all internal R&D expenditure is generated by only 12 foreign-controlled enterprises. The shares of internal R&D expenditure by foreign-controlled enterprises in 'IT-services and 'other R&D in natural sciences, engineering, agriculture and medicine' are 46.1% respectively 41.5%, while the share in 'architecture and civil engineering offices; technical, physical and chemical investigations' is only 5.6%.

[61] In this branch several so called cooperative institutes are included.

2. Recent Developments in Research and Innovation Policy and systems

2.1 National R&I strategy

The national R&I strategy, published in March 2011, covers research and innovation in an integrated manner. It emerged from an ex ante consultation process that included all relevant stakeholders. In addition it built on a strategy paper supplied by the Austrian Council for RTD and the system's evaluation of competitive funding in Austria. While the strategy does not provide a multi-annual roadmap with budgeting, it makes transparent the political target to invest 3.76% of GDP for R&D by 2020. A minimum of 2/3 of R&D funding should come from the corporate sector by 2020. Furthermore, the strategy committed to a 10% increase of R&D active companies by 2013, which was achieved, and to a 25% increase of R&D active companies by 2020. A newly launched, national target also aims to increase the annual number of start-ups by three percent by 2020. Among the most recent policy initiatives are the launch of the national infrastructure action plan as well as the establishment of new regional and thematic knowledge transfer centres (both in 2014), the publication of the 'Action Plan for a Competitive Research Area' (2015)[62], the launch of strategy processes for the field of humanities and social sciences as well as for an 'open innovation' strategy which should be ready by mid of 2016.

In the course of implementation of the national R&I strategy, a total of nine inter-ministerial working groups have been established in 2012, headed by a central R&I strategy task force of high-level ministry officials.[63] Only two of these working groups focus on thematic priorities outlined in the national strategy. However, thematic foci are in line with some of the key priorities in Europe 2020 and Horizon 2020, namely "Climate change and diminishing resources" and "Quality of life and demographic change". More prominently, all other seven working groups focus on policy measures and framework conditions in horizontal policy areas. More specifically, these include "Human potential", "R&D infrastructures", "Knowledge transfer and start-ups", "Corporate research", "International rankings" and a last combined working group on "Internationalisation and RTI foreign policy / plan of action for Austria and the European Research Area 2020". Three of these working groups have already delivered first results and proposals for substantial reforms in the next few years,[64] while other working groups have not yet advanced to this stage (e.g. preparation for a national bio-economy strategy).

Notably, the working groups on EU/internationalisation recently published strategic documents,[65] e.g. an update of the national EU action plan for the period 2013-2020 (whose successful implementation should be monitored / evaluated in 2016). This plan foresees, among other things, a) optimizing interfaces of Austrian STI policies with the Europe 2020 strategy (e.g. national funding criteria in line with EU ones; diversity and gender aspects in national funding activities), b) further implementation of ERA in the Austrian domain/territory, c) increasing national benefits from innovation union and from Horizon 2020 in particular via an increased industry participation and provision of strategic consultation services for R&I agents in Austria, d) effective governance via an improved strategic intelligence for Austrian actors on EU level (e.g. national activities within ERA observatory), and e) stronger emphasis on multilateral cooperation (e.g. reinforced implementation of macro-regional EU strategies such as the Danube strategy and further internationalisation on Austrian university (actor) levels).

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[62] BMWFW 2015c.

[63] https://www.bka.gv.at/site/7463/default.aspx; accessed on 31 October 2015.

[64] http://www.bundeskanzleramt.at/site/6485/default.aspx; accessed on 30 October 2015.

[65] Beyond Europe. Die Internationalisierung Österreichs in Forschung, Technologie und Innovation über Europa hinaus (July 2013) and Austria's EU action plan (to be passed by the federal government): Strengthen Austria's R&I stakeholders – actively make use of Europe – join group of innovation leaders; http://www.bundeskanzleramt.at/site/6485/default.aspx; accessed on 30 October 2015.

2.2 R&I policy initiatives

Several R&I policy initiatives have been launched recently such as the national infrastructure roadmap by the task force on research infrastructures, published in February 2014; the national roadmap by the RTI task force 'Quality of Life and Demographic Change' published in September 2015;[66] the open innovation initiative which should result in an open innovation strategy in 2016; the initiative to establish a strategy for social sciences and humanities until 2016 which started with a stakeholder consultation in October 2015[67]; the consultation for establishing the Austrian RTI bio-economy strategy which was conducted in June and July 2015;[68] the kick-off for the Life Science Strategy in October 2015,[69] the development of a national IPR strategy expected to be published in 2016 (see section 5.6); or the 'Alternative Financing Law', which passed the Parliament in August 2015 (see section 5.4) to name just a few. In general, however, scepticism prevails concerning the question if these initiatives will be really forwarded through adequately designed and budgeted support mechanisms or if they remain basically just on paper and simply summarise or reshuffle already existing support measures. An example for this scepticism is the 'Beyond Europe' position paper published in 2013, which was so far only partially followed-up with sufficient financial means.

For some of these policy initiatives, a major guiding document was published by the BMWFW,[70] the so called "Aktionsplan" ('Action Plan'), which identifies various starting points and measures for accelerating the implementation of the national RTI strategy in early 2015. It sketches pertinent public policy interventions in the fields of career development in science and research, enhanced science-industry cooperation, support for the science-society dialogue, facilitation of the framework conditions for philanthropic engagement, strategic development of social sciences and humanities and raising the competitiveness of the Austrian research area within ERA.

Overall, the national R&I strategy steers most of the new policy initiatives launched in the last three years to support research, innovation and education aspects in an integrated manner. This refers also to research infrastructure and its aspired shared usage by several research institutions and –albeit starting from a low level – companies. Coordinated, shared procurement and use of infrastructures were, however, only found in high-profile cases where the visibility of investments was high enough.

Expanding Austria's infrastructure and synchronising it with international best-practice standards is considered a major challenge. The focus is on refinancing of the infrastructure acquired before 2004, based on an inventory survey which has been recently finalised, and partially also financing of new infrastructures. A financial roadmap, however, is lacking. The acquisition and operation of research infrastructure is also regarded as a trigger to further develop and differentiate the research profiles of universities and non-university research institutions. They should focus on their priorities and strengths and should act as research infrastructure hubs vis-à-vis other research organisations and companies to guarantee optimal coverage, shared access and synergies.

Furthermore, the strategy also stipulates that future participation in pan-European infrastructures is of decisive importance for Austria's competitiveness as a place to do research and calls for a national roadmap for research infrastructure, which has been published in 2014. Finally, the strategy also calls for a regulatory improvement for using infrastructures such as biobanks and statistical data bases.

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[66] https://www.bka.gv.at/site/6485/default.aspx; accessed on 1 November 2015.
[67] BMWFW 2015d.
[68] http://www.nachhaltigwirtschaften.at/results.html/id8094; accessed on 1 November 2015.
[69] http://www.bmwfw.gv.at/Presse/Archiv/Archiv2015/Seiten/Mitterlehner--Mahrer-Österreichs-Life-Science-Branche-boomt-und-sichert-erstmals-über-51.000-Arbeitsplätze.aspx; accessed on 25 April 2016.
[70] BMWFW 2015c.

Guided by the Austrian RTI strategy and the Task Force for Research, Technology and Innovation[71] also a number of laws and regulations have been adopted and revised recently to foster innovation and strengthen the knowledge base, following a rather strategic, coherent and integrated RTI policy. Among the most important ones are the revision of the University Act in 2013, which stipulates a transition towards a capacity- and student-oriented university financing,[72] whose aim is to provide a sufficiently high number of study places based on unit costs[73] (see section 3.4). Based on the European legislation Nr. 651/2014 of the European Commission from 17 June 2014, new guidelines for funding of research and innovation projects have been enforced as of 1 January 2015 (see section 3.4). The Research and Technology Funding Act was revised to implement new governance and organisational structures and entered into force as of 1 October 2015. It resulted in leaner decision-making structures of FWF, which, however, was opposed by the board of trustees of FWF.[74]

Lastly, also at regional level several "Bundesländer" are in the process or have already published new regional RTI strategies in 2015, which are referring to the concept of smart specialisation (S3).

Evaluations, consultations, foresight exercises

In a recent comparative report[75], Austria has been recommended as a role model to newcomers who are trying to establish a research, technology, and innovation (RTI) evaluation culture in a reasonable time frame. Unlike the Anglo-Saxon or Scandinavian countries, whose tradition in evaluation goes back several decades, Austria succeeded in leapfrogging and has become one of the leading European countries in RTI evaluation in only a few years.

Many of the major turning points that triggered this shift towards a comprehensive RTI evaluation practice in Austria developed simultaneously, coevolved, or were mutually reinforcing. Examples include:[76]

1. A national RTI policy evaluation platform[77] ("FTEVAL") institutionalised and backed by the most important RTI stakeholders which renewed its evaluation standards in 2012.
2. An overall process was developed for improving the public sector efficiency through New Public Management concepts including impact-oriented budgeting, impact oriented steering and impact assessment[78] with evaluation playing a prominent role.
3. Binding guidelines, including a formalised approach concerning RTDI evaluations, were issued to support economic-technical research and technology development (2007, see below).
4. The Austrian Council for Research and Technology Development issued recommendations on the Evaluation and Monitoring of RTDI Programs on April 12, 2005.[79] The recommendations have had the character of a formative appeal for the whole R&D policy community.

[71] https://www.bka.gv.at/site/7463/default.aspx; accessed on 1 November 2015.
[72] https://www.ris.bka.gv.at/Dokumente/BgblAuth/BGBLA_2013_I_52/BGBLA_2013_I_52.pdf; accessed on 5 July 2015.
[73] A study place according to the law, §14c, is based on examination active students, who have to have passed and delivered a minimum of 16 ECTS points and at least 8 so called "semester hours" ("Semesterstunden") in a study year.
[74] *https://www.parlament.gv.at/PAKT/VHG/XXV/SNME/SNME_03806/imfname_417155.pdf; accessed on 20 April 2016.*
[75] *Tsipouri and Sidiropolous, 2013.*
[76] Schuch 2013. http://ostaustria.org/bridges-magazine/volume-37-may-15-2013/item/8102-research-technology-and-innovation-evaluation-in-austria; accessed on 13 September 2015.
[77] www.fteval.at, last accessed on 13 September 2015.
[78] Bundeskanzleramt 2013.
[79] *Rat für FTE 2005.*

The most specific formalised approach concerning RTI evaluations can be found in the 'Guidelines to support economic-technical research and technology development', which were issued by the Federal Ministry of Transport, Innovation and Technology (BMVIT) and the former Federal Ministry of Economy and Labour (now part of BMWFW) in 2007. There it states that *"a written evaluation concept must be established, containing the purpose, aims and procedures, as well as the dates for controlling the achievement of the funding objectives and suitable indicators*" (p. 4) for all funding programmes based on the RTI directive. These guidelines also call for the implementation of monitoring procedures. The guidelines refer to the Research and Technology Funding Act, which explicitly mandates the application and use of evaluations.[80]

Most of the programmes under the RTI directive have been established by the BMVIT and the BMWFW, and are administered by one of the three major RTI agencies in Austria: the Austrian Research Promotion Agency (FFG), the Austrian federal promotional bank (AWS), or the Austrian Science Fund (FWF). In terms of evaluation providers, the Austrian scene is dominated by non-university research institutions like WIFO, KMU Forschung Austria, JR, AIT, ZSI and international operating consultancies such as Technopolis, and a few others. All of them are member of FTEVAL. Finally, the research funders at national or state level (e.g. WWTF in Vienna) are also promoting the usage of evaluations.

The preferred limited tender procedure reflects the funding volume provided for the evaluation, which usually ranges between €10,000 and €120,000, with a moderate average around €55,000. *Dinges and Schmidmayer (2010)* rightfully point out that this corresponds, first, with the overall supportive and formative character of evaluations and, secondly, with the high number of RTDI policy measures in Austria – a good share of which are endowed with only limited funding volumes.

Ex-ante evaluations of program(s)/instrument(s)/organisation(s) are mostly conducted within the responsible ministry. Sometimes these ex-ante evaluations are supported by studies by external experts or internal studies by the funding agencies that contain elements of an ex-ante evaluation. According to *Dinges and Schmidmayer (2010)*, these studies go under the guise of "feasibility studies" that are introduced before, or at the beginning of, new initiatives. The vast majority of evaluations in Austria, however, are formative interim evaluations, which tend to be aimed at enhancing or readjusting programmes and their execution. Despite an increasing orientation towards efficiency in terms of justifying expenditures, there are relatively few clear examples of impact assessments and ex-post evaluations. *Reiner and Smoliner (2012)* also identified shortcomings of the RTI evaluation practice in Austria in the areas of ex-post evaluations (not enough), portfolio-evaluations (not enough), and efficiency analysis; and a too-limited access to public census data referring to companies. Moreover, they conclude that more advanced qualitative and quantitative methodological applications must be developed and applied in Austria for a better appraisal of efficiency and efficacy. Non-participant surveys and control-group approaches are little used in Austria, and peer reviews in programme evaluations are almost completely absent (*Dinges and Schmidmayer, 2010*). Also sophisticated quantitative and qualitative methods (econometric analysis, control group approaches, network analysis, case studies) are used only in very specific cases. The low level of funding has a decided influence on the applied mixed methodological approach.

In general it can be summarised that programme evaluations in Austria are frequent and provide accurate and comparable information about the quality and efficiency of funding through specific R&I programmes.

[80] Research and Technology Funding Act, Section II, § 12, last accessed on 16 October 2015.

Their results often lead to design improvements of funding programmes and related policies. Portfolio analysis to detect overlaps or potential synergies between individual support programmes, however, are not sufficiently employed.

With the 'Quality Assurance Framework Law' ("Qualitätssicherungsrahmengesetz") a new and single agency, i.e. Agency for Quality Assurance and Accreditation Austria (AQ) has been established in March 2012 which is responsible for external quality assurance in public universities, universities of applied sciences and private universities.[81] AQ includes the competences and activities of three previously existing organisations, namely the Österreichischer Akkreditierungsrat (Austrian Accreditation Council), the Fachhochschulrat (Council for Universities of Applied Science) and the Austrian Agency for Quality Assurance.

In contrast to studies (e.g. ex-ante estimations of needs and potentials), consultative processes and especially evaluations, foresight is only occasionally used in Austria for supporting RTI policy intelligence.

In Austria two institutes are endowed with supporting official macroeconomic modelling, namely the Austrian Institute of Economic Research (WIFO)[82] and the Institute of Advanced Studies (IHS). These models are taken into consideration by the Austrian Finance Ministry when establishing the budgetary policies and forecasts. In such calculations R&D is not directly considered (e.g. total factor productivity is not made dependent on R&D expenditures). Both institutes, however, consider the potential impact of R&I on macro-economic growth as essential through increasing the competitiveness of businesses and in particular through structural change of the economy towards a more knowledge-intensive, innovative and high-tech oriented economy.[83] Indicators used to trace this structural change are GERD in % of GDP, tertiary education rate of 30-34 years age cohort and percentage of school drop-outs of 18 to 24 years old.[84]

2.3 European Semester 2014 and 2015

The WIFO conducts a regular progress evaluation with regard to Austria's national Europe 2020 targets as well as the implementation of country-specific recommendations issued to Austria. The most recent evaluation report states that Austria is at a more favourable level than the EU average in all areas.[85] This holds also true for the 3% R&D investment in % of GDP goal of the EU, whose target in Austria is 3.76%. Most problematic in this respect seems to be the comparatively low share of the business enterprise sector when it comes to funding of R&D: the targeted R&D financing ratio (at least 67% private sector, 33% public-sector) has not yet been reached. In 2014, the business sector's overall share of funding comes to slightly above 60% (including FDI in R&D).

Among the country-specific recommendations outlined in the Austrian NRP 2014[86] there are only weak connections to R&I policy. It is important to mention that within the tax reform, which was concluded in 2015 and which will enter into force as of 1 January 2016, the indirect tax based research premium for R&D efforts of companies will be again raised from 10% to 12% to leverage R&D investments of the Austrian business enterprise sector. In course of this tax reform it is also foreseen to facilitate crowdfunding in Austria and to facilitate the immigration of researchers to Austria through preferential tax treatment.

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[81] http://www.ris.bka.gv.at/Dokumente/BgblAuth/BGBLA_2011_I_74/BGBLA_2011_I_74.pdf, last accessed on 16 October, 2016.

[82] WIFO has a dedicated unit of „Industrial economy, innovation and international competition" dealing with this issue.

[83] See for instance Aiginger, K., Tichy, G. and Walterskirchen, E., 2006; IHS 2015; Keuschnigg, C., Reiner, C. und Schibany, A. 2013.

[84] BMWFW 2015b.

[85] WIFO 2015.

[86] Bundeskanzleramt 2015.

One main issue at stake are educational outcomes in Austria, more specifically, of disadvantaged young people as well as drop-outs from higher education tracks. In this way, all relevant recommendations largely focus on maximizing the labour market and innovation potential ("reserves") among women and migrants. Migration in general contributes to Austrian labour force growth and skill supply.[87] However, certain migrant groups tend to suffer from important shortcomings in their human capital, which tends to be passed on to their children.[88] Policymakers have taken several initiatives in this area, in particular aiming to improve the situation for children with migrant background. In general, the proportion of migrants attending schools providing a university entrance qualification is below full-cohort average. Curbing early school drop-out was a key policy target in this policy field. The proportion of school drop-outs in Austria is lower than the EU average for natives, but still higher for migrants. 12.2% of pupils with migration background did not continue their education after finishing their eighth year of school at a lower secondary school in the 2011/12 school year. Overall, however, the number of youths who do not continue their education beyond the 8th year has considerably declined in the last four years. New policy initiatives include youth and apprentice coaching, targeted remedial instruction in German as the language of instruction, support measures in the first languages of multilingual children, free-of-charge programmes to provide qualifications to pupils who have not completed schooling (second-chance education), and training guarantees for pupils who have not found company based apprenticeships (by training them in dedicated public facilities). Early results from these initiatives are encouraging: Austria succeeded in reducing the average school drop-out rates more than in the other EU countries (despite starting from a lower average level) and reduced the rates for migrant children stronger than those for children with colloquial German language[89]. Arguably, one main caveat of these specific education policy measures is that they cannot fully avoid early streaming of migrant children to less demanding education streams. This goes hand in hand with the fundamental problem of the social selection of pupils after the fourth year of school which remains an issue of the coalition government in the sense that coalition partners are divided on this matter.

To facilitate the recognition of qualifications from abroad, an online-portal[90] has been installed which informs on recognition procedures and contact points.

In terms of gender, several policy measures in Austria address gender specific aspects, not at least to facilitate research careers of women in science, especially engineering sciences. The 2015 amendment to the Austrian Universities Act stipulates that university decision-making bodies must ensure that 50% of their members are women, as well as requiring the preparation of plans for the promotion of women and gender equality, especially when it comes to the compatibility of work and family. The enforcement of the law seems to be progressively taken up by the universities, although it is too early to have a clear picture on the results. In addition, strategic gender equality objectives will be defined for the universities in the performance agreements for the 2016-2018 period.

Another recommendation of the European Commission[91] refers to an improved strategic capacity-oriented financial planning in the field of higher education. Some of the recommendations in this respect developed by a Working Group on "Improving the Quality of Instruction in Higher Education"[92] of the University Conference between April 2013 and November 2014 are already addressed in the new performance agreement negotiations with the universities which will be implemented from 2016 to 2018.

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[87] Gächter, A., Manahl, C. and Koppenberg, S., 2015.
[88] European Commission 2012.
[89] Statistik Austria 2014.
[90] http://www.berufsanerkennung.at/, accessed on 11 October 2015.
[91] European Commission 2015.
[92] http://www.hochschulplan.at/wp-content/uploads/2015/03/Bericht-der-HSK-zur-Verbesserung-der-Qualität-hochschulischer-Lehre_20151.pdf, accessed on 11 October 2015.

An element to further develop the concept of enrolment-based funding is the extension of structured doctoral training. To reduce the number of higher education student drop-outs, proven instruments are continued such as the advisory and information tool "18plus" or "studieren probieren" ('try studying').

The core issue in Austria remains the ongoing discussion about a principal free-of-charge access of freshman to public universities who passed the secondary education with "Matura". Another core issue is to restrict access to the universities. While the principle of free-of-charge and only moderately restricted access is advocated by the Social Democratic Party, a more restrictive approach is supported by the Peoples Party, who both form the current coalition government. As a compromise limited access has been concluded already 10 years ago for certain study programmes (human medicine and dentistry, veterinary medicine, psychology, and communication sciences) [93] and for particularly demanded fields of study such as economics and business administration, information technology, biology, pharmacy studies, and architecture[94]. For the latter, a so called study entry introduction and orientation phase has been implemented, which aim to limit the number of new freshmen and to provide them with a better assessment of their aptitude for a certain field of study.

Several evaluations have been implemented to assess the effects of these already implemented access regulations to certain mass study programmes. The evaluation of the introduction and orientation phase[95] showed that this measure was able to increase the quality of tertiary teaching and learning and that capacity-oriented selection procedures before study commencement as well as an introduction phase stipulated in the curriculum can improve the study entry phase for students and facilitate the planning for universities. The results, however, differ remarkably between the universities. The evaluators of the introduction and orientation phase recommended a shortening of this phase. The evaluation of the selection procedures[96] according to §14 of the University Act 2002 showed that these procedures were able to reduce the number of freshmen and, thus, help to stabilise the mass study programmes under scrutiny. Large effects on the social and gender composition of university freshmen could not be observed, but it seems that students who study extra-occupationally seem to be negatively affected. The evaluators, however, also argued that empirical effects can hardly be traced because of the limited observation period.[97]

2.4 National and Regional R&I Strategies on Smart Specialisation

Austria is registered on the RIS3 platform at national level and with a growing number of regions. The country met the ex-ante conditionalities for the ERDF investment priority area 1 (research, technology, innovation) at national level with a strategic framework around the federal government's R&I strategy and regional investment priorities. Austria has adopted a longer-term perspective in using the smart specialisation concept as a vehicle to encourage and mobilise the triple/quadruple helix towards strategic co-operation. Regional strategies include a more or less detailed consideration of financial requirements. While Austrian universities of applied sciences (so called "Fachhochschulen") have by statute a regional orientation, the BMWFW also aimed to position the national Austrian universities within these strategies. For this purpose the *"Leitinstitutionen-Initiative"*

[93] §124b of the University Act 2002.
[94] §14 of the University Act 2002.
[95] Unger et al., 2015.
[96] Unger, Thaler, Dibiasi und Litofcenko, 2015.
[97] http://www.ots.at/presseaussendung/OTS_20150625_OTS0288/zugangsregelungen-fuer-unis-schueren-grundsatzdebatte-im-parlament; accessed on 11 October 2015.

('The Lead Institutions Initiative') has been implemented within the current performance agreement period of the universities running from 2013-2015 to help universities realise their full regional potential as entrepreneurial co-shapers of regional development. This initiative shall be forwarded in the next performance contract period backing a shift from a purely institutional to a knowledge-place-based perspective. By now it basically included the drafting of a university-focused location concept and activities to engage the universities to contribute to the current and next generation of RTI and regional development strategies in their regions, specifically to exploit the universities' contribution to the identified regional priorities. The majority of universities have anchored own locational concepts within their performance agreements. The higher education institutes have banded together in a few Bundesländer (Salzburg, Styria, Tyrol, Carinthia and Burgenland) to so called 'higher education conferences' to coordinate the strategic development of the regional higher education area and to exploit synergies within common locational concepts. The "Leitinstitutionen"-initiative of the BMWFW was considered a best practice for implementing S3 by a group of experts working on behalf of the European Commission[98].

At regional level, Austria has R&I strategies in place in all nine federal states ("Bundesländer"), and an increasing number of regional R&I strategies (2015: Salzburg, Vorarlberg, Vienna) was drafted according to the S3 model. In general, the regional strategies are actively implemented and shape the regional policy initiatives. Aspects of S3 have already been interlaced in the RTI strategies of Upper and Lower Austria, Vienna[99] and Styria, especially as regards the ex-ante SWOT analysis. Upper Austria is also founding member of the so called Vanguard initiative *"…committed to ensuring greater visibility and stronger positioning of smart specialisation principles and practice in the EU governance for innovation and industrial renaissance"*.[100] However, in Styria and Upper Austria separate research and economy strategies have been developed, which complicate a holistic analysis of regional potentials and the development of joint fields of action between research and economy. The new regional RTI strategies which are currently developed in Salzburg[101] and in Vorarlberg[102] orient themselves stronger towards S3 priority-setting and profiling than the already established ones.

The use of indicators and processes to monitor and measure the implementation, progress and results of regional RTI strategies (including S3) varies from region to region.[103] External peer review processes for exchange and learning have been proposed (but not yet carried out).[104] Austrian experts from both the national (BMWFW) and regional governments (e.g. Lower Austria) have been already repeatedly active in S3 peer reviews abroad.

The regional priorities, shown in Table 2, are identified on basis of political processes, which differ in terms of stakeholder participation.[105] Stakeholders are usually included in the development phase of measures but not in the priority setting phase. Most of the regional strategies also lack measurable indicator-based goal formulations. [106]

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[98] European Commission 2014c.

[99] MA23 2015.

[100] http://www.s3vanguardinitiative.eu/; accessed on 10 October 2015.

[101] See presentation of Christian Salletmaier at the Bundesländerdialog on 6 October 2015 on "Science and Innovation Strategy Salzburg 2025".

[102] https://www.vorarlberg.at/vorarlberg/bildung_schule/bildung/wissenschaft/weitereinformationen/wissenschaft/wissenschafts-undforschun.htm; accessed on 2 November 2015.

[103] Rechnungshof 2012

[104] Leitner et al., 2015

[105] Leitner et al., 2015.

[106] Leitner et al., 2015.

Table 2: Strategic and thematic RTI-priorities in the Bundesländer based on current strategies[107]

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

[107] BMWFW and BMVIT, 2015. Information about Vienna which published its strategy in September 2015 was added by Klaus Schuch.

Bundesland	**Strategic priorities/fields of action**	**Strategic R&D priorities and potentials**
Lower Austria	*RTI strategy*	
	Agricultural technologies for food and veterinary medicine	Currently under drafting
	Society, culture	
	Health, medicine	
	Natural sciences, engineering sciences	
	Environment, energy, resources	
Carinthia	*General RTI strategy*	
	Human resources	In the field of engineering and natural sciences
	ICT	Interdisciplinary connections between ICT with SSH; embedded system technologies
	Production technologies	
	Sustainability	Renewable energies; sustainable construction
	Strategic higher education goals	
	University of Klagenfurt	To foster tertiary education in natural sciences and engineering sciences
	University of Applied Sciences Carinthia	To foster tertiary education in engineering and economy
Tyrol	*RTI future topics*	
	Creative industries	
	Material sciences	
	Material engineering	
	Alpine space	
Burgenland	Sustainable technology	Construction material and technologies; energy efficiency; sustainable and renewable energies; smart grids/regional consumption systems

Bundesland	Strategic priorities/fields of action	Strategic R&D priorities and potentials
	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
	Smart processes, technologies and products	Opto-electronics; mechatronics; smart application of materials
Vienna	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.) Innovative city administration (incl. Living Labs, Policy Labs und Proof of Concept; innovation oriented public procurement etc.) 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

As regards the use of investment and structural funds for these regional strategies, one has to state that first of all 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) focuses 90% of the available budgetary resources on three priorities:

(1) R&D and innovation;

(2) enhancement of the competitiveness of SMEs and

(3) transition to a low carbon society.

The focus on financial instruments and on sustainable urban development is very limited. Although there is - for the first time - only one operational programme[108] (instead of 9) in Austria, which also led to a reduction of funding units from 36 to (still) 16, a high level of thematic differentiation to meet regional conditions can be observed. 22 measures have been identified to serve this thematic regional differentiation. Research and innovation infrastructure support is foreseen to enhance regional competitiveness and to contribute to sustainable urban development.

[108] ÖROK 2015.

€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.[109]

2.5 Main policy changes in the last five years

Main Changes in 2011
In early 2011 the national R&I strategy "Becoming an Innovation Leader: Realising Potentials, Increasing Dynamics, Creating the Future" is published, following the consultation of main stakeholders in the science and innovation system and an extensive (systemic) evaluation exercise.
Main changes in 2012
A total of nine inter-ministerial working groups are established, with the main mission to safeguard the implementation of the Austrian R&I strategy and to develop concrete policy measures in each area of action.
Main changes in 2013
Federal elections held in September ("Nationalratswahl") *Coalition agreement by conservatives and social democrats (ÖVP and SPÖ, respectively) signed in December establishes a new Ministry of Science, Research and Economy (BMWFW), an institutional merger of the former Ministry of Science and Research (BMWF) and parts of the former Ministry of Economy, Family and Youth (BMWFJ).*
Main Changes in 2014
In September the government coalition is rearranged and the current Minister of Science, Research and the Economy (BMWFW), Reinhold Mitterlehner, is appointed vice chancellor. *"ERA Observatory Austria", "ERA Policy Forum Austria" and "ERA Council Forum Austria" are established.*
Main Changes in 2015
New guidelines for RTI funding are in force as of 1 January 2015 (see section 3.4). *New members are appointed for the Austrian Council for Research and Technological Development and the Austrian Science Board.* *Research Action Plan published addressing issues such as promoting researchers' careers, facilitating private financing of research, or improving the innovation potential and entrepreneurial spirit of universities.* *Kick-off of several RTI strategy processes (e.g. open innovation; RTI and bio-economy; strategy for humanities and social sciences; bio-tech strategy).*

[109] Ibid.

3. Public and private funding of R&I and expenditure

3.1 Introduction

Table 3: Basic indicators for R&D investments

Indicator	2011	2012	2013	2014	2015	EU-28 average (2014)*
GERD (as % of GDP)	2.68	2.89	2.96	2.99	NA	2.03
GERD (Euro per capita)	988.2	1,088.1	1,132.4	1,155.9	NA	558.4
GBAORD (€m)	2,428.143	2,452.955	2,587.717	2,736.304	2,758.066	92,828.145
R&D funded by BES (% of GDP)	1.24	1.31	1.45	1.39	NA	1.12 (2013)
R&D funded by PNP (% of GDP)	0.01	0.01	0.01	0.01	NA	0.03 (2013)
R&D funded by GOV (% of GDP)	0.96	1.11	1.00	1.13	NA	0.66 (2013)
R&D funded from abroad (% of GDP)	0.45	0.45	0.49	0.46	NA	0.2 (2013)
R&D performed by HEIs (% of GDP)	0.69	0.71	0.72	0.73	NA	0.47
R&D performed by government sector (% of GDP)	0.14	0.13	0.13	0.13	NA	0.25
R&D performed by business sector (% of GDP)	1.84	2.03	2.1	2.11	NA	1.3

* Reference date is 2014 unless otherwise indicated.

The overall RTI policy target in Austria is to invest 3.76% of GDP for R&D by the year 2020 as outlined in the national R&I strategy, based on a public versus private split of 1:2. The 2.99% in 2014 and the estimated 3.01% for 2015 are a valuable, logical next step in the right direction. Compared to 2014, the total sum of Austrian R&D expenditure will increase by 2.8%. However, as noted before, very moderate growth prospects of the economy and recent budgetary reforms may limit the availability of public funds in the next years and will make it very difficult to achieve this target. Furthermore, the national R&I strategy committed to a 10% increase of R&D active companies by 2013, which has already been realised. GERD per capita is twice as high in Austria than the EU-28 average (see Table 3). R&D funded by BES in % of GDP is 1.39 in 2014 (EU-28: 1.12). The corresponding share funded by the governmental sector is 1.13 in 2014 (EU-28 in 2013: 0.66) (see Table 3).

According to Statistik Austria[110], also in 2015 the largest part of total R&D expenditure will be financed by Austrian businesses (approx. 47.2% or €4.76b). The public sector will contribute 37.3% (approx. €3.77b); of this share, the federal government ("Bund") will finance the majority of around €3.21b, the regional governments ("Bundesländer") around €443m and other public funding such as local municipalities, professional chambers or social security institutions will finance about €110m. 15.1% (€1.53b) will be financed from abroad and 0.4% (approximately €43m) by the private non-profit sector. The funds from abroad originate predominantly from foreign enterprises. [111] A considerable part comes from multinational enterprises whose affiliates in Austria perform R&D. 95.31% of funding from abroad (including international organisations but without EU) goes to the corporate sector.

EU funds, mainly from FPs and mostly financing HEIs, account for roughly 11% of total external funding or €180m in 2013 (only 1.9% of total GERD). More specifically, since Austria is not a cohesion country, structural funds do not play a role on federal level, but partly on regional level (see section 2.4).[112] €1,194.9m of EC funds were channelled through 2,472 FP7 projects since 2006, funding 3,606 participants in Austria.[113]

A total of €191m have been approved to be granted to Austrian participants under Horizon 2020 since the start of the programme in 2014 (data include three quarters of all 2014 H2020 calls. Austrian institutions participate in one out of 10 Horizon 2020 projects so far. The Austrian success rate (18.4%) is higher than the EU average (16.9%). The higher education sector accounts for 32% of Austrian participations. 33% come from Austrian enterprises, a participation rate above the EU average of 29%. Austrian SMEs have been particularly successful in Horizon 2020 so far with 17% of all approved Austrian participations (compared to an EU average SME participation of 14%).[114]

In 2015 the highest shares of the federal expenditure for R&D by socio-economic objectives can be found in the categories promotion of the general advancement of knowledge (32.8%), promotion of industrial production and industry (24.7%), and promotion of health (20.0%). Contributions to international organisations aimed at research and research promotion amount to €100m.

3.2 Smart fiscal consolidation

Austria follows to a very high extent the principle of smart fiscal consolidation. [115] Although the 2015 budget will be adjusted by approximately €500m, another zero structural deficit should be achieved in 2015.

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110 http://www.statistik.at/web_en/statistics/EnergyEnvironmentInnovationMobility/research_and_development_r_d_innovation/global_estimate_r_d_intensity_annual/index.html, accessed on 16 October 2015.

111 http://www.statistik.at/web_de/statistiken/energie_umwelt_innovation_mobilitaet/forschung_und_innovation/f_und_e_in_allen_volkswirtschaftlichen_sektoren/index.html; accessed on 31 January 2015.

112 For the planning period 2007 – 2012 a total of €1,204.5m were available for Austria. A financial breakdown according to EU areas of assistance has been published in the National Reform Programme 2008-2013; it shows that the importance of R&D and innovation has increased tremendously to 43.5% of the total budget, i.e. €524m compared to €143m or 14% in the previous planning period. Austrian provinces have earmarked approx. 15% of their SF budget on R&D equalling €177m.
Note however that the data on structural funds (RIO elaboration of DG REGIO data) is low in comparison to data reported elsewhere such as 2013 country report. One of the explanations for this difference is the definition adopted. The data presented here refers to core RTD (See Annex for categories included), whereas the information provided elsewhere adopts a broader definition of RTDI and linked activities. In addition the data reported here refers to ERDF funding only and does not include cohesion funds.

113 Proviso 2014.

114 http://era.gv.at/object/news/1732; accessed on 15 October 2015.

115 Fiscal consolidation is a policy aimed at reducing government deficits and debt accumulation. Smart fiscal consolidation is understood as fiscal consolidation which spares or increases public expenditures in R&I.

The additional funds released will flow into education and to the Ministry of the Interior, especially to tackle the challenges of the refugee crisis.

3.2.1 Economic growth, fiscal context and public R&D

The crisis had milder direct impact (i.e. a one-off drop of 3.8% in 2009) on Austrian GDP growth than in many other EU member states. However, except for 2011 (3.1% growth) the post-crisis period was characterised by subdued growth or stagnation. Export growth slowed down significantly amid moderating foreign demand. Domestic demand was weak due to weak consumption and investment growth. However, growth is expected to improve in 2016-17 (expected GDP growth of 1.6-1.7%), as a result of expected acceleration of private consumption[116] and investments.

Austria had a decreasing budget deficit in the pre-crisis period, maintaining the headline deficit permanently below the 3% reference value. After a significant jump of around 4% in 2010, the country managed to reduce the deficit again by the end of 2011, relying on a mix of discretionary saving and tax measures, both one-off and dynamic personal income tax revenue due to the strong rise in the employment rates. However, during the same period the government assisted financially the rescue of several banks, Hypo Alpe Adria Group being the largest. On 1 March 2015 the Austrian Financial Market Authority (FMA) initiated the resolution of Heta Asset Resolution AG in accordance with the European bank resolution regime. Together with the subdued economic growth this has led to a significant widening to 2.7% of the deficit by 2014 (from 1.5% in 2013). Given the one-off character of the support, in 2015 the headline deficit fell to 1.6% and is expected to stay at around the same level (1.7%) during 2016-17. The government debt rose to 85.9% of GDP by 2015 due to the above mentioned Hypo Alpe Adria case and is expected to moderately decrease to 84% during 2016-2017. Finally, the budgetary impact of population ageing may pose a challenge to long-term fiscal sustainability of pensions and health policies, areas that have been subjects of 2014-15 Country Specific Recommendations.

In June 2014, the Austrian National Council adopted the Budget Accompanying Act 2014 (Budgetbegleitgesetz; Federal Law Gazette 40/2014), a package of measures with a net budget reduction effect totalling nearly €553m for the years 2014 to 2018. In addition to relieving pressure on the federal budget through spending cuts, consolidation measures, increased revenues and other cost reduction effects, the package provides for increases in efficiency through the simplification of administrative procedures and a more efficient handling of costs. The Federal Budgetary Framework for the year 2014 also provided for cuts in discretionary appropriations in the amount of €500m (cf. Federal Law Gazette 38/2014). For the year 2015, the Framework calls for a reduction of discretionary spending at the amount of €300m (cf. Federal Law Gazette I No. 39/2014)[117], which also affects the field of S&T.

On 17 March 2015, the Austrian federal government adopted the 2015/16 tax reform package, which will bring nearly €5b in relief to workers and employees subject to income tax. One element of this reform is an economic stimulus package in the amount of approximately €200m to generate additional stimuli for growth, competitiveness and employment.

The tax reform is to be financed through measures against tax and social security fraud as well as structural measures under the tax code (i.a. phasing out of special allowances). Furthermore a "solidarity package", which includes an adjustment of the assessment basis for the real estate transfer tax and an increase of the real estate profit tax and capital gains tax rates, will also contribute to the financing of the tax reform.[118]

[116] Following the 2016 tax reform households' disposable income are expected to increase by ca. 4%.
[117] Bundeskanzleramt 2015.
[118] Bundeskanzleramt 2015.

In connection with the 2015/16 tax reform, spending cuts totalling €1.1b throughout Austria were adopted with regard to grants/subsidies and administration; these cuts are distributed between the federal government and the provincial/municipal governments according to the revenue sharing ratio (2/3 for the federal government, 1/3 for the provincial/municipal governments). Furthermore, the tax reform should be reciprocally financed via administrative reforms, which will bring in an estimated total of €3.3b by 2020. Here, the core elements consist of public posts that become vacant but are not filled, and wage agreements. In addition, across all ministerial departments, €20m will be saved on subsidies – the specific measures fall under the auspices of the respective ministry.[119] This might also affect R&D subsidies to a certain extent, e.g. the closure of SOQUA, a postgraduate course for vocational training for international social scientific research.

On 14 October 2015 the new budget plan for 2016 has been released. The budget plan for 2016 reveals a humble total increase for public R&D expenditures compared to 2015, but it also features some cuts, for instance the Austrian Science Fund, the Climate and Energy Fund, less contributions to the European Space Agency as well as R&D expenditure cuts within the budgets of BMVIT and the Austrian Federal Ministry of Agriculture and Forestry, Environment and Water Management.[120] In general, the policy fields 'education' and 'research' have been least negatively affected by the budget consolidation measures.

The budget increase for the public universities concerns their institutional funding (so called global budget) and the competitively awarded and mostly indicator-based so called "Hochschulraumstrukturmittel" ('higher education area structural means'), which will be increased by €300m to a total of €750m for the period 2016-2018. This is still only around 8% of the total public budget of around €9b allocated to the universities between 2016 and 2018. Emphasis within this competitively awarded institutional budget is put on the indicator measuring the number of active students (approximated by attendance of examinations). Also the budget of the universities of applied sciences will be increased from €264.9m to €281.6 caused by a higher number of study places and a higher unit-cost based funding rate per study place.[121]

As of 1 January 2016 the indirect tax based research premium funding will be increased from 10% to 12%. Finally, the additional tax revenues, which are caused by the temporarily limited increased top income tax rate of 55% on incomes succeeding €1m/year, will be transferred into an "Österreichfonds" ('Austria Fund') which will be also used for R&D activities.[122]

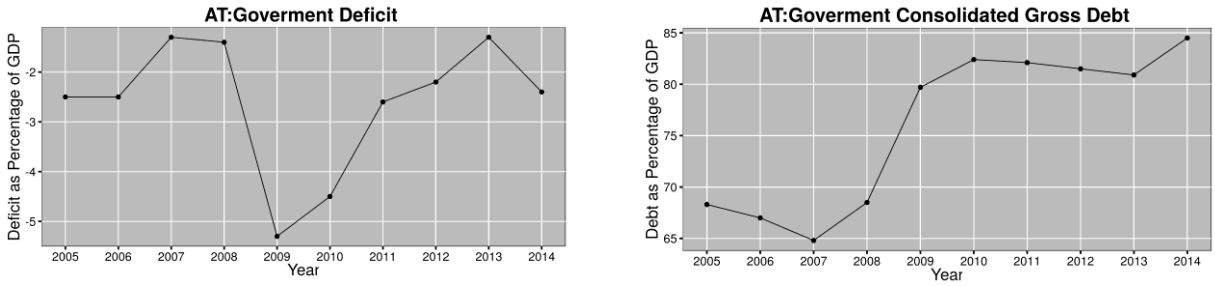

Figure 2: Government deficit and public debt. Data source: Eurostat

Total GERD in Austria was 9,571m in 2013. There are three main sources of R&D funding: the business sector (€4,666m), the government (€3,214m), and foreign funding (€1,499m).

[119] https://www.bmf.gv.at/aktuelles/budget_2016.html; accessed on 16 October 2015.
[120] BMF 2015.
[121] BMF 2015b.
[122] BMF 2015b.

Direct funding from the government is allocated to R&D in the business enterprise sector (€846m), the government (€377m) and the higher education sector (€1,988m)[123].

Table 4: Key Austrian Public R&D Indicators

	2007	2009	2013
GBAORD, % of gov. exp.	1.28	1.39	1.57
GERD, % of GDP	2.43	2.61	2.96
out of which GERD to public, % of GDP	0.71	0.82	0.85
Funding from GOV to, % of GDP			
Business	0.18	0.20	0.26
Public (GOV+HES)	0.61	0.71	0.74
Total	0.79	0.91	1.00
EU funding, % of GDP	n.a.	0.03	0.06

Source: Eurostat

3.2.2 Direct funding of R&D activities

Figure 3 below shows the historical evolution of GERD financing in current prices in Austria.

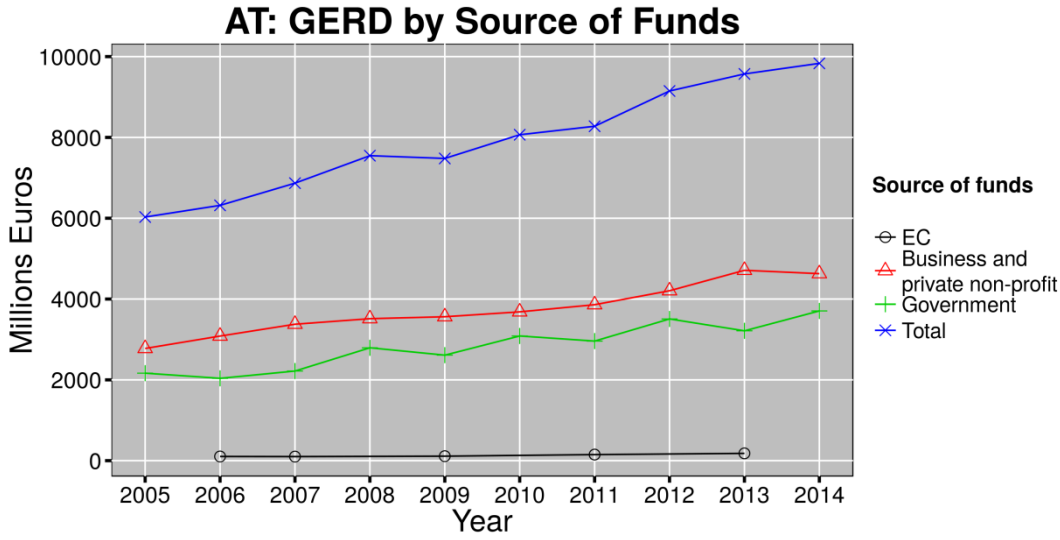

Figure 3: funding of GERD. Data source: Eurostat

The total GERD increased almost linearly in the period 2005-2014, with a small decrease only in 2009 as a consequence of the decrease in funding from the government from that year.

The private sector is the main funder of the Austrian GERD, but the share of public contribution to GERD has risen during the period under scrutiny. The funding from the European Commission, for which only sparse data is available, plays an extremely marginal role in the financing of the Austrian GERD.

[123] Austria reports GERD by sector of performance and source of funds every 2 years, last available data from 2013.

3.2.2.1 Direct public funding from the government

Direct public funding is usually the main source of the total governmental support to R&D. Figure 4 below shows the time evolution of the total R&D appropriations (GBAORD) and the GERD directly funded by the government.

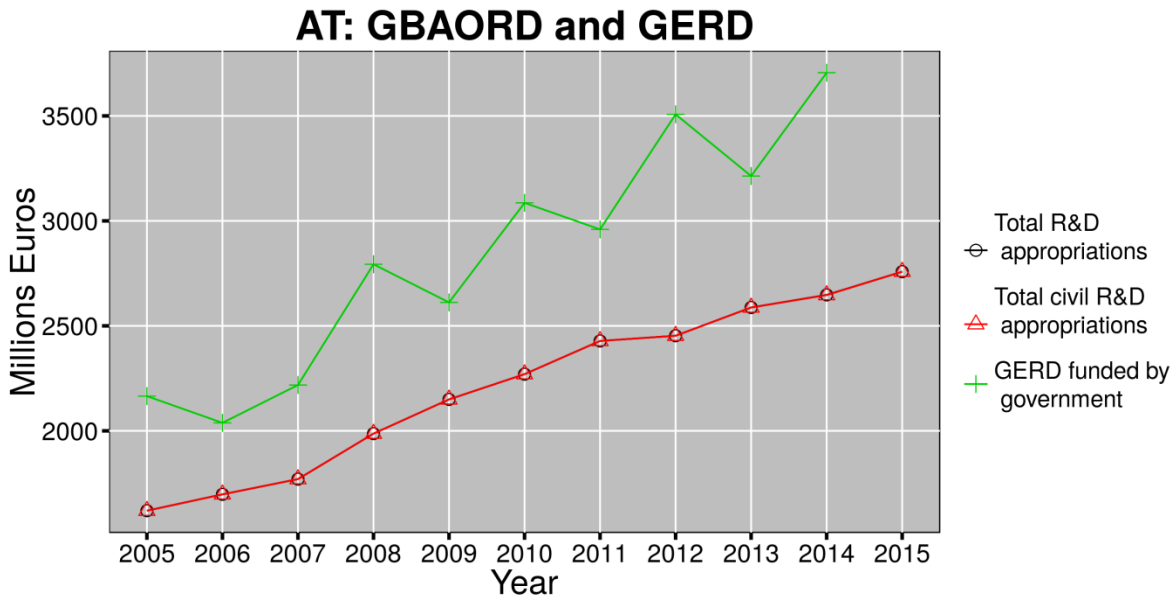

Figure 4: R&D appropriations and government funded GERD in millions of national currency. Data source: Eurostat

The total (civil) appropriations grew almost linearly in the period 2007-2015. The total and the civil appropriations are practically coincident, i.e. the appropriations for military R&D are almost non-existent in Austria.

The government funded GERD shows some fluctuations (with dips in 2009, 2011 and 2013) superimposed on an overall growing trend.

3.2.2.2 Direct public funding from abroad

Table 5 shows data about the external public sources of R&D funding for Austria (in €m).

Table 5: External public sources used for financing total Austrian R&D

Source from Abroad	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Total	1087.5	1163.4	1230.2	1240.5	1255.9	1297.6	1401.7	1436.0	1590.2	1499.4
BES	NA	1035.9	1103.6	NA	1114.5	NA	1211.8	NA	1362.6	NA
EC	NA	103.9	101.1	NA	111.5	NA	150.3	NA	180.7	NA
International Organizations	NA	14.3	14.1	NA	10.6	NA	7.6	NA	13.6	NA
Total as % GERD	18.0	18.4	17.9	16.4	16.8	16.1	16.9	15.7	16.6	15.3
EC as % GOVERD	NA	5.1	4.6	NA	4.3	NA	5.1	NA	5.6	NA

Despite some issues of data incompleteness, the overall emerging picture is quite clear. The business sector (obviously not a public source of funding) is the main source of funding from abroad (more than 50% of MNCs investing in Austria were headquartered in Germany).

The contribution from the European Commission has increased in nominal values, but it remains approximately one order of magnitude smaller than the one from business. Overall, the funding from abroad is far from negligible as it amounts to more than 16% of the Austrian GERD in 2013.

The contributions from international organizations are small enough to be left out from this discussion.

Distribution of public funding

Figure 5 below shows how the distribution of public funding to sectors of performance evolved over time:

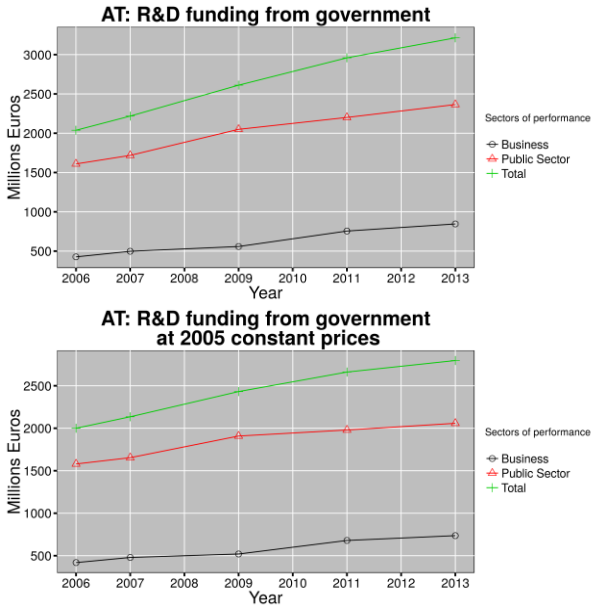

Figure 5: Government intramural expenditure by sectors of performance.
Data source: Eurostat

Unsurprisingly, the public sector is the main recipient of the government funding, with an almost linear growth from 2006 to 2011. Noteworthy is the increase in the direct support to business from 2009 onwards.

3.2.3 Indirect funding – tax incentives and foregone tax revenues

Considering the absence of harmonisation of the tax regimes in EU law, data come directly from national sources, using domestic definitions. Attention should be paid when interpreting data from different sources.

Austria promotes business R&D activities with generous tax incentives in the form of a cash back incentive also known as research premium ('Forschungsprämie'). In 2011, direct government funding of business R&D and indirect support via R&D tax incentives each accounted for 0.1% of GDP. In 2012, indirect support through tax credits exceeded direct funding for business sector R&D for the first time. Austria also used to offer an R&D allowance, i.e. a reduction of the tax assessment base ('Forschungsfreibetrag') at a maximum of 25% of total R&D expenditures. This allowance was discontinued in 2011. In exchange, the funding rate of the research premium was raised from 8% to 10%. The restructuring of the Austrian system for indirect R&D support to business has overall been regarded as a simplification which makes the system more comparable to good practice in other countries. In 2015, a decision to increase the research premium to 12% by 2016 was adopted by the Austrian government. Unfortunately, recent enough data to estimate the impact of the new research premium is not available.

In 2011 the take-up of the tax credit skyrocketed: in 2012 the volume of tax credits rose to €574.1m from €313.2m in 2011, for the first time exceeding the level of direct support which added up to€483m in 2012. Latest figures from Statistik Austria[124] from April 2015 show that after a decrease in 2013 (€378.3m), the research premium increased steadily to €493.2m in 2014 and even further to €501.9m in 2015. (see also section 3.5.2). The research premium was increased to 12% from the fiscal year 2016 onwards, and thus will have a budgetary effect beginning in 2017.

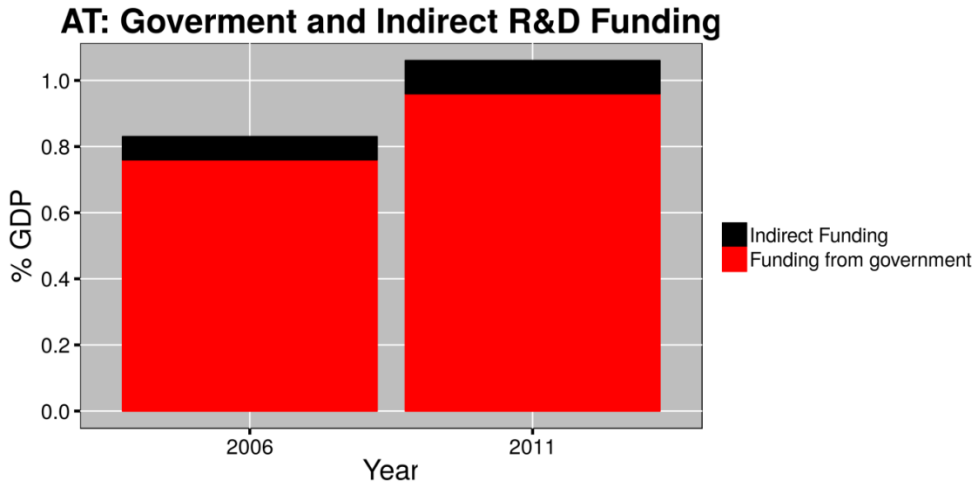

Figure 6: government and indirect funding to R&D.
Data source: OECD.

As one can see from figure 6, rather sparse data is available about the indirect funding to R&I in Austria. The 0.1% of the GDP for 2011 (already mentioned in this section) represents an increase with respect to the levels of 2006 and it amounted to almost 10% of the funding from the government.

3.2.4 Fiscal consolidation and R&D

As can be seen in Figure 7, in spite of some fluctuations, both GBAORD and government funded GERD are on an increasing trend since 2000. Figure 7 shows the scatterplot of the structural balance vs. GBAORD as % GDP (left panel) as well as GERD as % GDP (right panel)[125]:

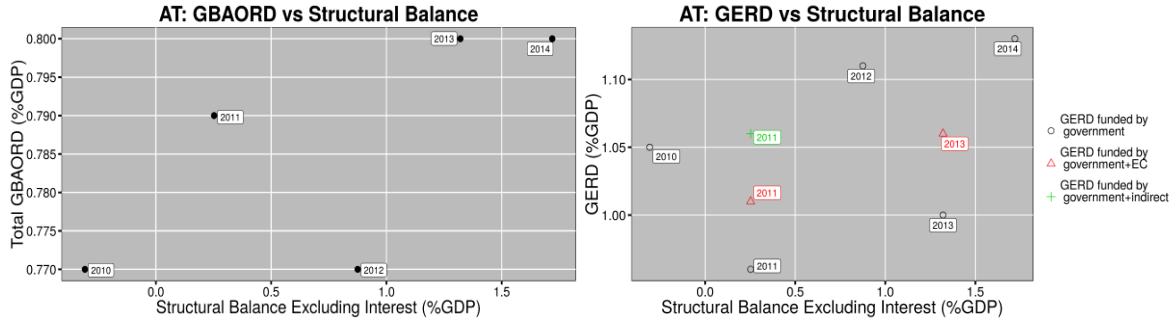

Figure 7: Fiscal consolidation and R&D.
Data sources: AMECO, Eurostat, OECD

[124] Statistik Austria, http://www.statistik.at/web_de/statistiken/forschung_und_innovation/globalschaetzung_forschungsquote_jaehrlich/023703.html

[125] Structural balance data comes from the AMECO database the other indicators were taken from Eurostat, and OECD.

Fiscal consolidation appears to have had a small negative impact of 0.02% of GDP on R&D appropriations in 2012, but otherwise GBAORD has been always increasing during the post-crisis fiscal consolidation period, i.e. 2010-2014 in the Austrian case.

The government funded GERD shows an overall increase from 2010 to 2014 whereas at the same time the structural balance improved. However, Figure 7 (right) shows small fluctuations every two years. The drop by 0.1% of GDP in 2011 has been fully compensated by indirect funding through tax incentives. Absence of more recent data on indirect funding does not allow for similar conclusions in 2013.

Based on the above analysis it can be argued that the post-crisis fiscal adjustment process has not come at the expense of public support to the Austrian R&D.

3.3 Funding flows

3.3.1 Research funders

The main sources of public research funding are to be found at the state level, namely the Federal Ministry of Science, Research and Economy (BMWFW) and the Federal Ministry of Transport, Innovation and Technology (BMVIT). The BMWFW is responsible for tertiary education and for basic research. It is also responsible for the Austrian Science Fund (FWF), the largest independent funder for basic research in Austria, and represents Austria at the European level on issues related to research and university education.

Through the merger in 2013 between the former Ministry of Economy, Family and Youth and the former Ministry of Science and Research, today's BMWFW is also responsible for innovation support, technology transfer and the promotion of entrepreneurship. It holds stakes of the Austrian Research Promotion Agency (FFG), which is the main agency for funding applied R&D, and the Austria Wirtschaftsservice Gesellschaft (AWS), which focuses on (pre)seed, guarantees or expansion and growth-finance of start-ups and SMEs. Finally, the BMWFW also supports the Christian Doppler Research Association (CDG) (Hofer, 2009).

The BMVIT is mainly in charge for applied research to which it contributes the majority of application-oriented research programmes. It is the majority shareholder of the Austrian Institute of Technology (AIT). Also the BMVIT holds stakes at FFG and AWS.

The R&D funding activities of other, sectoral ministries (e.g. for agriculture, health, education etc.) are comparably small and basically focused on contracting research required by the respective ministry for the fulfilment of its responsibilities.

In addition to the public budgets of the ministries, public funding for R&D also comes from the National Foundation for Research, Technology and Development ("Nationalstiftung"), whose capital endowment comes from the Austrian Federal Reserve, the ERP Fund and the federal level. It competitively allocates money to research funding structures, namely the FFG, FWF, AWS, ÖAW, LBG and CDG[126], which fall under the authority of the federal government. In 2015 the remunerations of the National Foundation for RTD were mainly used for strengthening research infrastructures, complexity research and support for establishing new knowledge-based business.[127]

At the operational level, most of the funding for R&D and innovation is managed by three agencies on behalf of the ministries: the FWF is the most important body for the funding of basic research, the FFG funds applied research and development, and the AWS is specialised in funding start-ups and innovation projects in companies. The FWF funds are allocated based on international peer-review procedures.

[126] Nationalstiftung 2015
[127] Rat für FTE 2015.

Decisions on funding of applied research and innovation by the FFG are usually done via panel/jury and peer review decisions based on specific tailored evaluation criteria. Its funding decisions have to be taken upon the principles of transparency, impartiality and fairness as regards application and funding procedures.

As regards the AWS selection procedures, selection criteria and processes typically require an affiliation to one of Austria's high-tech sectors, in particular ICT, life sciences, physical sciences or nano technology. Procedures follow common investment and banking ones as regards start-up and SME access to venture capital (e.g. letter of intent, due diligence and exit).[128]

In Austria sources of private not-for-profit funding of public research performers are almost negligible[129] amounting to only 1% of funding of the HES. The volume of donations distributed by foundations in Austria for serving the public good is only around €20m to €25m per years according to an estimate of the Julius Raab Stiftung[130]. This low volume is caused by the fact that most of the 3112[131] foundations in Austria do not serve the public good[132] but their own[133] and, secondly, that even public-good donations are taxed with 25%. To increase this volume, the current government proposed changes to the foundation law.

3.3.2 Funding sources and funding flows

As regards the overall composition of national R&D funding between private and public funding in general and within public funding sources in particular no peculiar changes can be observed during the last 3 years.

The share of public R&D funding was 34.1% in 2013. As regards public funding sources, 74.3% of public spending for R&D in 2013 came directly from the federal level, in particular the two competent ministries BMWFW and BMVIT. 9.4% came from the provincial level (i.e. the "Bundesländer") and a mere 0.2% from the local municipalities. The remaining 16.1% came from research funding agencies, mainly FFG and FWF. Also included thereunder is R&D financing by the HES.

EU funding for R&D in Austria is comparatively small. In 2013 its share accounted only 1.9% of the overall total R&D funding in Austria. Around 2/3 of the EU funding comes from the European Framework Programmes for RTD. The reminder is mostly from structural funds. Structural funds money for R&D is thus around 0.5% in Austria and it is mainly absorbed at regional level through various initiatives of the "Bundesländer". Under the structural funds period 2007 until 2013, many research, technological development and innovation projects were funded at the science-industry interface. The main R&D related activities funded have had a focus on innovation and technology development under the title "innovative business". Examples are cluster-policies or the establishment of incubators. Most of them addressed explicitly SMEs. In some Federal States, e.g. Carinthia, Upper Austria and Styria, more research related projects were funded, especially in the context of the national COMET programme (see section 3.5 for more details). Maybe also because of their smallness, structural funds financing was fully absorbed in Austria. There were, however, severe complaints of the fund takers as regards the disproportionality of the administrative efforts.[134] Also several funding providers claimed too high bureaucratic efforts. This raised questions if the system of structural funding in Austria should be further simplified or even abandoned.[135]

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[128] Cuntz 2015.
[129] Leo 2012.
[130] http://www.juliusraabstiftung.at/unsere-ideen/gemeinnuetzige-stiftungen/111.gemeinnuetzige-stiftungen-oesterreich-kann-mehr.html; accessed on 15 October 2015.
[131] In 2010.
[132] In 2014, 701 foundations for public good exist in Austria according to: Bund der gemeinnützigen Stiftungen (2015).
[133] Leo 2012.
[134] Rat für FTE 2013b.
[135] Such questions were openly discussed during the ERDF-kick-off event „Investitionen in Wachstum und Beschäftigung

In the new structural funds period 2014-2020 €536m are allocated via the ERDF for Austria, which should stimulate an investment at the amount of €2b including additional national and private funds (see also section 2.4). 90% of the funding is concentrated on three priority intervention areas, namely (i) research and development and innovation; (ii) fostering the competitiveness of SMEs and (iii) facilitating the transition towards a CO_2 reduced economy. 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 will be implemented. Out of these, 11 are directly addressing R&D and innovation support (see Table 6).

Österreich 2014-2020" on 1 October 2015 in Vienna in the House of the European Union, especially reflecting a presentation of Markus Gruber on 20 years of ERDF (regional) programmes in Austria.

Table 6: Overview on ERDF funding areas in Austria (2014-2020)[136]

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 $C0_2$ 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

[136] ÖROK 2015b.

Main intervention area	Measure Number	Measure description	Potential beneficiaries	Regional coverage	Total funding budget foreseen (national public and ERDF) (2014-2020)
	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 development	Public corporations, public and private cooperations, foundations and funds, HEI, other	Upper Austria, Vienna	€ 14,550,000
	M19	Optimizing locational and settlement structures in the context of Upper Austrian city regions	Public corporations, associations, public organisations, entreprises	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

Apart from European programmes, transnational or inter-regional public funding plays a minor role in Austria

In 2013, 48.7% of the total R&D expenditures in Austria were financed by the business enterprise sector in Austria. Another 14.7% was financed from abroad (without EU funds). This share of financing from abroad is almost entirely R&D funding of multinational companies financing R&D activities of their subsidiary companies in Austria. Thus, in total the share of private funding in Austria amounts to around 63%.[137]

3.4 Public funding for public R&I

3.4.1 Project vs. institutional allocation of public funding[138]

In general, public funds in Austria are more often distributed via institutional than via project-based modes, roughly accounting for 3/4 and 1/4, respectively, of all (direct) public funds. This relation has not changed significantly but remained stable during the last couple of years.

The share of institutional funds allocated on a competitive basis in Austria has been weakly increasing during the last years.[139] Public funding performed in the higher education sector is mostly institutional and accounting for more than 90% of total institutional funding in Austria. Only a very small fraction of institutional funds is performed in government and private non-profit R&D sectors.

The share of institutional HEI funding in civil GBAORD is close to a remarkable 60% in 2013 in Austria and the highest in relative terms among all OECD economies, only comparable to shares observed in Sweden or the Netherlands.

The overall R&D funding of the Austrian HES depends to a high extent on public funding (88% in 2013). The contribution of the business enterprise sector to the R&D budgets of Austrian universities is 5%. 2% of the overall HES funding comes from abroad (without EU funding); 4% from EU funding, only 1% from the private non-profit sector, which is still negligible as funding sector for R&D in Austria. Within the HES project-based funding is relatively limited, whereas more than 60% of this type of funding is performed by Austrian businesses.[140]

R&D project financing is competitively organised in Austria mainly through the activities of the FWF and the FFG. The Research and Technology Funding Act was revised to implement new governance and organisational structures of FWF and entered into force as of 1 October 2015. Moreover, on 1 January 2015 the new guidelines for funding of research and innovation projects have entered into force.

These new guidelines correspond to the European legislation Nr. 651/2014 of the European Commission from 17 June 2014. The following new RTI-guidelines replace the previous RTD-guidelines:[141]

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137 http://www.statistik.at/web_de/statistiken/energie_umwelt_innovation_mobilitaet/forschung_und_innovation/f_und_e_in_allen_volkswirtschaftlichen_sektoren/index.html; accessed on 31 January 2016.

138 Institutional funding is defined as the total of national budgets in a given country, attributed to an institution, with no direct selection of R&D project or programmes and for which money the organisation has more or less freedom to define the research activities to be performed. Institutional funding can be in the form of non-competitively allocated Block funding. Institutional funding may also be allocated in a variable/competitive manner tied to institutional assessments. Project funding is defined as the total of national budgets in a given country, attributed to a group or an individual to perform an R&D activity limited in scope, budget and time, normally on the basis of the submission of a project proposal describing the research activities to be done. Steen, J. v. (2012), "Modes of Public Funding of Research and Development: Towards Internationally Comparable Indicators", *OECD Science, Technology and Industry Working Papers*, 2012/04, OECD Publishing. http://dx.doi.org/10.1787/5k98ssns1qzs-en.

139 Cuntz 2015.

140 Ibid.

141 https://www.bmvit.gv.at/innovation/foerderungsrecht/richtlinien/fti_richtlinien_2015.html, accessed on 30 June 2015.

- **Thematic-RTI-Guideline** as basis for programmes focussing on thematic priorities, in particular with emphasis on societal challenges-
- **Structure-RTI-guideline** as basis for thematically open programmes which aim to improve research structures, especially in terms of science-industry relations.
- **Human resources-RTI-guideline** as basis for thematically open programmes, which tackle the Austrian research area via human resource related issues.

These changes in the guidelines also triggered corresponding changes of the guidelines for the Austrian Research Promotion Agency. The following new FFG-guidelines replace the previous FFG-guidelines of 2007:[142]

- **FFG-Guideline Offensive** as basis for programmes, whose focus is on strategic funding for enhancing an impact-oriented RTI policy (incl. programmes such as Competence Headquarter, BRIDGE, etc.; see section 3.5 for more details).
- **FFG-Guideline SME** as basis for thematically open programmes targeting SMEs.
- **FFG-Guideline Industry** as basis for thematically open programmes, which are not targeting SMEs.

3.4.2 Institutional funding

The financing structure of public universities changed considerably with the University Act of 2002[143] which bases the larger institutional block or core funding and the considerably lower competitively allocated institutional funding (the so called 'Higher Education Area Structure Means'[144]) to universities on three-year performance agreements between each university and the BMWFW.[145] These two financing parts together form the global institutional budget of the universities. Their usage is up to the discretion of the universities themselves. The current contracting period runs from 2013 to 2015. Basically, the number of students, weighted by groups of studies, constitutes the institutional block funding.[146]

The indicators for the performance based part of the financing of public HEI in Austria, which are the so called "Hochschulraum-Strukturmittel" ('Higher Education Area Structural Means'), are based on five criteria, and are as follows, taking the actual state-of-art after revision of the "Hochschulraum-Strukturmittelverordnung"[147] (Higher Education Area Structural Means Regulation') into account:

- Criterion 1) regular studies with active examinations (this criterion accounts for 60% of the available financial means distributed under the 'Higher Education Area Structural Means'):
  Indicator: number of regular bachelor, diploma and master studies with active examinations weighted according to grouped fields of study;

- Criterion b) graduates of regular studies (this criterion accounts for 8% of the available financial means distributed under the 'Higher Education Area Structural Means'):
  Indicator: number of graduates of regular bachelor, diploma and master studies with active examinations weighted according to grouped fields of study;

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[142] https://www.bmvit.gv.at/innovation/foerderungsrecht/richtlinien/ffg_richtlinien_2015.html, accessed on 30 June 2015.
[143] Bundesgesetz über die Organisation der Universitäten und ihre Studien (Universitätsgesetz 2002 – UG)StF: BGBl. I Nr. 120/2002 (NR: GP XXI RV 1134 AB 1224 S. 111. BR: 6697 AB 6717 S. 690.); http://www.ris.bka.gv.at/GeltendeFassung/Bundesnormen/20002128/UG%2c%20Fassung%20vom%2031.01.2016.pdf; accessed on 31 January 2016.
[144] In German: Hochschulraum-Strukturmittel.
[145] https://www.ris.bka.gv.at/Dokumente/BgblPdf/2002_120_1/2002_120_1.pdf, last accessed on 4 July 2015.
[146] BMWF and BMVIT 2013.
[147] Verordnung des Bundesministers für Wissenschaft und Forschung über die Bemessung der Hochschulraum-Strukturmittel (Hochschulraum-Strukturmittelverordnung -HRSMV), StF: BGBl. II Nr. 292/2012. https://www.ris.bka.gv.at/GeltendeFassung/Bundesnormen/20007973/HRSMV%2c%20Fassung%20vom%2031.01.2016.pdf; accessed on 30 January 2016.

- Criterion c) knowledge transfer (this criterion accounts for 15% of the available financial means distributed under the 'Higher Education Area Structural Means'): Indicator: revenues of R&D projects and projects for developing and exploiting arts in Euro, generated through FWF (the Austrian Science Fund) or EU sources, whereat revenues of FWF are weighted by factor 2;
- Criterion d) structured doctoral education (this criterion accounts for 4% of the available financial means distributed under the 'Higher Education Area Structural Means'):
  Indicator: number of doctorate candidates with a regular employment relation to the university;
- Criterion e) cooperation (this criterion accounts for 13% of the available financial means distributed under the 'Higher Education Area Structural Means'): Indicators for this criterion are designed case-by-case based on specific calls for proposals to engage in cooperative activities in the fields of education, research, and administration.The means for criterion d) will be first allocated in 2017 based on data of 2016.

According to the revision of the University Act in 2013, a transition towards a capacity- and student-oriented university financing has been concluded,[148] whose aim is to provide a sufficiently high number of study places based on unit costs[149] - without reducing the total number of students enrolled in 2013 - according to qualitatively adequate international benchmarks. Special emphasis is on improving the student-professor ratio. The capacity- and student-oriented university financing model will be fully implemented the first time in the performance agreement period 2019-2021. For the performance agreement period 2016-2018 up to 60% of institutional funding to HEIs will be based upon this model.[150]

Performance agreements have also been concluded with Austria's largest non-university research organisation, the Austrian Academy of Sciences (ÖAW); the first for the period 2012-2014, signed in 2011 and the second for the period 2015-2017, signed in 2014, which are also indicator-based. In 2015 a performance agreement with IST Austria was concluded for the first time.[151] Institutional funding of the few other non-university research organisations in Austria which receive institutional funding is usually based on extrapolated yearly budgets. On the other hand institutional funding for the universities of applied sciences is based on unit cost based study place allocations.

Within the scope of their autonomy HEIs themselves are responsible for quality assurance and improvement in the areas of teaching, research and organisation. To supervise and thus ensure the quality of the HEI the Agency for Quality Assurance and Accreditation Austria (AQ Austria) was established in 2012. AQ Austria is responsible for the entire higher education sector in Austria (with the exception of university colleges of teacher education).[152] AQ basically organises accreditation procedures and audits.

The accreditation procedures are implemented for private universities and universities of applied sciences for state recognition according to the Act on Quality Assurance in Higher Education. In turn, audits are conducted with the aim to certify that the higher education institution's internal quality management system is effective and properly organised and supports further improvement of that system.

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[148] https://www.ris.bka.gv.at/Dokumente/BgblAuth/BGBLA_2013_I_52/BGBLA_2013_I_52.pdf;accessed on 5 July 2015.
[149] A study place according to the law, §14c, is based on examination active students, who have to have passed and delivered a minimum of 16 ECTS points and at least 8 so called "semester hours" ("Semesterstunden") in a study year.
[150] https://www.ris.bka.gv.at/Dokumente/BgblAuth/BGBLA_2013_I_52/BGBLA_2013_I_52.pdf; see §14f; accessed on 5 July 2015.
[151] http://wissenschaft.bmwfw.gv.at/bmwfw/forschung/national/forschung-in-oesterreich/partner-institutionen/institute-of-science-and-technology-austria-ist-austria/ and http://wissenschaft.bmwfw.gv.at/uploads/tx_contentbox/Leistungsvereinbarung_2015-2017.pdf; accessed on 25 April 2016.
[152] https://www.aq.ac.at/en/; accessed on 5 July 2015.

There is no formal system for institutional evaluations of non-university research organisations in place in Austria, while research funding organisations such as FWF, FFG and AWS and umbrella organisations such as LBG or CDG are undergoing external evaluations every now and then. FFG, AWS and CDG will be institutionally evaluated in 2016. For the CDG, this will also include the programmes being implemented (i.e. Christian-Doppler-Laboratories and Josef Ressel-Centres). The public RTI funding agencies and R&D organisations directly under public control are also regularly audited by the Austrian Court of Auditors.

3.4.3 Project funding

Around two thirds of direct competitive public project funding is distributed via bottom-up programmes which are not pre-assigned to any thematic priority ('generic funding'). Structural and thematic programmes share the rest. The major sources for thematically open 'bottom-up' project-based funding of R&D activities are the programmes of Austria's two major funding agencies, the FWF and the FFG.

The major part of project-based funding in Austria addresses structural or horizontal priorities, e.g. scholarships and grants for individual researchers or cooperation between various players of the research system, mostly academia and businesses.[153]

The FWF is the main funding agency for basic research in Austria, open to all fields of science. It is primarily financed by the BMWFW. Projects can be submitted by individual researchers as well as by teams. Each project is evaluated by international peers and funding decisions are taken according to the standards of the international scientific community. The main selection criterion is excellence. According to BMWFW the total FWF funding stood at €204.7m[154] in 2015 (2014: €211.4m[155], 2013: €202, 2012: €196.4m, 2011: €195.2m). Despite the fact that all major RTI policy studies[156] request increasing competitive budgets especially for basic research, the budget of the Austrian Science Fund (FWF) has increased only gradually during the last years (and even dropped in 2015), while success rates show a declining trend.

Most of the FWF funds went to Austrian universities (2015: 84%, 2014: 85%; 2013: 83%, 2012: 80.8%; University of Vienna: 25.3% of total in 2015; 2014: 19.9%, 2013: 18.7%); 8.9% to the Austrian Academy of Science (2014: 8.2%, 2013: 7.0%) and 5.3% to other R&D institutions (including universities from abroad, 2014: 5.0%, 2013: 6.2%) or to applicants with no current affiliation.

According to the BMWFW, almost half of the total funds approved by the FWF in 2015 were granted to individual scientists on basis of dedicated research proposals (i.e. €93.4m). The success rate was 24.9%. In 2015, €22.4m of total funds supported the establishment of new or the continuation of structured doctoral programmes in the higher education sector ("Doktoratskolleg") with a success rate of 83.3% for continuing doctoral programmes and 21.8% success rate for new doctoral programme proposals.

[153] Cuntz 2015.
[154] BMWFW and BMVIT 2015.
[155] BMWFW and BMVIT 2015.
[156] Leitner et al. 2015.

Further important action lines within the FWF portfolio in 2014 were the targeted programmes "Spezialforschungsbereich" ('special research area') and "Nationales Forschungsnetzwerk" ('national research network') with approvals amounting to €24.7m (€31.1m in 2014) (success rate of 84.3% as regards continued national research networks and only 3.1% success rate in terms of newly proposed national research networks), and international programmes with an approved budget of € 21.4m (2014: €27.2m) with a success rate of 14.4% (2014: 19.5%). The rest was allocated to international mobility of researchers, awards, career support measures, the PEEK programme for arts related research and for support for science communication.[157] The research personnel financed directly through FWF grants amounted to a 4,110 headcount (46% women) in 2015 compared to a headcount of 3,542 (46% women) in 2011. During 2010 and 2014, 40.1% of the grants are consumed by researchers from the fields of biology and medicine, 40.9% by natural sciences and engineering sciences and 19.0% by social sciences and humanities. [158]

The funding budget of the Austrian Research Promotion Agency (FFG) in 2014 was €620.3m (incl. guarantees) respectively €481.4m in cash values. The majority of FFG funding comes from the BMVIT. Almost 60% of all FFG funds (incl. guarantees) in the same year went to Austrian companies. In terms of cash values, 48% went to companies in 2014 (60% in 2013), 34% to non-university research institutions and competence centres, and 17% to universities. The relatively low cash value share of companies in 2014 is mainly caused by the unique budget appropriations to the COMET competence centre programme in this year. In general, funding decisions are done by jury or panels, sometimes supported by peer reviews, and are always based on clearly communicated criteria, including excellence and economic potential.

Thematically targeted R&D priority funding still remains relatively small in Austria. Most thematic R&D programmes in Austria, which usually focus on societal challenge topics (mainly renewable energy and energy efficiency, ICT and mobility), are managed by FFG, which spent around 29% or €139.6m (2013: 26% equal to €117m; 2011: 27%) of its total funds in 2014 on thematic lines.

Apart from very few exceptions in the field of agriculture and environment, thematic R&D programmes are mainly commissioned by the BMVIT, less by BMWFW and not by sector ministries. Another €110m of funds were invested by the Austrian climate and energy fund in 2014 and allocated on several programme lines and agencies.[159] In sum, thematic funding in 2013 accounts for roughly 10% of total GBAORD in Austria. One of the main focus areas for grand challenges and in terms of budgeting is climate and energy related R&D.

[157] BMWFW und BMVIT, 2015.
[158] BMWFW und BMVIT, 2015.
[159] Cuntz 2014.

In Austria all R&D programmes have to undergo an evaluation. The R&D programme evaluations in 2014 and 2015 included among others the accompanying evaluation of the women led "Laura Bassi Centres of Expertise"[160], the ex-post evaluation of the competence centre programmes Kplus and K_ind/K_net (the precursors of the COMET programme) [161], the evaluation of the Austrian bilateral science and technology agreements and MoUs[162], the ex-post evaluation of the Austrian genome research programme (GEN-AU)[163], the terminal evaluation of the AT:net (the Austrian electronic network programme)[164], the evaluation of the R&D support programme for universities of applied sciences (FHplus)[165], the impact evaluation of the Erwin Schrödinger Fellowships with return phase[166], the interim evaluation of the human resource development programme "Talente"[167], the ex-post evaluation of the Austrian R&D security programme "KIRAS"[168], the evaluation of the Doctoral Programme of FWF[169] and others, whose detailed listing[170] and analysis would require several pages.

3.4.4 Other allocation mechanisms

Other than institutional or project based allocation mechanisms are only marginally available in Austria. The most important ones might be the yearly awards for excellent single researchers (i.e. The "START-Programm", which is very similar to the ERC Starting Grant, and the "Wittgenstein-Preis") with a total sum of €10.5m in 2015 donated by FWF.

3.5 Public funding for private R&I

3.5.1 Direct funding for private R&I

Austria spends a high proportion of public funding for private R&D. 25.9% of total public R&D funding went to the business enterprise sector in 2013. The contribution of public funding to overall R&D in the BES was €846.8m or 12.5% of R&D funding performed in the BES in 2013. Almost 70% of this sum was financed by the federal level and another 26% was financed through competitive project based funding, mainly by FFG.

The rest of the public funding for private R&D originated from the federal states ("Bundesländer"). From this public R&D funding of €846.8m which are allocated to the BES, around a quarter is allocated within the BES to the so called 'cooperative sector', which consists of R&D institutions, such as the AIT or the Competence Centres, whose main purpose is to serve industrial R&D demands and needs. Three quarters or €641m of public funding for private R&D was allocated to private companies. Around a quarter of the €846.8m was financed through competitive project based funding. The rest was mainly allocated by the federal level through the research premium, which amounted to €378m in 2013 for the whole BES sector.[171]

[160] Heckl und Dörflinger, 2014.
[161] Schibany et al., 2013.
[162] Schuch et al., 2013.
[163] Warta et al., 2014.
[164] Ruhland und Wolf, 2014.
[165] Dinges et al., 2014.
[166] Bührer and Meyer, 2014.
[167] Heckl et al., 2014.
[168] Heinrich et al., 2014.
[169] Ecker et al., 2014.
[170] All evaluation studies are published on www.fteval.at, last accessed on 8 October 2015. Summaries of major evaluations are published in BMWFW und BMVIT (2014; 2015).
[171] http://www.statistik.at/web_de/statistiken/energie_umwelt_innovation_mobilitaet/forschung_und_innovation/f_und_e_in_allen_volkswirtschaftlichen_sektoren/index.html; accessed on 31 January 2016.

The main public programme to stimulate research and innovation in the private sector is the 'bottom-up' designed general programme of FFG with a total budget (incl. guarantees) of €310.7m [172] in 2014 (2012: €271m; 2011: €258.4m and 2009: €263.5m[173]) respectively a cash value of €171.9m in 2014. Also important are several other structure-oriented or thematically-oriented programmes of FFG which focus either on structural and institutionalised science-industry collaborations or on thematic collaborative R&D projects.

In 2014, the structure oriented R&D funding programmes of the FFG without a thematic focus – apart from the general programme, which includes also the "Bridge" programme with a separate cash value of €17.1m in 2014 - included the "COMET" programme with a cash value of €106.1m, "Research Studios Austria" (€15.8m), "COIN" (€13.3m) and the human resource oriented umbrella programme "Talente" (€8.5m), mainly targeting joint science-industry R&D projects and technology transfer, with more than 30% of FFG's overall budget.[174]

Due to the high allocation to the COMET programme in 2014 the overall share of structure oriented R&D funding programmes within the FFG portfolio was much higher than in 2013.

The most important thematically-oriented programmes are 'e!MISSION' in the field of energy-related R&D, 'ICT for the Future', 'Production of the Future' and 'Mobility of the Future'.[175] Most of these are mission-oriented addressing societal challenges (see also section 3.4.3).

In 2014 a few new funding instruments have been launched by FFG, including endowed professorship, a pilot initiative on "heating and cooling in historical buildings" through pre-commercial procurement and a new programme called "Forschungspartnerschaften" ('research partnerships') to support doctoral education at the interface between science and economy.[176]

The application procedures for participating in the programmes of FFG are relatively lean, backed up by an online application system. The selection criteria of the general programme of FFG and the science-industry focused R&D programmes are straightforward including aspects of excellence and economic leverage. Peer review is occasionally used, but most selection procedures are panel or jury-based. The R&D funding rate for the applying companies, which is usually around 50%, however varies with their status (SME or non-SME) and the technology-readiness position of their proposals.

Since Austria has a strong industrial SME basis, most of the applied and industry oriented R&D programmes are directly targeting SMEs (exceptions are the COMET programme or the Headquarter Programme, which both have a stronger focus on large firms, but do not exclude SMEs at all). Some measures, such as the innovation voucher programme, on the other hand, are addressed to SMEs with little or no systematic R&D in place.

In general, public funding streams cover the entire R&D&I process from fundamental research to market innovation. More recently, missing links in this process are being addressed, e.g. funds are allocated to prototype research targeting the commercialisation of university (basic) research results (i.e. new technology transfer centre program "Prize" launched in 2014). Similarly, overall funds assure a high connectivity among major actors in the science and innovation system.

[172] BMWFW und BMVIT, 2015.
[173] Yearly comparison numbers are taken from Cuntz 2015.
[174] BMWFW und BMVIT, 2015.
[175] BMWFW und BMVIT 2015.
[176] BMWFW und BMVIT, 2015.

High connectivity is correlated with a high number of fairly effective policy instruments fostering knowledge and technology transfer, launched in the past decade.

Similarly, Austria has a relatively high share of public-private co-publications of 3.1% (see also Table 6) of the total (EU-28 average: approximately 1.8%) and it ranks 4th worldwide in terms of university-industry research collaborations (WEF Competitiveness Report).[177]

In Austria, also well-targeted, clearly differentiated, and easily accessible support schemes to finance innovation are in place. Most of these public funded schemes are managed by AWS, the Austrian federal promotional bank. The priorities of AWS in its multiannual strategic programme, which runs from 2014 to 2016, are set on business start-ups and on growth and industry. The monetary funding and financing instruments encompass low-interest credits, guarantees, grants and more and more also venture capital financing. AWS also provides information, consultancy and other services.

This includes also IP consulting. Since 2013, AWS is in charge for managing the BMWFW programme 'Knowledge Transfer Centres and IPR-exploitation'. Three regional knowledge transfer centres were established, which next to services in the field of technology transfer also cater for transfers and cooperation projects between universities and other stakeholders in the field of social sciences and humanities. In addition a thematic knowledge transfer centre in the field of life sciences was established with a focus on pre-clinical agents and diagnostics development. [178]

AWS support usually requires an innovation orientation of the submitted projects to become active. Pure replacement investments are excluded. In 2014, 5,141 innovation and growth projects with a total project volume of €1.87b were funded by AWS. However, both the number of projects and of the total financing volume decreased compared to 2013 due to the weak economic activity.[179] For projects supported by AWS usually two or more instruments are combined to guarantee a sound financing basis for companies and also to reduce the allocation of public means (e.g. combining grants with guarantees to leverage credits on the private bank market). Thus, it is not surprising that an increase of guarantees, grants and venture capital could be observed in 2014 compared with 2013. A fifth of all funding services of AWS are guarantees and more than half are credits. Both instruments showed a trend towards smaller projects in 2014.[180]

Based on agreements with the EU programmes 'Competitiveness of Enterprises and SMEs' (COSME) and 'InnovFin' (EU Finance for Innovators), AWS is in the position to allocate additional funding in the next two years and to reduce the costs of guarantees.[181]

AWS explores crowdfunding support mechanisms and social business development. In 2014, AWS Equity Finder, a capital brokerage platform, to facilitate contact between business angels, venture capitalists and crowdfunding and crowd-investment platforms was established. Indigenous leadmarket initiatives are not fully worked out in Austria, but due to the high export orientation of Austrian businesses respective developments in major economic partner countries such as Germany are closely observed and supported in Austria through special R&D programmes (e.g. in the field of eMobility). Other innovative financing solutions in the frame of private-public partnerships are explored but not frequently implemented.

[177] Cuntz 2015.
[178] BMWFW and BMVIT 2015.
[179] BMWFW and BMVIT 2015.
[180] BMWFW and BMVIT 2015.
[181] BMWFW and BMVIT 2015.

Programme based funding schemes are regularly evaluated and benchmarked against comparable schemes in other countries. An exception to this general principle which is stipulated by law is the research premium (see 3.5.2). It is not clear if it will be subject to an external evaluation in 2016.

Public procurement of innovation and precommercial procurement

Public procurement in Austria represents around €40b per year[182]. The potential for Public Procurement Promoting Innovation (PPPI / *Innovationsfördernde Öffentliche Beschaffung*, IÖB) is estimated at 2%-5% of total public procurement.

Austria transposed the two 2004 Directives on public procurement (2004/17/CE and 2004/18/CE) into national law in 2006 with the Federal Public Procurement Law 2006 (*Bundesvergabegesetz* 2006, *BVergG* 2006). Article 16 of Directive 2004/18/CE and Article 24 of Directive 2004/17/CE including exemptions for R&D services were also transposed into national law and the corresponding provisions can be found in § 10 (13) of the Federal Public Procurement Law (*BVergG*)[183].

PCP/PPI landscape in Austria

At the beginning of this decade the move towards a strategic planning of public procurement of innovative products and services gained strong momentum in Austria.

In spring 2011, the Austrian Strategy for Research, Technology and Innovation (*FTI-Strategie der Bundesregierung*) was published. The strategy is the main policy document for Austria's R&I policy for the present decade and it made public procurement of innovative products and services a priority. Simultaneously, the Austrian Council of Ministers' approval of a strategic approach towards innovation-friendly public procurement formed the political basis for the creation of a national concept for innovation-oriented public procurement[184]. According to the Council of Ministers, *Public Procurement Promoting Innovation (PPPI / Innovationsfördernde Öffentliche Beschaffung*, IÖB) essentially comprises two types of instruments:

- Pre-commercial procurement of research and development services by the public sector;
- Commercial procurement of innovation (via the normal procedures of procurement of goods and services by the public sector).

The concept was developed under the auspices of the Federal Ministry of Transport, Innovation und Technology (BMVIT) and the Federal Ministry of Economy, Family and Youth (BMWFJ) in cooperation with the Federal Procurement Agency (BBG) and the Austrian Institute of Technology (AIT).

The process led to the creation of the national *Action Plan on Public Procurement Promoting Innovation (PPPI)* which was adopted by the Austrian Federal Government in September 2012[185]. The Action Plan covers a broad range of activities, recommendations and proposed measures in the field of PPPI and also contains specific references to and provisions for both PCP and PPI. The responsibility for the ongoing implementation of the Action Plan lies with the Ministry of Science, Research and Economy (BMWFW) and the Ministry for Transport, Innovation and Technology (BMVIT)[186].

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[182] Cuntz, 2015, RIO Country Report Austria 2014, p. 44.

[183] http://www.jusline.at/10._Vom_Geltungsbereich_des_Gesetzes_ausgenommene_Vergabeverfahren_BVergG2006.html

[184] http://www.bbg.gv.at/fileadmin/daten/Downloads/IOEB/IOEB_-_5_-_Ministerratsvortrag_IOEB.pdf
http://www.ioeb.at/fileadmin/ioeb/dateiliste/dokumente/Downloads___Links/IOEB_-_4_-_Erster_Ministerratsvortrag_IOEB.pdf

[185] https://www.bmvit.gv.at/service/publikationen/innovation/forschungspolitik/downloads/leitkonzept_ioeb.pdf
http://www.ioeb.at/fileadmin/ioeb/dateiliste/dokumente/Downloads___Links/IOEB_-_1_-_IOEB-Leitkonzept.pdf

[186] After the federal election in autumn 2013, the Federal Ministry of Economy, Family and Youth (BMWFJ) was transformed into the Ministry for Science, Research and Economy (BMWFW).

The approval of the Action Plan of the Council of Ministers constituted a formal political commitment to public procurement of innovative solutions[187].

The Austrian Federal Government commits itself to a modern and innovation-friendly system of public procurement. The Council of Ministers states that the public sector should increasingly procure innovative and high quality technological products and services, wherever an added value can be expected. The Council sees three main benefits of such an approach:

- better services for citizens and a more efficient and effective public administration (e-government, online tools);
- contribution to solving societal challenges (e.g. eco and resource efficient products, e-mobility);
- the public sector acting as an "intelligent customer" that helps opening up reference markets for new products, services and procedures and provides incentives for increased R&D activity in the business sector.

The Council also emphasised the importance of, among others,

- sustained political support for innovation-friendly public procurement at all levels of public administration;
- creation of PPPI strategies in those contracting public entities where innovative public procurement plays an important role, e.g. because of complex technical products to be purchased, which offer scope for further technological development;
- development of quantitative indicators and measurement systems in order to better assess the success and impact of PPPI policy;
- establishing clear responsibilities for promoting innovation in public procurement (such as procurement coordinators).

Some of the objectives of the Action Plan have already been realised such as the amendment of the Federal Public Procurement Law (BVergG) in 2013 which now allows for including innovation as a secondary procurement criterion next to social, ecological and SME related aspects (§§19 and 187)[188]. Another objective that has been realised in 2013 is the establishment of a PPPI service centre as part of the Federal Procurement Agency (BBG). It serves as a first point of contact and supports pilot projects of interested public bodies. The service centre also partners with other institutions active in innovation policy, namely Bundesimmobiliengesellschaft (BIG), Austrian Energy Agency (AEA), the Austrian federal promotional bank AWS and the applied research promotion agency FFG, and offers education and training modules[189].

A first study on approaches to measure quality and efficiency of PPPI policy was commissioned by BMWFJ and published in February 2012[190]. A comprehensive impact evaluation of the Action Plan is scheduled for 2017. Development of a monitoring system and an indicator set has been started in 2014[191].

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[187] http://www.bbg.gv.at/fileadmin/daten/Downloads/IOEB/IOEB_-_3_-_Ministerratsvortrag_IOEB_vom_25.09.2012.pdf http://www.ioeb.at/fileadmin/ioeb/dateiliste/dokumente/Downloads___Links/IOEB_-_6_-_Zweiter_Ministerratsvortrag_IOEB.pdf

[188] http://www.jusline.at/19_Grunds%C3%A4tze_des_Vergabeverfahrens_BVergG2006.html; http://www.jusline.at/187_Grunds%C3%A4tze_des_Vergabeverfahrens_BVergG2006.html

[189] http://www.ioeb.at/ueber-ioeb-und-die-servicestelle/ioeb-kompetenz-und-kontaktstellen

[190] http://www.bbg.gv.at/fileadmin/daten/Downloads/IOEB/IOEB_-_4_-_Studie_IOEB-Metrik_BMWFJ_2012.pdf http://www.ioeb.at/fileadmin/ioeb/dateiliste/dokumente/Downloads___Links/IOEB_-_4_-_Studie_IOEB-Metrik_BMWFJ_2012.pdf

[191] Austrian Institute of Technology, 2014, Implementation of the Austrian PPPI Action Plan 2013/2014. PPPI Policy Brief October 2014

Even though innovative public procurement us increasingly being carried out and streamlined in the general procurement process, little effort has been made so far to fine-tune the co-evolution of demand side with supply side support policies. One notable exception is the thematic field of green tech and support to sustainable growth. Here, green public procurement is essentially coupled with public efforts to provide additional venture capital and a variety of other supply-side activities under the umbrella of the Austrian Climate and Energy Fund[192].

PCP/PPI initiatives in Austria

The PPPI service centre has established the online platform "Innovationspartnerschaft", a kind of market place to connect providers of innovative products and services with innovation-oriented public procurers[193].

The PPPI Action Plan foresees the implementation of PCP pilot calls. During the process of setting up the Action Plan, a first Austrian PCP pilot on Traffic Infrastructure R&D (Verkehrs Infrastruktur Forschung – VIF 2011) was launched in October 2011 by the BMVIT in cooperation with ASFINAG (Autobahnen und Schnellstraßen Finanzierungs-Aktiengesellschaft), ÖBB Infrastruktur AG and the Austrian Research Promotion Agency (FFG). During the first phase 5 competitors were working for 8 months on their design/feasibility study.

The prototyping phase was foreseen to last 2 years and award contracts to 3 competing solution providers. ÖBB and ASFINAG have expressed satisfaction with the results achieved so far[194].

In 2014, BMWFW set up a pre-commercial procurement initiative for "heating and cooling in historical buildings", in cooperation with FFG and the authority responsible for publicly-owned historical buildings (Burghauptmannschaft Österreich)

An interesting development at regional level is the "WienWin" project of the City of Vienna; a platform for structured dialogue between regional suppliers of innovative solutions and public procurers. The project won the prize for best practises in public procurement of innovation "Innovation schafft Vorsprung" by the German Ministry of Economics and Energy in 2014[195].

Austrian procurers participate in the buyers group of the EU-funded PPI projects HAPPI on healthy ageing (BBG), and INNOBOOSTER on office furniture and lighting (Federal Ministry of Finance, BBG, Airport Linz). Austrian procurers moreover participate in the P4ITS networking project that is preparing a PPI on intelligent transport systems (ASFINAG, Austria Tech) and in the INSPIRE healthcare procurement networking project (BBG)[196].

In parallel to the developments in Public Procurement Promoting Innovation, progress has also been made in the area of Sustainable Public Procurement. In July 2010, the Council of Ministers adopted the Action Plan on Sustainable Public Procurement which had been initiated by the Federal Government and coordinated by the Federal Ministry of Agriculture, Forestry, Environment and Water Management. Major measures of this action plan include the setting-up of expert groups for the development of social core criteria and for dismantling budgetary barriers as well as an extension of the knowledge base regarding the effects of sustainable procurement[197].

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[192] Cuntz, 2015, RIO Country Report Austria 2014, p. 36: https://rio.jrc.ec.europa.eu/en/country-analysis/Austria/country-report.
[193] http://www.innovationspartnerschaft.at/
[194] Austrian Institute of Technology, 2014, Implementation of the Austrian PPPI Action Plan 2013/2014. PPPI Policy Brief October 2014.
[195] http://www.wienwin.at
[196] http://ec.europa.eu/digital-agenda/news/innovation-procurement-initiatives-around-europe
[197] http://www.nachhaltigebeschaffung.at/node/185

A reform in 2013 of the national procurement legislation (BVergG) also obliged procurers on federal level to account for EC regulation on energy efficiency[198]. Guidelines issued by the Federal Ministry of Agriculture, Forestry, Environment and Water Management provide assistance for municipalities who want to engage in sustainable procurement[199].

Austrian procurement bodies cooperate with institutions in several other MS (among others Sweden and Germany) in the context of the FP7-funded ECOPOL project, which makes recommendations on the deployment of eco-innovative policies and the consumer behaviour of public authorities[200].

3.5.2 Indirect financial support for private R&I

The massive expansion of subsidies for corporate research, attributable primarily to the expansion of the indirect research (tax) premium effective in 2011, has caused a major shift in how increasing public funds are used.[201] In 2002, the business enterprise sector accounted for just 11% of public funding. By 2013, this figure had risen to 26%.

The research premium, a cash back organised tax incentive, was raised to 10% of the R&D costs of the companies during the last years and will be further increased to 12% as of

1 January 2016. The research premium is mostly absorbed by large companies, while its effect on SMEs is unclear.[202]

However, the strong increase of this indirect tax-revenue based scheme did not lead to a reduction in direct public funding for private R&D investments in Austria. According to the latest available figures by OECD the relation between direct and indirect allocation of public funds to businesses is close to 1:1.[203] More specifically, as regards the share of indirect funding, Austria ranks 6th among OECD economies. According to OECD statistics, Austria experienced the fastest relative growth of indirect funds among all OECD economies between 2006 and 2011. In comparison with other OECD economies with a high share of indirectly allocated R&D funds like France, Canada or Korea, Austria simultaneously spends considerably more funds on direct support of businesses than governments in aforementioned countries. Thus, the Austrian government is one of the few that does not seem to select or focus on one specific funding approach.[204] In 2011, direct government funding of business R&D and indirect support via R&D tax incentives each accounted for 0.1% of GDP in Austria.

In Austria, R&D premium refunds by tax authorities effectively allow firms to benefit from incentives as if they were profitable (even if they are not at present). Firms are eligible for the research premium once they are certified by the FFG (implemented with the research premium reforms in 2011).

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[198] http://www.nachhaltigebeschaffung.at/node/392

[199] http://www.nachhaltigebeschaffung.at/sites/default/files/nB_eOfG_webversion0412_2012.pdf

[200] Cuntz, 2015, RIO Country Report Austria 2014, p. 44: https://rio.jrc.ec.europa.eu/en/country-analysis/Austria/country-report.

[201] In 2011, the research premium had been increased from 8 to 10%, while simultaneously disposing tax allowances under § 4 Para 4 of the Austrian Income Tax Act.

[202] http://derstandard.at/2000021530709/Drei-Viertel-der-Forschungspraemie-geht-an-Grossbetriebe; accessed on 27 October 2015.

[203] http://www.oecd.org/tax/rd-tax-stats.htm#design; accessed on 15 October 2015.

[204] Cuntz 2015.

It is not clear yet if the existing system emphasises or favours specific actors, e.g. SMEs or large firms. The premium can be deducted or claimed on internal as well as extramural R&D expenditure.[205] €574m were allocated in this way to Austrian businesses in 2012. This constitutes a massive increase in absolute and relative numbers by more than 80% when compared to the previous year (2011: €313m)[206] and exceeded direct funding for R&D in the BES. The research premium refunds declined once after the introduction of compulsory verification process of FFG as of 1 January 2013 (2013: €378m) and rose again up to €493m 2014 and even €502m in 2015. Not least to trace this erratic funding development, which causes apprehension of windfall and hollow-out effects, it is increasingly discussed to subject the research premium to an external evaluation which will likely take place in 2016.

Other tax incentive schemes such as explicit patent boxes have not been introduced so far. However, the Austrian tax system already offers specific regulation (i.e. favourable tax treatment) for corporate groups of firms and their headquarters when located in Austria. It is currently discussed to provide tax incentives for common good foundations in Austria to fund R&D activities of HEI and research organisations. Another important issue for R&D donations would be the omission of the immediacy requirement which is a qualification criterion for donations of common public interest.[207]

3.6 Business R&D

3.6.1 The development in business R&D intensity

As Figure 8 shows, BERD intensity in Austria has followed an upward trend for the past nine years, apart from a slight slowdown in 2011. The size of this increase (around 0.45 percentage points) was rather substantial, and Austria has kept pace in this regard with innovation leader MS. The increase from 2011 to 2012 was visibly steeper than in the other years.

This may be due to an expansion of the Research Premium (R&D tax incentive) from 8% to 10% in 2011, making it more attractive for companies to designate expenditure as R&D investment in their accounts.

The manufacturing sector's contribution to total BERD intensity was roughly double that of the service sector for most of the period under study, due to a concentration of most R&D activity in a few high-tech manufacturing firms. However, the gap has been narrowing, with service sector BERD intensity rising more rapidly than manufacturing BERD intensity.

[205] Cuntz 2015.
[206] Cuntz 2015.
[207] BGBl. I Nr. 160/2015 Gemeinnützigkeitsgesetz and http://www.fwf.ac.at/de/news-presse/news/nachricht/nid/20151028-2152/; accessed on 28 October 2015.

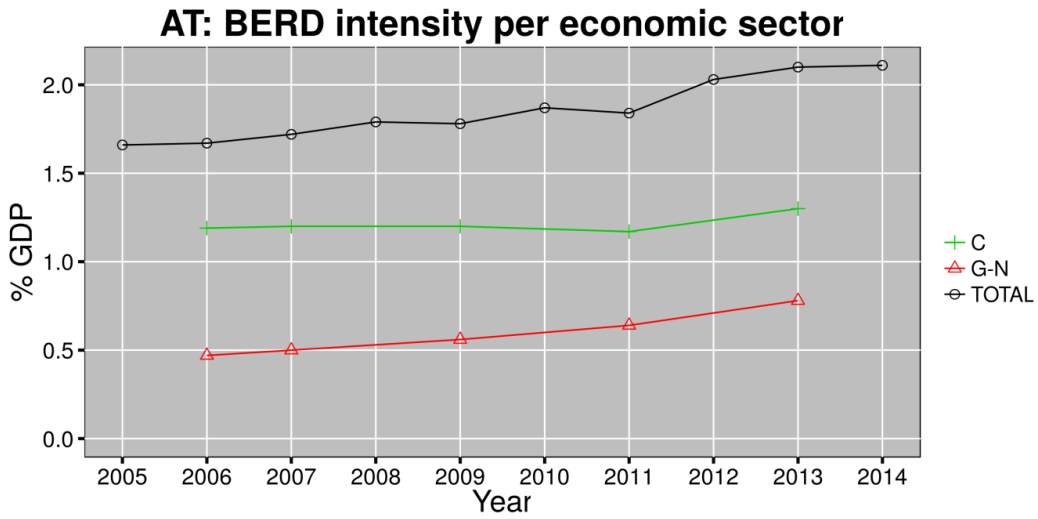

Figure 8: BERD intensity broken down by most important macro sectors (C= manufacture, G_N=services).

The private sector contributes by far the most funding to Austrian BERD. Its share of funding in percentage of GDP increased only marginally until 2011, but then jumped relatively steeply in 2013 (Austria reports GERD and components by source of funds only every two years). Again, one reason for this could be the increased Research Premium after 2011.

Contributions from Abroad are made up largely of foreign multinational companies (or their subsidiaries) that conduct R&D in Austria. The Research Premium reform seems not to have an effect on their R&D funding, potentially because foreign corporations could already benefit from tax reductions before when setting up headquarters (or establishing subsidiaries) in Austria.

Funding by government has only grown modestly. Whereas Austria employs a plethora of private R&D support instruments, some of these have rather low funding values, and several older instruments have been phased out as new ones have been set up. Given the high value of BES funding of BERD, the near-stagnation of public funding is not a cause for concern.

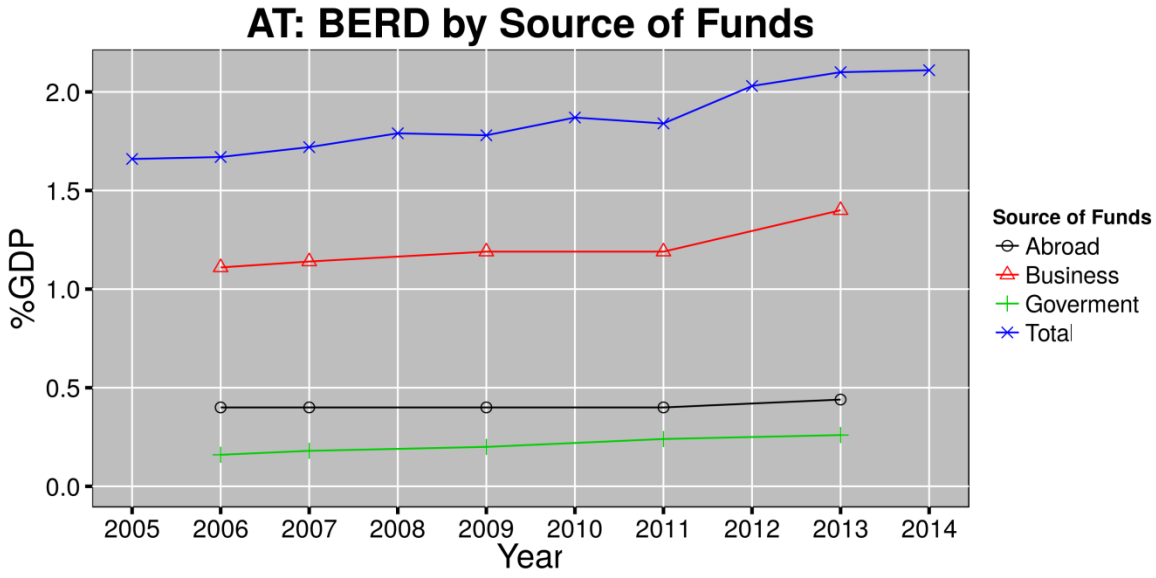

Figure 9: BERD by source of funds

3.6.2 The development in business R&D intensity by sector

The manufacturing sector increased its R&D intensity moderately, from 1.19% in 2006 to 1.3% in 2013. Only Germany, Finland and Sweden outrank Austria within the EU-28 in this regard. The service sector has greatly contributed to overall BERD intensity growth, rising from 0.475 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 IT and software service companies as well as engineering firms that mainly provide consulting and construction/design services.

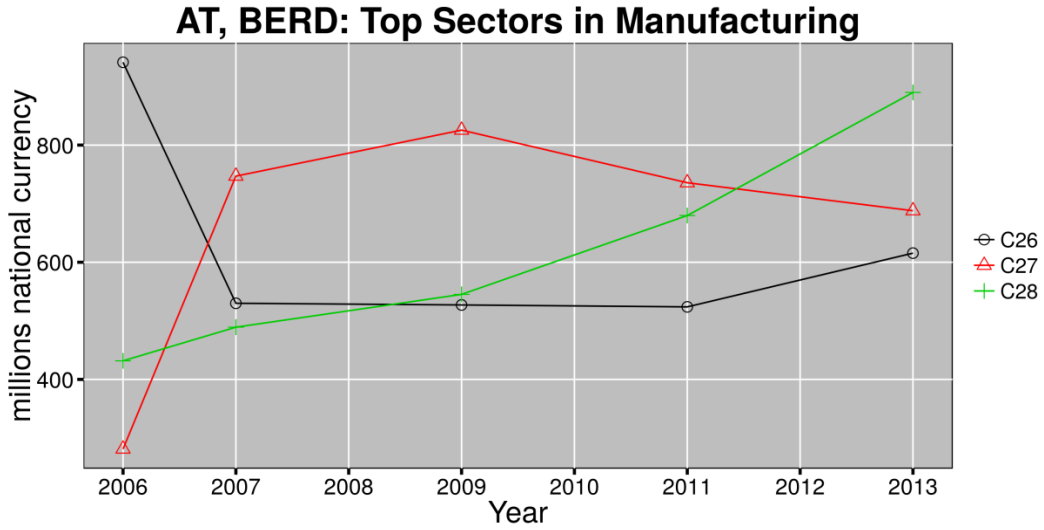

Figure 10: top sectors in manufacturing (C26=manufacture of computer, electronic and optical products; C27: manufacture of electrical equipment; C28=manufacture of machinery and equipment n.e.c).

Figure 10 shows that, within manufacturing, manufacturing of machinery and equipment (which is not classified in other categories) has become the top sector in R&D spending, more than doubling its expenditure during the period under study. Manufacturing of computer, electronic and optical products has suffered a sudden drop from 2006 to 2007, but recovered slightly in the past four years. Manufacture of electrical equipment increased its R&D expenditure by more than 100% from 2006 to 2007, but has been on a downward trend in recent years.

This reversal might be partially explained by foreign multinational electrics/electronics manufacturers shifting the sectoral focus of their Austrian subsidiaries.

Turning to the service sector, figure 11 clearly shows that information and communication as well as wholesale and retail trade had persistently low R&D expenditure. The increase in service sector R&D intensity was mainly carried by professional, scientific and technical activities, which increased their R&D expenditure from an already high level by 126% between 2006 and 2013, making this sector the largest spender on R&D overall. Again, this is partly due to the booming demand for professional and engineering services, the latter of which are especially R&D intensive.

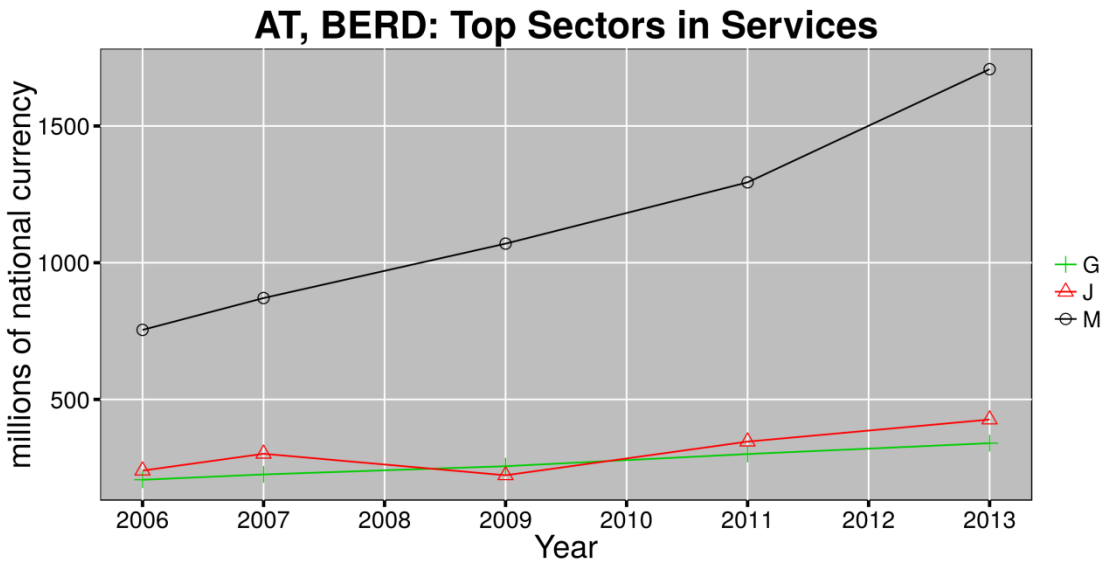

Figure 11: top service sectors (J=information and communication, G=wholesale and retail trade; repair of motor vehicles and motorcycles, M=professional, scientific and technical activities).

The biggest R&D spenders in Austria are Voestalpine (industrial metals), Borealis (chemicals), Andritz (industrial engineering), and Benteler (automobile parts).

3.6.3 The development in business R&D intensity and value added

The manufacturing sector is the biggest in terms of Gross Value Added (GVA) in the Austrian economy (Fig. 12). This goes hand in hand with its role as largest driver of private-sector R&D. The second and third largest sectors by GVA, however, are wholesale/retail and real estate activities, which both have had persistently low R&D expenditures.

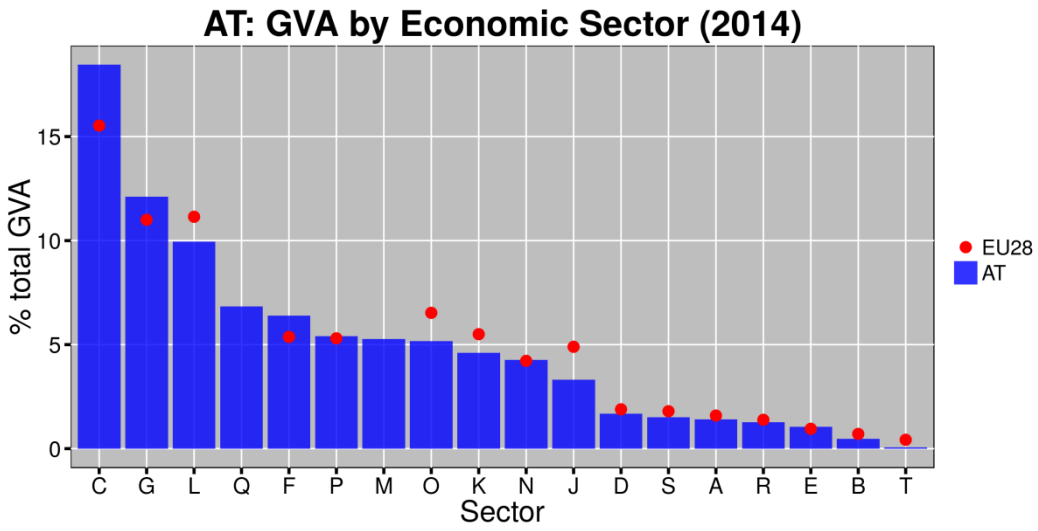

Figure 12: Economic sectors as percentage of the total GVA.
Top 6 sectors in decreasing order: 1) manufacture, 2) wholesale and retail trade (repair of vehicles and motorcycles), 3) real estate activities, 4) human health and social work activities, 5) construction, 6) education.

When further disaggregating the manufacturing sector, machinery and equipment manufacture (not elsewhere classified) turns out to be the leading sector in terms of share in total GVA (2.5%). This is also the sector with the highest R&D expenditure. Those sectors following next in the GVA ranking are not particularly R&D intensive, except for manufacture of electrical equipment, with almost 1.5% GVA share.

Thus, share in Gross Value Added reflects sectors' R&D expenditures only at the very top of the distribution, and only in manufacturing.

Figure 13: GVA in manufacturing.
Top 6 manufacturing sectors: 1) manufacture of machinery and equipment n.e.c., 2) Manufacture of fabricated metal products, except machinery and equipment, 3) Manufacture of food products; beverages and tobacco products, 4) Manufacture of electrical equipment, 5) Manufacture of motor vehicles, trailers and semi-trailers, 6) Manufacture of basic metals.

This picture changes further when analysing sectors' value added at factor cost in nominal terms (Figure 14). Here, machinery and equipment manufacture (not elsewhere classified) exhibit rather low values over the whole period under study. Professional, scientific and technical activities, which spent the most on R&D among service sectors, have a somewhat higher value added, which has been increasing moderately but constantly.

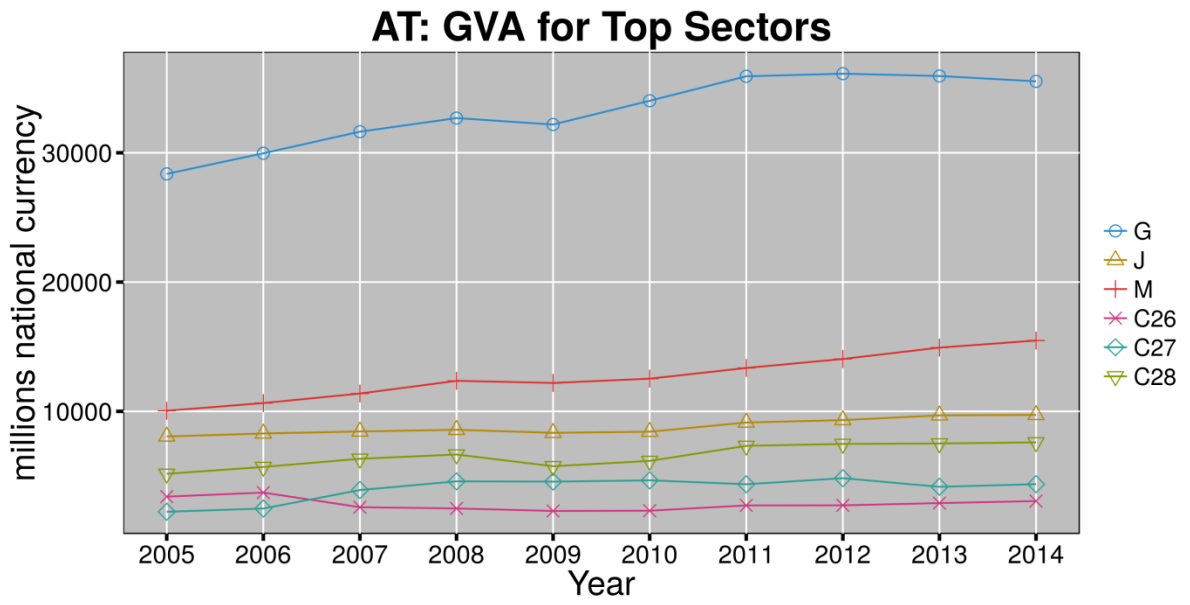

Figure 14: Value added at factor cost for the leading sectors in Figures 10 and 11.

3.7 Assessment

In general, the public R&D funding system seems to be functional. It is to a high extent transparent and competitive funding is based on clear criteria and international best practices. Also the policy mix is comprehensively covered by a manageable number of R&D programmes and instruments. The overall balance between competitive and institutional funding, subsidies vs. tax incentives, and the extent of collaborative funding has not drastically changed in the last three years despite some erratic oscillations of single programmes respectively instruments (e.g. research premium all time high before the introduction of a certification process managed by FFG; uneven yearly budget flows to some programmes such as COMET). Despite budget consolidation requirements, the overall share of public R&D expenditure remains on a high level.

Many evaluations of collaborative or business-oriented R&D programmes confirm that public financial support to business R&I succeed in leveraging business expenditures in R&I through most R&D programmes. There are, however, doubts as regards the leverage or windfall effects of the research premium. Moreover, overall R&D statistics do not confirm a growing share of BERD in Austria during the last few years.

Nevertheless, certain issues call for improvement or even reform.

First, the negotiations of the performance agreements (which consume the largest part of public R&D funding in Austria) concluded between BMWFW and the single public universities (and the ÖAW) are considered to be very extensive. Moreover, an ex-post indicator-based monitoring of their implementation in terms of R&D is hardly in place and the compliance of implementation of the agreements with stipulated objectives is to a high extent trust-based and leaves only limited steering possibilities to the supervising and financing body, i.e. the ministry.

Second, and contrary to public financing of R&D in the business enterprise sector, which is taking place in Austria at a comparatively very 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.[208] This holds also true for R&D organisations in the government sector (with exception of the IST Austria), the cooperative sector and the private non-profit R&D organisations.

[208] Polt et al. 2015.

Especially the non-financing of overhead costs causes a severe systemic problem for organisations, especially those which do not receive institutional funding.

Third, the funding budget allocated for basic research in Austria is not only too low compared to international benchmarks,[209] it is also supporting predominantly small-sized activities which are under-critical in terms of their potential contribution to the advocated profiling of universities and non-university research organisations. Moreover, the low overall funding budget of the FWF prevents the mobilisation of a dormant potential of academic researchers who were not applying to FWF funding by now.

Fourth, while the funding volumes and funding rates applied by FFG for applied research projects seem to be adequate for technical and business-oriented projects both for companies and institutionally financed public universities, they are not sufficient to mobilise research organisations whose R&D activities are not institutionally financed, such as the universities of applied sciences, the private non-profit research sector or civil society organisations.[210]

Fifth, while a full-fledged funding portfolio is available in Austria for applied research in the field of technical and business-oriented R&D, no applied R&D programme for social sciences and humanities exists. Social scientists located in Austria have to compete for European funding in HORIZON 2020 when they want to engage themselves in applied SSH.[211] The situation for (not only) SSH is aggravated by the fact that private funding of SSH (including social innovation) through foundations or charities does basically not exist in Austria.[212]

Sixth, due to the budget consolidation requirements, the ministries are reduced to provide for financial security of long-term contracts with the major research organisations, but have no extra means to experiment with new policies or establish new initiatives with substantial 'fresh money'.

[209] Leitner et al. 2015.

[210] This assessment is backed by corresponding statements of participants of the „Zukunftsforum zur strategischen Weiterentwicklung der Geisteswissenschaften – Kulturwissenschaften – Sozialwissenschaften" held on 2 December 2015 in Vienna.

[211] This assessment is backed by corresponding statements of participants of the „Zukunftsforum zur strategischen Weiterentwicklung der Geisteswissenschaften – Kulturwissenschaften – Sozialwissenschaften" held on 2 December 2015 in Vienna.

[212] Leo 2012.

4. Quality of science base and priorities of the European Research Area

4.1 Quality of the science base

Table 7: Main output indicators assessing the quality of the science base[213]

Indicator	Year	EU-28
Number of publications per thousand of population (full count)	2.32 (2013)	1.43 (2013)
Share of international co-publications	59.7% (2013)	36.4% (2013)
Number of international publications per thousand of population (full count)	1.39% (2013)	0.52% (2013)
Percentage of publications in the top 10% most cited publications (full count)	15.62% (2010)	12.25% (2010)
Share of public-private co-publications (according to SciVal)	3.1% (2011-2013)	1.8% (2011-2013)

The output of Austrian R&D measured in publications belongs to the higher ones in the EU in relative terms (see Table 7). While the EU-28 value in terms of number of publications in full count per thousand of population was 1.43 in 2013, it was 2.32 in Austria. Austria is ranked on 10th place in this respect. However, it has to be noticed that for this indicator the size effect of the total population has a strong influence in favour of smaller countries. Fractional counting is less distinct but shows a similar trend: 1.22 in the EU-28 versus 1.42 in Austria. Austria's relative share in both counting approaches is, however, far below Denmark, Sweden, Finland, the Netherlands, and Slovenia and close to countries such as UK, Belgium, Ireland, and Luxembourg.

As regards the share of international co-publications Austria, like most small but open countries (and economies), is in a good position. Its share is 59.7% in 2013, compared to 36.4% at EU-28 level. According to this indicator, Austria ranks 3rd in the EU behind Luxembourg (72.7%) and Cyprus (61.6%). The reasons for this are manifold, but mostly connected to the traditionally high trans-border cooperation with Germany and Switzerland (mostly same language), a generally high level of internationalisation of Austrian researchers and a comparatively low number of domestic journals with international reputation. As regards the number of international publications by thousands of population in full counting, Austria also has a good position with 1.39 publications per 1000 population compared to the EU-28 value of 0.52 in 2013. Innovation leader countries such as Denmark (2.05), Sweden (1.88) and Finland (1.60), which have a comparable size, clearly outperform Austria in this respect.

An important indicator to measure the excellence of the publication performance is the percentage of publications in the top 10% most cited publications. Here the Austrian share increased noticeable from 12% in 2000 (full count), slightly above the EU-28 value of then 10.55%, to 15.62 in 2010 (EU: 12.25%), which indicates a strong development towards excellence orientation in this past decade. This upward trend is also evidenced by looking at the percentage of publications in the 10% most cited publications in fractional count (2000-2013):

[213] Source: JRC IPTS RIO elaboration on Scopus data collected by Sciencemetrix in a study for the European Commission DG RTD (Campbell, 2013). The share of public-private co-publications is derived from the Scival platform and is also based on Scopus data (September 2015). SciVal ® is a registered trademark of Elsevier Properties S.A., used under license. The data on public-private co-publications is not fully compatible with the data included in the IUS, due to differences in the methodology and the publication database adopted.

While the EU share was 10.55% (11.29 in terms of full counting), the share of publications from Austria based researchers in these publications was 10.85% (13.45% in full counting).

As regards this indicator, Austria ranks on 6th position in the EU in terms of full counting (2000-2013) and on 9th position in terms of fractional counting (2000-2013), clearly behind countries such as Denmark (full counting 2000-2013: 17.01%; fractional counting 2000-2013: 14.50%), The Netherlands (16,78; 14.75%), Sweden (14.84; 12.56), UK (14,54; 12.91), and Belgium (15.07%; 12.56%), and close to countries such as Germany, Finland, Ireland and Luxembourg.

An indicator addressing the level of excellence-oriented science-industry collaboration is the share of public-private co-publications. Austria ranks with a share of 3.1% according to SciVal statistics (2011-2013) on 5th place in the EU, just below Denmark (4.7%), The Netherlands (3.6%), Sweden and Belgium (both 3.3%) and on par with France (3.1%), and Germany (3.0%). Given the high level of science-industry collaboration in Austria, which was at the top of the political agenda since at least 15 years, this is not particularly surprising. In terms of public-private co-publications per million population according to SciVal (2011-2013), Austria has 233.32 compared to an EU value of 87.07, around the same level as Belgium (254.08), Finland (236.24), Ireland (228.27) but far below Denmark (541.35), Sweden (345.76) and the Netherlands (345.18). Also with this indicator, size effects in terms of the number of population are very influential. Private-public co-publications per million population according to the IUS database 2014 confirm this pattern. Also here Austria is ranked 5th, far below the top-positioned Denmark (196.7) but clearly higher than the EU (52.8).

The relatively good performance of Austria's research base in terms of excellence orientation is also evidenced by its successful participation in ERC activities, although the results still clearly lag behind those of comparable countries with strong science and research systems such as the Netherlands, Switzerland, Israel, Belgium and Sweden. In order to reduce research fragmentation and to establish critical mass, the Austrian government promotes specialisation and priority setting in the HES mostly bottom-up defined by the autonomous HEI through the performance agreements and the competitive allocation of the "Hochschulraumstrukturmittel".

4.2 Optimal transnational co-operation and competition

4.2.1 Joint programming, research agendas and calls

Both the Austrian research programme owners and funding agencies are open-minded as regards sharing information and engagement in joint activities such as developing joint research agendas, joint calls and joint programming. According to a recent report from Haegeman, Doussineau and Boden (2015), Austria belongs to a group of relatively few countries whose share of national public funding to transnationally coordinated research in total GBAORD in 2010 was with slightly below 5% higher than the EU average of 4.27%.

In 2013, the working group AG7b of the inter-ministerial RTI task force concluded Austria's EU action plan "Strengthen Austria's R&I stakeholders – actively make use of Europe – join group of innovation leaders", which foresees synergetic use of transnational cooperation to strengthen R&D in Austria. The focus here is on non-financial means. Already in FP7, Austrian national co-funding to FP7 activities was relatively modest.[214]

[214] Haegeman, Doussineau and Boden, 2015.

Austria, however, is an active and important player in a variety of EU level initiatives including cross-border research cooperation and coordination such as Science Europe, ERA-Nets,[215, 216] Joint Undertakings and JPIs, in particular those addressing grand challenges, but also with regard to the development of supranational or EU-wide standards for coordination of research.

Compared to the size of its economy and its research and innovation system, Austria was involved in a large number of ERA-NETs. More specifically, it was active in 66% of all active networks in 2013, often in charge of a coordinating role and ranking among the top 5 countries in terms of participation. In turn, this contributes not only to a more efficient allocation of funding but also embraces cross-border relations with researchers from other EU Member States.[217] Because of its contribution to raising the quality of the national research system and preparing the ground for successful proposals in the European Framework Programmes for RTD incl. HORIZON 2020, transnational co-operation and competition seems to be widely considered as an asset in Austria. This assessment is evidenced by active practice; there is hardly anything to read about this in official strategy documents. The Austrian Council for RTD called already in its Strategy 2020[218] for transnational coordination and cooperation when defining key research areas so that management structures can be developed that go beyond the direct responsibility of the RTI ministries and also the currently prevailing programme logic. Also the 'Beyond Europe' strategic recommendations on RTI internationalisation call for continuous engagement of Austria in international ERA-NETs,[219] which, however, have been put to sleep by DG R&I.

Austria is active in 8 out of 10 Joint Programming Initiatives (JPIs) focusing on grand challenges. The two exceptions are the JPI 'Healthy and Productive Seas and Oceans' and the JPI 'The Microbial Challenge – An emerging threat for human health'. For JPI Urban Europe Austria contributed up to €2.1m[220]. In 2010, Austria also committed to and taking the lead in the coordination and support action (CSA) "JPIs to Co-Work", explicitly focusing on framework conditions for Joint Programming.[221] In general, however, the funding allocation to ERA-NETs and JPIs is often only moderate. FFG for instance allocated only €81m for more than 100 implemented calls within several ERA-NETs.[222] Common ex-post evaluations of ERA-NETs are agreed only on case-by-case basis[223] but not as a principle.

In the context of European and international projects and agreements[224], the FWF as the main funder of basic sciences approves a yearly grant volume of €15m and more (€ 21.4m in 2015; €27.2m in 2014[225]; €15.8m in 2013; €17.9m in 2012; €15.1m in 2011[226]). This equals 10% to 15% of its total funds.

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[215] https://www.bmvit.gv.at/en/innovation/international_eu/eranet.html; last accessed on 24 October 2015.
[216] http://www.fwf.ac.at/en/about-the-fwf/international-activities/multilateral-activities/
[217] Cuntz 2015.
[218] Rat für FTE 2009.
[219] See presentation of Gollubits, C. at the Bundesländerdialog event in autumn 2015, http://wissenschaft.bmwfw.gv.at/fileadmin/user_upload/forschung/Standortpolitik/BLD_6_Oktober_2015/Gollubits_Beyond Europe_BLD06102015.pdf; accessed on 31 January 2015
[220] https://www.ffg.at/JPIUrbanEurope; accessed on 24 October 2015.
[221] Özbolat and Boden 2013.
[222] https://www.ffg.at/content/die-ffg-im-internationalen-kontext; accessed on 24 October 2015.
[223] For instance as regards the Southeast European ERA-NET Plus; See Gajdusek and Sidiropolous 2014.
[224] Until 2014 no differentiation between European and international activities was possible according to the available data. In 2014, €2.1m were allocated under bilateral programmes of FWF with non-European partners; €15.8m were allocated under bilateral programmes of FWF with European partner organisations and another €9.4m were allocated under ERA-NETs.
[225] This high increase compared to the previous years is attributed to ERA NET contributions of the FWF.
[226] FWF (2011, 2012, 2013, 2014), Annual Report.

Most of these international grants are allocated in the lead agency procedures, especially under the D-A-CH-agreements with Germany and Switzerland; the remaining funds were national contributions to ERA-Nets and international/bilateral research agreements in Europe with Germany, France, Luxembourg, Switzerland, Slovenia, Hungary, the Czech Republic and Flanders. In 2014, the FWF decided to take part in seven additional trans-national initiatives in the fields of humanities, biodiversity, rare diseases, cancer research, systems medicine, cardiovascular diseases and gender issues. In total more than half of all ongoing FWF projects are being carried out in cooperation with partners outside of Austria. Most of the cooperation partners are located in Germany, followed by the US, the UK, France and Switzerland. Despite the positive development in terms of funding of transnational and international cooperation in the year 2014, FWF already announced that it will not be able to continue on this course of growth in bilateral and multilateral initiatives due to its current budget situation. In particular, this will affect the FWF's activities in the context of ERA-Net initiatives. [227]

All of FWF's European collaboration agreements follow the idea of a lead agency. The core of the lead agency principle is that partners of international research projects have to apply only to one funding agency. That agency is responsible for the entire administration including the peer review process. The lead agency procedure foresees that research agencies accept the evaluation of the international projects of one lead agency and fund the parts of the project that are being performed in their part of the respective country. This principle only works if individual national systems are close enough in terms of proposal selection criteria and national success rate.[228] In the case of the D-A-CH agreement, the German Research Foundation (DFG), the Swiss National Science Foundation (SNSF) and the FWF have agreed to follow a lead agency principle for research projects with participants of at least two of the three countries. Negotiations are ongoing to include similar funding agencies from other Member States. Notably, Lead Agency agreements can be regarded as innovative practice in the EU. Also FFG usually accepts evaluations within European initiatives such as ERA-Net and Art. 185. However, formal eligibility might be ensured by national authorities.[229]

In terms of further developing transnational cooperation, the FWF is actively engaged in Science Europe. The FWF is participating in nearly all of the activities outlined in the Science Europe Roadmap.

Additionally, a multilateral (and "macro-regional") strategic communique was signed in 2012 by eleven countries in the Danube region, addressing potential R&D synergies for Horizon 2020 and Structural Funds. By the end of 2013, six scientific clusters have been launched in the strategy's context. The strategy itself has been positively evaluated in 2013, but the evaluation recommends an even tighter alignment of signatory countries with European Structural and Investment Funds. Furthermore, the recent coalition agreement of the new government stresses the national importance of an additional macro-regional strategy for the Alpine region – which was launched by the European Commission in July 2015.[230]

In addition to ERA-Net, Art. 185 and Joint Programming approaches, EUREKA is also worth mentioning in the field of transnational R&D cooperation. In contrast to most other programmes mentioned here, EUREKA is basically open to all technological areas, focussing at transnational cooperation projects of R&D-intensive SMEs (EUREKA´s 185 initiative Eurostars) or at cooperation in applied research more generally (EUREKA network projects).

[227] FWF 2015.
[228] Cuntz 2015.
[229] Ibid.
[230] Ibid.

EUREKA clusters, though, as third element of the EUREKA portfolio, are thematically focussed, and Austria is engaged in some IT-oriented EUREKA cluster projects. EUREKA is also administered by FFG. In 2015, a total volume of €6.4m of FFG funding has been dedicated to EUREKA projects (including Eurostars and EUREKA Clusters). Recently, specific bi-/multinational cooperation initiatives have been launched within EUREKA with Austrian participation, including a dedicated cooperation initiative with Israel and a joint EUREKA call within the Danube region activities. Another novelty of EUREKA is an outreach "beyond Europe" (Canada, South Korea, South Africa) which offers additional opportunities also for Austrian enterprises and which is supposed to gain importance in future.

4.2.2 RI roadmaps and ESFRI

The strategic development of research infrastructure is an important objective of the federal RTI strategy and is dealt with by the RTI Task Force's Working Group 4, "Research infrastructure", in Austria. EU financing instruments (especially ERDF) in the European Structural and Investment Funds (ESIF) represent important complementary funds for the financing of research infrastructure, while funding for Austrian research infrastructure from the European Framework Programmes for RTD and Horizon 2020 is at relatively modest levels.

In accordance with ESIF regulations, the Austrian operational programme "Investment in Growth and Employment Austria 2014–2020"[231] focuses on four thematic programme objectives. "Strengthening research, technological development, and innovation" stands at the top of the programme objectives and priorities. The first initiative, "research and technology infrastructure", specifically names the development and expansion of R&D infrastructures with the aim of deepening regional thematic fields or developing centres with an international orientation. It is considered advantageous if projects anticipate cooperation between research institutions or enable firms to have access to research infrastructures, as well as research centres and infrastructures in international context (i.e. in terms of transnational strategies, such as those of the EU Danube Region/EUSDR), and/or if these projects have international relevance (such as ERIC). It is envisaged that larger, basic-research-oriented infrastructures and centres with potential European and transnational significance, as well as the support of further development of Austrian ESFRI projects, should be established only in regions in Austria which already dispose of competitive advantages in this respect. This refers particularly to the ESFRI Biobanking and Biomolecular Resources Research Infrastructure (BBMRI) located in the Austrian city of Graz.

In 2014, Austria published its national Research Infrastructure Action Plan.[232] It takes the ESFRI roadmap actively into account, but hints at several challenges, especially the long-term financial commitments which are required in participating in European strategic research infrastructures. The Plan describes several advantages for strengthening the Austrian R&D competitiveness through actively engaging in strategic European research infrastructures, such as securing complementarity with national infrastructures, access to equipment and data, agenda setting as regards specific projects, knowledge and technology transfer, strengthening the basis for structural improvements of SSH through defragmentation processes especially in cultural studies and humanities and through strategically engaging in transnational research initiatives such as JPIs.

The plan mentions the following ESFRI infrastructures which are of importance for the further development of basic research in Austria:

- BBMRI (Biobanking and Biomolecular Resources Research Infrastructure)
- CESSDA (Council of European Social Science Data-Archives)

[231] ÖROK 2015.
[232] Task Force FTI 2014.

- CLARIN (Common Language Resources and Technology Infrastructure)
- CTA (Cherenkov Telescope Array)
- DARIAH (Digital Research Infrastructure for the Arts and Humanities)
- ECRIN (Pan-European Infrastructure for Clinical Trials and Biotherapy)
- E-ELT (European Extremely Large Telescope for Optical Astronomy)
- ELIXIR (Upgrade of the European Life-science Infrastructure for Biological Information)
- ESRF upgrade (European Synchrotron Radiation Facility Upgrade)
- ESS (European Social Survey)
- EuroBioImaging (Research infrastructure for imaging technologies in biological and biomedical sciences)
- EU-OPENSCREEN (European Infrastructure of Open Screening Platforms for Chemical Biology)
- FAIR (Facility for Antiproton and Ion Research)
- ILL Upgrade (Institut Laue-Langevin, European Neutron Spectroscopy Facility)
- Infrafrontier (European infrastructure for phenotyping and archiving of model mammalian genomes)
- INSTRUCT (Integrated Structural Biology Infrastructure)
- PRACE (Partnership for Advanced Computing in Europe)
- SHARE (Survey of Health, Ageing and Retirement in Europe)
- X-FEL (Production of intense X-ray flashes to identify biological structures and chemical reaction processes)

In general, Austria puts a strong RTI infrastructural focus on social sciences and humanities as well as on human biological research.

It has to be mentioned that Austria is already member in 9 of these strategic European research infrastructures, namely BBMRI, CESSDA, CLARIN, DARIAH, E-ELT, ESRF Upgrade, ESS, ILL Upgrade, and SHARE and currently scrutinises further membership (CTA, EuroBioImaging, ELIXIR). The implementation of the Austrian participation in the strategic European research infrastructures and their financing is done within the framework of performance agreements with the Austrian hosts of these infrastructures, which makes the identification of exact budgetary allocations difficult.

In terms of applied research infrastructures, Austria puts emphasis on enabling technologies (ICT, biotech, material science and nanotechnology). Also co-financing of public-private shared core facilities is under consideration.

There are only a few larger international research infrastructures in Austria. Next to BBMRI, which was mentioned above, MedAustron[233] is currently being built in Wiener Neustadt for ion beam therapy and research. The first patient treatments are planned in 2016. In the full operational phase up to 1,200 people per year are expected to benefit from the international services offered by MedAustron.

In 2011, a research infrastructure database was developed with the universities to provide a foundation for financing research infrastructures in the context of performance agreements. The database contains distinct research infrastructures with a procurement cost of at least €100,000. The database also has information about the number and type of research infrastructures in individual fields of science.[234] Data were updated in 2012 and 2014. In 2014, the universities entered data on 1,492 such infrastructures. In addition to the 22 public universities, the Austrian Academy of Sciences also took part in the 2014 survey with 92 research infrastructures, and the Institute of Science and Technology Austria (IST Austria) with 21[235].

[233] http://www.medaustron.at/; last accessed on 24 October 2015.
[234] The Austrian system (Statistics Austria 2013) was used as a reference for categorising research infrastructures by fields of science in 2012, which was based on the OECD revision of the system of fields of science (published as "New Fields of Science and Technology Classification").
[235] In 2014 it reported already 35 infrastructures.

Also a few universities of applied sciences, the Ludwig Boltzmann Society, and Campus Science Support Facilities Ltd., the "Zentralanstalt für Meteorologie und Geodynamik" ('Centre for Meteorology and Geodynamics') as well as the "Geologische Bundesanstalt" ('Federal Geological Survey') reported a few research infrastructures. In terms of disciplinary allocation, over 900 research infrastructure spaces at Austrian universities are allocated to the natural sciences, which is more than half of all research infrastructures (55%). One quarter of research infrastructures (25%) is being used in engineering and 14% in human medicine (BMWFW und BMVIT 2015).

Overall, the Austrian universities, the Austrian Academy of Sciences, and IST Austria reported research infrastructure investments of €548 million: 75% (€381m) was used for major equipment, 19% (€98m) for core costs[236] for core facilities, 3% for electronic databases (€13m), 5% (€25m) for research infrastructure spaces, and 6% (€31 million) for other research infrastructures. The share of procurement costs in the individual fields of science corresponded in general with the number of research infrastructures mentioned above. More than half of funds (54% or €281 million) for financing of procurement costs came from global budgets of the HES and another 28% or €146 million came from funding programmes of the BMWFW (BMWFW und BMVIT 2015). Funding from FFG, FWF and the European Research Framework Programmes amounted to about 1% each. No research infrastructure has yet been (co)financed with use fees.

80% of the usage of the procured research infrastructure remains mainly within the same institution in almost all fields of science. The highest share of usage in cooperation with external partners (18%) is found in engineering. About three quarters of university research infrastructures are in principle available to other HEI through cooperative agreements and to companies, provided that the latter either pay a rent or contract R&D. The actual share of usage by external partners remains significantly lower though (BMWFW und BMVIT 2015). Therefore, the BMWFW pushes open access to the research infrastructure database for companies and other research organisations. It also aims to prepare model contracts for research infrastructure cooperation.[237]

The Christian Doppler Laboratories, implemented at universities and non-university research organisations, and the Josef Ressel Centres, implemented at universities of applied sciences, are two dedicated funding programmes (and support infrastructures) for enhancing science-industry cooperation in Austria. This cooperation takes place in specially established research units with fixed terms, in which application-orientated basic research is pursued. In order to establish a CD Laboratory or JR Centre, two prerequisites must be met: on the one hand, the specific need of a company for knowledge and know-how from the application-orientated basic research and, on the other, the willingness of scientists to open themselves up to this commercial need in the long term. If both prerequisites are met, the partners can jointly develop a research programme lasting several years that must do justice to high scientific claims. The research units are staffed by research groups of 3-15 researchers, who are led by highly qualified scientists. For CD Laboratories, the annual budget is between €110,000 and €700,000; for JR Centres between €80,000 and €400,000. The research units are funded up to 50% by the public. CD Laboratories and JR Centres are subject to a rigorous scientific quality monitoring. The quality of the scientific work is regularly assessed by international experts. The evaluation results decide whether the research unit and its work are to be continued. In November 2015, the new CD programme "Partnership in Research" was launched to widen cooperation with the BES.[238]

[236] The core costs are the procurement costs for core facilities that are left after deducting affiliated research infrastructures over €100,000 that are recorded under their own entries.
[237] BMWFW 2015c.
[238] http://www.cdg.ac.at/; accessed on 24 October 2015.

The USP of this programme is that it is jointly implemented by the CD Society and the FWF to identify cooperation opportunities in the field of basic research with enterprises with which no previous cooperation existed.[239]

4.3 International cooperation with third countries

Top-notch research is increasingly conducted in a worldwide network where international competition and co-operation are both equally relevant. In general, Austria is well engaged in international R&D exercises and participates in international large-scale research programmes and infrastructures such as CERN, Elettra, EMBL, EMBC, ESA, ESO, ESRF, EUMETSAT, IARC, ILL, IODP/ICDP. The highest yearly budget allocations go to ESA (more than €50m in 2015), CERN (€20.3m) and ESO (€6.2m).[240][241] Access to these international large scale programmes and infrastructures is promoted through the performance agreements. For some infrastructures, such as ESO, ILL, or ESRF access is based on competitive proposal application processes combined with peer-reviews.[242]

In July 2013, the National RTI Strategy Task Force Working Group 7a published its strategic recommendations entitled 'Beyond Europe – The Internationalisation of Austria in Research, Technology and Innovation'[243] and submitted it to the high-level RTI Task Force of the Austrian government. It included also a non-published roadmap with budget appropriations. However, until December 2015 most of the measures recommended had not been implemented, but the document serves as a guideline for daily RTI internationalisation policy within the constraints of the available budget. In December 2015, however, the Austrian Federal Ministry of Science, Research and Economy has launched a new "Beyond Europe" programme, which supports applied research cooperation activities of Austrian companies (and research institutions) together with their partners from outside Europe. The volume of the first call amounts to €4.6m. The programme, which follows a thematically open approach, is administered by FFG.

The Beyond Europe concept also suggested a stronger concentration on a few international partner countries, which were grouped in three categories. The top-group included, hardly surprising, USA, China, India and Russia. The second group included South Korea, Brazil, Japan, South Africa (incl. Southern Africa), Israel, Canada, Turkey, Singapore/Malaysia, and Australia. For all three groups dedicated measures are suggested.

According to "Beyond Europe" the following five dedicated goals should be attained through increased international cooperation:

1. Excellence objective
2. Market objective
3. Resource optimisation objective
4. Grand challenges objective
5. Science diplomacy objective

[239] https://www.fwf.ac.at/de/forschungsfoerderung/fwf-programme/sonderprogramm-partnership-in-research/; accessed on 31 January 2016.
[240] Data from BMF 2015.
[241] Slightly different but also more comprehensive financial contributions are mentioned by Minister Mitterlehner during a parliamentary inquiry, see https://www.parlament.gv.at/PAKT/VHG/XXV/AB/AB_04346/imfname_423504.pdf; accessed on 1 February 2016.
[242] https://www.parlament.gv.at/PAKT/VHG/XXV/AB/AB_04346/imfname_423504.pdf; accessed on 1 February 2016.
[243] AG7a 2013.

For each of these objectives and priority countries, a series of measures has been recommended, including the development of joint labs, more resources for existing international agreements, launch of joint calls, reduction of mobility barriers, support for bilateral bottom-up R&D cooperation of enterprises, increased international technology transfer, upgrading of the innovation protection programme, better domestic information exchange, upgrading of alumni networks, increasing representation of Austria's R&D abroad through Austrian Offices for Science and Technology (OSTAs) and RTI attachés, development of strategic intelligence to monitor and analyse international trends etc. In fact, also the coalition agreement of the government explicitly referred to a tightening of international strategic S&T partnerships via the establishment of FTI-Attachés and additional OSTAs to be located in priority countries outside Europe, but due to administrative and financial problems no progress could be achieved until now.

Especially under the resource optimisation objective of "Beyond Europe" a stronger consideration of European programmes and initiatives, such as international ERA-NETs, EUREKA and COST and a further involvement in SFIC activities was strongly advocated. The BMWFW has since long been engaged in a number of international ERA-NET projects, starting with the Southeast European ERA-NET in 2005. Subsequently, it launched together with the EC under the Austrian EU Council Presidency the Steering Platform on Research for the Western Balkan Countries in 2006. Since a few years it is step-by-step refraining from direct participation, but encourages the participation of FFG and FWF in international ERA-NETs with mixed results. Apart from the above mentioned ERA-NET project, the BMWFW was participating in the KORANET (Korea), ERA-NET New Indigo (India), ERA.NET RUS (Russian Federation) and ERAfrica (Africa).

Moreover, the BMWFW is still engaged as partner in a few strategic INCO-NETs (e.g. Danube INCO-NET, where it is leading the work package on policy dialogue)[244] and supports the participation of FFG and the analytical work of the Centre for Social Innovation (ZSI) in a number of BILAT-projects and INCO-NET projects. Through regular bilateral meetings and exchange BMWFW makes use of the analytical work produced by ZSI in the frame or its participation in such projects. ZSI also publishes on behalf of BMWFW a regular newsletter to inform Austrian stakeholders about participation opportunities in activities implemented under international ERA-NETs, BILAT and INCO-NET projects. To reach the most important stakeholders in the field of RTI internationalisation, FFG organises regularly Beyond Europe Roundtables with frequent analytical input from international European projects (especially INCO-NETs, BILAT projects and international ERA-NETs) on behalf of BMWFW and BMVIT. Currently a Beyond Europe online platform is developed to facilitate regular exchange among the Austrian stakeholders about their RTI internationalisation activities, to make use of potential synergies by avoiding duplication and by developing joint activities.[245]

Both ministries (BMWFW and BMVIT) are also involved in SFIC activities to advance a better coordination of the objectives and activities of the EU, Member States and Associated Countries towards third countries and International Organisations and to further develop Multi-Annual Roadmaps for international cooperation. Due to financial restrictions, however, the Austrian engagement in this respect is contained.

In the last couple of years, Austria progressed in reducing the barriers for international immigration of top-researchers in terms of recognition of foreign certificates. To further facilitate international immigration of top-researchers a preferential tax treatment for researchers immigrating from abroad will be introduced in 2016 to create additional incentives for outstanding talent in this area.[246]

[244] http://danube-inco.net/about/projectstructure; accessed on 23 October 2015.
[245] https://beyond-europe.era.gv.at/login; accessed on 1 February 2016.
[246] Bundeskanzleramt 2015.

As a response to the refugee crises, several initiatives to support a smoother integration of students and researchers into the Austrian education and research system have been launched in Austria such as the MORE initiative[247] addressing students amongst the asylum seekers and refugees, who would like to pursue their studies in Austria, the 'Science in Asylum' initiative[248] addressing researchers who took refuge or FWF's engagement in this respect, which also includes cooperation with the European initiative 'science4refugees'.[249]

Austria has signed various intergovernmental bilateral S&T agreements or memoranda of understanding with Argentina, China, FYR of Macedonia, Montenegro, India, Korea, Russia, Serbia, Ukraine and Vietnam at federal government level. However, also cooperation across borders on the levels of universities or public non-university research organisations, e.g. the ÖAW and its Slovenian counterpart, or involvement of the national exchange services (OeAD) or Austria's main research funding agencies FWF and FFG is taking place. FWF has international bilateral agreements with Argentina, China, India, Japan, Russia, South Korea and Taiwan.[250] Calls for bilateral research projects under these agreements are issued regularly, funding amounted to € 2.2m in 2015 and €2.1m in 2014. FWF also participates in the "horizontal" ERA Nets INNO INDIGO and ERA-RUS. Another new part of FWF's international portfolio is a cooperation arrangement with the US National Science Foundation (NSF) within the GROW (Graduate Research Opportunities Worldwide) initiative.[251]

In the last few years, also FFG established a series of cooperation agreements with foreign agencies, including a bilateral agreement with the Israeli research funding agency MATIMOP in January 2014[252], with the Shanghai University in September 2014 and the Chinese Academy of Sciences in February 2015 as regards joint calls in the field of nanoscience and nanotechnology with a budget volume of €742,500 respectively €1m[253], with the Korean Institute for Advancement of Technology (KIAT) in March 2015[254], with the Actions Community for Entrepreneurship Limited (ACE) from Singapore in June 2015[255] and with the New Energy and Industrial Technology Development Organization (NEDO) from Japan in June 2015.[256] Within most of these agreements regularly updated thematic priorities are identified, workshops organised, networking meetings and joint research projects initiated. Common ex-post evaluations of these agreements are not agreed.

4.4 An open labour market for researchers

4.4.1 Introduction

Austria's labour market for researchers is fairly open and characterised by a high institutional autonomy, in particular also for higher education and other public research institutions. Human resources in science and technology (HRST) account for 35.3% of the Austrian working population in 2013 (aged 25 to 64 years; 2012: 34.3%), which is slightly higher than the average of 31.8% in the EU-28, but comparatively lower than among innovation leaders and followers. As regards employment in knowledge-intensive sectors in % of total employment, Austria positions herself with 37.5% below the EU average of 39.2% in 2013, far below countries such as Luxembourg (57.8%), Sweden (51.7%), or Denmark (49.3%).

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[247] http://uniko.ac.at/projekte/more/idee/index.php?lang=EN; accessed on 1 February 2016.
[248] http://www.scienceinasylum.org/index.php/home/; accessed on 1 February 2016.
[249] http://ec.europa.eu/euraxess/index.cfm/jobs/science4refugees; accessed on 1 February 2016.
[250] https://www.fwf.ac.at/de/forschungsfoerderung/fwf-programme/internationale-programme/joint-projects/; accessed on 23 October 2015.
[251] FWF 2015.
[252] https://www.ffg.at/bilat-israel; accessed on 24 October 2015.
[253] Presentation of Haas, M. in the Chamber of Commerce on 1 June 2015.
[254] https://www.ffg.at/news/ffg-unterzeichnet-abkommen-mit-suedkoreanischer-agentur; accessed on 24 October 2015.
[255] https://www.ffg.at/news/tueroeffner-zu-asiatischen-innovationen; accessed on 24 October 2015.
[256] https://www.ffg.at/news/ffg-unterzeichnet-abkommen-mit-japanischer-agentur-nedo; accessed on 24 October 2015.

In 2013, 66,186.1[257] full-time equivalents (FTEs) were active in R&D (2007: 53,252 FTEs), of which 70.1% were employed in the business sector, 25.4% in the higher education sector (HES), 3.8% in the government sector, including public research organisations (PROs), and 0.6% in the private non-profit sector. This constitutes a significant increase compared to the 56,438 FTEs in 2009, but also a significant increase of 8.2% compared to 2011, which is mainly caused by a strong growth in the BES (+10.2%), a fair increase in HES (+4.6%) and moderate losses in PROs (-1.2%) and the PNP sector (-3.2%)[258]. R&D employment belongs to the most dynamic labour markets in Austria. Data does not provide evidence on a negative effect of the crisis on the labour market for researcher. In general, with 17% foreign-born, Austria is among the OECD countries which have a large share of immigrants in the workforce.

4.4.2 Open, transparent and merit-based recruitment of researchers

Since 2009, Austrian university laws require universities to advertise for research positions internationally. However, it is up to autonomous research institutions in Austria to publish job vacancies in English, systematically establish selection panels or establish clear and transparent rules for the composition of selection panels, among other things. Additionally, Austria has implemented the Scientific Visa Directive 2005/71/EC and recommendations 2005/762/EC and 2005/761/EC. General immigration procedures for researchers from all over the world have been facilitated in 2008. However, migratory regimes will undergo further revision. A study of OECD showed that the effects of the "Rot-Weiß-Rot" visa card are limited,[259] partly caused by a high level of complexity and requirements. However, also Austrian researchers who emigrated for a certain time report problems in returning back into the Austrian academic system.[260] According to the recent coalition agreement of the new government a coherent national migration strategy (including monitoring etc.) should be developed.

Academic inbreeding in public research institutions (i.e. the practice of hiring internal candidates) as the result of the informal favouritism of internal candidates despite formal provisions for open recruitment is occasionally suspected in Austria. Transparent procedures and advertisement standards, which are regularly checked, often prevent academic inbreeding and assure fair and international recruitment.

Austrian universities advertise most positions internationally as stipulated by law, including on EURAXESS Jobs. It participates in the EURAXESS initiative with a national portal[261] and with several EURAXESS service centres. In 2011, the number of research posts advertised through the EURAXESS Jobs portal per thousand researchers in the public sector was 34 in Austria compared with an average of 47 among the innovation followers. In 2012, 58 posts were advertised (innovation followers: 67; EU-27: 41). In 2014 and 2013, 1043 respectively 1042 total jobs in Austria were offered via EURAXESS Jobs. Offers advertised online have been constantly increasing in the last few years (2012: 779; 2011: 578).[262]

Currently there is no standardised system in place to automatically establish the equivalence of foreign academic ranks (e.g. professor, senior lecturer) with national ones, whether tenured or non-tenured.

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[257] Data from Statistics Austria; http://www.statistik.at/web_de/statistiken/energie_umwelt_innovation_mobilitaet/forschung_und_innovation/f_und_e_in_allen_volkswirtschaftlichen_sektoren/index.html; accessed on 20 October 2015.

[258] Data from Statistics Austria; http://statcube.at/superwebguest/login.do?guest=guest&db=def1898; accessed on 20 October 2015; own calculations.

[259] https://science.apa.at/dossier/Rot-Weiss-Rot-Card_Nur_jeder_Dritte_bekommt_sie/SCI_20150129_SCI60952979022170422; and http://diepresse.com/home/politik/innenpolitik/4620320/OECD_RotWeissRotCard-weiter-hinter-Erwartungen; last accessed on 20 October 2015.

[260] Konzett-Smoliner 2015.

[261] http://www.euraxess.at/; accessed on 20 October 2015.

[262] Cuntz 2015.

Such decisions are often taken on a case-to-case basis during employment negotiations in Austria. In terms of recognition ("Nostrifizierung") of foreign diploma and training qualifications, speed and number of recognition accelerated as of 2011 and has proven relatively successful so far (in the first half of 2011, 1,036 foreign diploma were approved; for the same period in 2012, already 1,239 were approved). The coalition agreement of the ruling government (2013) outlines plans to further simplify the overall approval of foreign qualification and degrees including equivalence of academic ranks.[263]

Language barriers for students as well as for employment of foreign university researchers persist as most Master programmes and courses are still held in German, notwithstanding the fact that Austrian foreign-born researchers are frequently from German-speaking neighbouring countries, which, on the other hand, could also be a result of the existing language 'mono-culture'. The same applies for many higher level courses.[264] Noteworthy, as a destination country for higher education, Austria ranks well above EU average according to the MORE2 study.[265]

Even though Austria is a preferred destination country for students in higher education, the science system still lacks career opportunities for young researchers. The attractiveness of scientific careers suffered from the lack of tenure track opportunities and clear career perspectives. Young researchers are often stuck in precarious contracting situations with constrained career perspectives.

Although in 2009 a collective agreement for university employees between the association of Austrian universities and the labour union was implemented after a six years negotiation period, the provision of PhD and post-doctoral positions in combination with adequate career opportunities is still problematic, not at least through the practice of temporary contracting. 75% of scientific personnel at Austrian universities are employed on basis of temporary contracts with a few years duration only.[266] Their perspectives to become part of permanent staff are limited. This is evidenced by the number of permanently employed researchers at HEI which only increased by 1,000 FTEs between 2002 and 2013.[267] Temporary contracts, which are often based on competitively acquired research grants[268], can be prolonged on yearly basis up to six times (respectively eight years in part-time employment). After that no further extension can be granted according to §109 of the University Act.

The practice of temporary contracting at HEI in Austria is also caused by a conservative approach towards hiring and firing.[269]

[263] Cuntz 2015.
[264] Cuntz 2015.
[265] MORE2 2013.
[266] BMWFW 2015c.
[267] BMWFW 2015c.
[268] For instance, as of December 31, 2014, the FWF funded the salaries of nearly 4,000 people working in science and research, mostly in the HES (which is almost a quarter of employees in this sector). This figure has more than doubled since the year 2000; FWF 2015. 30% of the researchers employed by universities are financed through competitively acquired grants (Leitner et al. 2014).
[269] http://diepresse.com/home/bildung/universitaet/751533/Unis_Keine-Kultur-der-Kundigung; accessed on 20 October 2015.

Austria's science and innovation system experienced net migration of mobile academics close to zero in the past 15 years, i.e. actively publishing scientist inflows versus outflows between 1996 and 2011. At the same time, there was a net loss of high-performing academic talent as regards scientific impact (citations) of mobile researchers' publications.[270] This also applies for the top-level scientists with Austrian nationality: By the end of 2010, close to 40% of all Austrian (advanced and starting) grantees under the European Research Council scheme worked at research institutions and universities abroad and not in Austria; by the end of 2013, this non-resident share stood at more than 50%.[271]

Similarly, as regards diversity in industry innovation, the share of patenting inventors with foreign nationality resident in Austria stood at roughly 12% in the last decade between 2001 and 2010 (1991 - 2000: 8%). This is comparable to levels observed for the Netherlands or the UK.[272] However, in sum, there was a net loss of inventors resident in Austria, i.e. lower foreign inventor inflows than outflows of inventors with Austrian nationality.

4.4.3 Access to and portability of grants

In general, access to research funding in Austria is based on the territoriality principle. The FFG law[273] is not very explicit in this respect but stipulates that FFG should, firstly, implement measures servicing research, technological development and innovation in Austria (§1), secondly that the Austrian economy and science should be supported as regards participation in international and European research and technology cooperation (§3, Art.2) and, thirdly, that long-term investment loans can be given to the Austrian economy. The regulations of the Austrian Research and Technology Funding Act[274], which regulates the operations, structure and governance of FWF as well as the funding of RTI in Austria in general, provide no further reference to the territoriality principle. However, the new RTI guidelines, which went into force on 1 January 2015, explicitly stipulate, that also non-Austrian natural and legal persons are eligible for funding, but that it is possible to limit their share of funding by setting an upper limit within the singe RTI funding programmes or calls. It also provides for the option that the specific call documents can request from the funding applicant an establishment or branch office in Austria in order to qualify for reimbursement.

In terms of access, the latest available data on (formal) eligibility criteria for non-resident scientists to R&I funding programmes in Austria shows that roughly 25% of programmes were not open for the latter group. In 20% of the programmes researchers from abroad were allowed to participate, but only without access to (cross-border) funding. In more than 40% of programmes these researchers were provided with public funding, but could only participate together with a partnering research institution in Austria. Close to 15% of programmes were considered fully open, i.e. did not require a domestic partner in order to access to national funding. Accordingly, Austria has one of the more open national funding systems in the EU28 in this respect.[275]

[270] OECD 2013.
[271] Cuntz 2015.
[272] Cuntz 2015 quoting WIPO Indicator Report 2013.
[273] Bundesgesetz zur Errichtung der Österreichischen Forschungsförderungsgesellschaft mit beschränkter Haftung (Österreichische Forschungsförderungsgesellschaft mbH-Errichtungsgesetz - FFG-G.
[274] Bundesgesetz zur Förderung der Forschung und Technologieentwicklung (Forschungs- und Technologieförderungsgesetz - FTFG).
[275] Cuntz and Peuckert 2014.

Usually the research funder establishes a funding agreement with an either domestically or foreign-owned organisation resident in Austria. This organisation then awards an employment contract or a stipend to the individual researcher, who can either work in Austria or abroad depending on the legal requirements. In such cases, the research funder does not check the location of work of the researcher. This common procedure, which is the dominant design in applied research, has to be differentiated from the awarding of individual grants, which is significantly more common in Austria in the field of basic research funding (e.g. by FWF). In this latter case, also foreign researchers can apply for FWF funding provided that they either work at or are affiliated with an organisation resident in Austria. In the latter case, the added-value for R&D in Austria has to be justified.

As regards FWF, also researchers who are not affiliated to an Austrian research institution or university can apply for grants, provided that they have been based in Austria for at least three of the previous ten years (principle of territoriality) at the time the application is submitted.[276]

In general, grant portability is limited to individual grant merits rather than grants allocated to organisations. Additionally, the affiliation of a scientist to a recognised institution is often more relevant than residency criteria with regard to individual grant portability in Austria. For example, grants allocated by the FWF or the Austrian Academy of Sciences (ÖAW) are very flexible in this respect, while for instance the Vienna Science and Technology Fund (WWTF) is more restrictive. Research fellowships and programmes administered by the ÖAW may be used either domestically or abroad, i.e. APART, and DOC Programmes.[277]

The Money Follows Researcher agreement between the main (basic) science funds from Austria, Germany and Switzerland allows grant portability between these three countries to a very high extent. An extension of this practice to other European funding organisations under the umbrella of Science Europe is in preparation for early 2016. In order to be eligible for transfer, the research project must be ongoing at the time the principal investigator (PI) moves to the partner country. Before moving, the PI has to seek the approval of the funding organisation in charge, which checks whether the conditions for the successful continuation of the project are met at the new host institution. Once the funding organisation has approved the transfer, the project can be relocated to the new host country. From then on, funds flow across borders. Projects that have not yet begun at the time the PI moves to another partner country will be financed by the funding organisation of the new host country. This funding organisation trusts the review process and funding decision of the partner organisation and accepts to fund the project in accordance with its own funding regulations. In these cases, cross-border money transfer is no longer necessary while the research can continue seamlessly.

Applied research grants are more often awarded to organisations than individuals. Therefore, Austrian researchers with applied research grants are usually only allowed to move their publicly-funded grant to another ERA country to a fairly moderate extent as portability largely depends on one hand on the specific research funding organisation and on the other hand on the funded organisation and is dealt with on case-by-case basis.

4.4.4 Doctoral training

Public universities in Austria are completely autonomous in developing doctoral training, which is mostly based on the global budgets which they receive from the BMWFW.

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[276] European Commission 2012, quoted in Cuntz 2015. For applications from abroad, the following rule is in place: http://www.fwf.ac.at/en/research-funding/applications-from-abroad/; accessed on 20 April 2016.

[277] http://stipendien.oeaw.ac.at/de/stipendium/apart-austrian-programme-advanced-research-and-technology and http://stipendien.oeaw.ac.at/de/stipendiat/unterlagen-doc-und-doc-fforte; accessed on 20 October 2015.

This, however, does not apply to universities of applied sciences. Despite strong demands in this direction raised by them, they are not allowed to grant PhDs[278].

In particular in the Life Sciences structural forms of doctoral training are already common. Also in the Natural and Technical Sciences structural forms of doctoral training became more widespread (depending on the faculty), while in the Social Sciences and Humanities structural doctoral training only plays a minor role by now. There is a multitude of different initiatives to reform doctoral training in Austria. At the University of Vienna for example the so-called "Initiativkollegs" have been implemented. These are currently replaced by the Vienna Doctoral Academies and the funding of individual but structured doctorates (uni:docs).[279]

At the University of Graz and Technical University of Graz doctoral schools have been implemented. Also at Medical Universities PhD programmes became more widespread as these institutions had to change their curricula in line with the Bologna reforms. Some Medical Universities also established doctoral schools, e.g. the Medical University of Graz.[280] Most important, however, for initiating and sustaining a structural change in doctoral training in Austria was the FWF Doctoral Programme ("Doktoratskollegs") (see below).

In the winter term 2014 a total of 27,143 doctoral students were enrolled at Austrian universities and a total of 2,163 students obtained a doctoral degree in the study year 2013/2014[281]; thereof only 204 (9.4%) students graduated in a PhD Programme. In total 7,158 doctoral students were employed at Austrian universities in 2012. These numbers include those doctoral students with temporary positions who were funded by competitive means, as provided by the funding programmes of the FWF. In total the FWF as the most important funding agency for basic research in Austria funded 1,998 doctoral candidates in 2015 (2014: 1,955; 2013: 1,967).[282]

In the period from 2004 to 2013 the FWF Doctoral Programme (DK) alone funded 1,121 doctoral candidates.[283] On average about 46% of the students in the DK were females. A special characteristic of the DK (compared to other FWF funding schemes) is that it is the only programme that funds excellent research as well as the training of young researchers. The funding of the training of young researchers aims in particular at establishing a well-functioning and excellent training environment for the most talented young researchers. Doctoral candidates are employed in the framework of the collective agreement for an amount of 75% of full-time employment at their host institutions; i.e. 30 hours per week. Doctoral candidates are funded for a three-year period by the programme. The funding period can be extended by an additional fourth year in case the doctoral student spends a continuous research stay of three months abroad. However, only a limited number of doctoral candidates have completed their doctoral study within the three year funding period. The "Doktoratskollegs" (DK) are open to PhD students from all over the world through a competitive application procedure. Although the share of foreign PhD students is very high (57%), only a few of the foreign graduates also remain within the Austrian research system.

[278] However, cooperation with universities to grant PhDs are allowed.
[279] https://doktorat.univie.ac.at/finanzierung-fuer-doktorandinnen/unidocs-foerderprogramm-der-universitaet-wien/; accessed on 1 February 2016.
[280] Ecker et al., 2014; http://www.zenodo.org/record/20578#.Vi4GoEbz_Lc; accessed on 20 October 2015.
[281] BMWFW 2015e.
[282] Ecker et al., 2014; http://www.zenodo.org/record/20578#.Vi4GoEbz_Lc; accessed on 20 October 2015.
[283] Ecker et al., 2014; http://www.zenodo.org/record/20578#.Vi4GoEbz_Lc; accessed on 20 October 2015.

Between 2004 and 2013 the FWF received about 135 proposals for DK. 42 were selected for funding under an international peer review procedure, in particular from the field of Life Sciences where almost half of the DK that have been funded since 2004 have been established. The budget for these 42 DK amounts to €130.6m.[284] However, as the FWF has to face serious budget constraints the approval rate of new proposals has been strongly decreasing in the recent years.

In 2013 the approval rate of proposals for the first funding period was at only 31%, compared to much higher success rates before. In 2014, FWF was not able to accept any new outline proposals for DKs.[285] It is, however, envisaged to fund systematic doctorate programmes directly within the recently concluded performance agreements 2016-2018 between the BMWFW and the public universities, complementing and building on DK experiences.

This shift towards direct funding of universities in terms of systematic doctoral education is also caused by the facts that in recent years Austrian universities started own initiatives in structural doctoral training and performed well in the Marie Skłodowska-Curie Actions.

These institutional initiatives were mostly related to the developments on the European level, in particular the Bologna process and influenced by the release of the European Charter for researchers and the Code of Conduct for the Recruitment of Researchers. Since the BMWFW concentrates the funding of graduate programmes within universities, the funding of the acknowledged post-graduate programmes in the field of SSH offered by the non-university research organisations IHS and ZSI are about to become terminated.

So far, the idea to change the culture of doctoral training has not been realised to its fullest extent. Different reasons account for this: on the one hand the DK implemented in some disciplines such as SSH are still quite young. On the other hand it has to be considered for these disciplines that the master-apprentice model is deeply ingrained in their doctoral training cultures. When looking at the overall performance of the DK programme, its impact on doctoral training at Austrian universities, and the incentives that the programme provided for the reform of doctoral training can be assessed as very high.[286]

As regards a rare example of philanthropic support in Austria, the FWF was able to launch a cooperation arrangement with the non-profit Dr Gottfried and Dr Vera Weiss Science Foundation in order to provide funding for junior scientists and researchers in the fields of meteorology and anaesthesiology in June 2014. The bequest includes a considerable portfolio of real estate assets in Vienna, and the net annual return from those assets will be used entirely for the purpose of promoting junior scientists in the two disciplines mentioned above. The first call - for meteorology – was published in 2014.[287] In general, however, from the low level of €20-25m philanthropic funding annually spent in Austria, only 7.4% are allocated to science and research.[288] A revision of the legal framework to stimulate this sector for more R&D funding is currently being implemented.

[284] Ecker et al., 2014; http://www.zenodo.org/record/20578#.Vi4GoEbz_Lc; accessed on 20 October 2015.
[285] FWF 2015.
[286] Ecker et al., 2014; http://www.zenodo.org/record/20578#.Vi4GoEbz_Lc; accessed on 20 October 2015.
[287] FWF 2015.
[288] Millner, Schneider und Meyer, 2014.

4.4.5 Gender equality and gender mainstreaming in research

Although it is regarded as common sense that the inclusion of gender and other dimensions of diversity (such as age, physical impairment, or level of education) in R&D leads to a stronger target-group orientation and therefore to an expansion of a product's market segment, the participation of female scientists in R&D continues to be very low in Austria. In 2013 66,186.1 persons measured in full-time equivalents (FTE) were employed in R&D in Austria; mostly in the business enterprise sector (70.1%) and in the higher education sector (25.4%). 76% of these employees were men and 24% were women. As regards scientific personnel only, the share of men increases slightly to 77% in terms of FTE. A better gender balance can only be detected in the field of other auxiliary personnel with 43% women.[289]

When differentiating between the sectors of performance, the HES shows a considerably higher gender balance than the BES. While the share of men in the HES in FTE was 57.3% (65.2% as regards scientific personnel) in 2013, the share of men in the BES was 84.2% (84.3% as regards scientific personnel), which indicates a strong gender distribution in favour of men and a strong glass ceiling for female researchers, especially in the BES. A much more balanced gender distribution can be observed in the other two sectors, namely the government R&D sector (53.7% share of men in total/FTE; 57.7% share of men in scientific personnel/FTE) and the private non-profit sector (48.1%; 60.6%).

A higher number of R&D organisations from the field of SSH is represented in the latter sector, which traditionally also employ a higher number of women in Austria.[290]

According to the Austrian Research and Technology Report 2015[291], and despite the sobering numbers just presented, Austria has made some progress in terms of equal opportunities and gender in RTI, both at the level of the representation of women in research teams as well as the consideration of gender in research content and technology development. In addition to the increases of women in the HES, also the proportion of women among all scientists has increased from 20% to 25% in non-university research during 2004 to 2013 (BMWFW und BMVIT 2015). It remains striking, however, that the strongest growth and greatest proportions of women are in the younger age groups, the lower-income groups, and the lower functional levels. Women are represented in non-university research organisations at only 10% in management and 14% in the higher levels of management. The COMET Centres have made a major contribution to this rise in the proportion of female researchers because their funders make sure that the funded institutions implement measures to promote equal opportunities. The non-university research sector, which focuses on research in natural sciences and engineering, therefore lies somewhat in between the two large R&D sectors in Austria, namely the business enterprise and higher education sectors.

Part-time employment is a regular characteristic in R&D in Austria. In general, 1 FTE is staffed with 1.8 persons in 2013. This figure even has a strong gender bias: in terms of men it corresponds to 1.6, while in terms of women 1 female FTE research position is staffed with 2.3 female researchers. The overall situation in the HES is even worse: here 1 FTE is at average staffed with 2.7 persons in 2013 with high part-time levels both for men (1:2.5) and women (1:2.9), which is partly also caused by external lectureships.

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[289] Own calculations; data from Statistics Austria; http://www.statistik.at/web_de/statistiken/energie_umwelt_innovation_mobilitaet/forschung_und_innovation/f_und_e_in_allen_volkswirtschaftlichen_sektoren/index.html; accessed on 25 October 2015.

[290] Own calculations; data from Statistics Austria; http://www.statistik.at/web_de/statistiken/energie_umwelt_innovation_mobilitaet/forschung_und_innovation/f_und_e_in_allen_volkswirtschaftlichen_sektoren/index.html; accessed on 25 October 2015.

[291] BMWFW und BMVIT 2015.

The situation in terms of part-time employment is more gender balanced in the BES, where in total 1 FTE is staffed with 1.4 persons (1:1.39 as regards men and 1:1.57 as regards women).

Since 2004, also the proportion of both men and women in part-time employment positions has increased significantly in the non-university research organisations. In 2013, 49% of all female scientists, and 26% of all male scientists, were part-time employed. This trend, which can also be observed in the BES and HES sectors, is also caused by the introduction of a legal right to part-time employment for parents ("parental part-time employment") which came into force on 1 July 2004.

The two major R&D funding organisations in Austria, FFG and FWF have integrated the consideration of gender and equal opportunities into their application and reporting mechanisms in order to more deeply anchor gender in research. The FFG also developed gender equality guidelines for all programmes. Between 2008 and 2014, the FWF funded a total of 84 research projects in different funding programmes that explicitly took gender into account.[292]

Total funding of €15,229,565 was approved for these 84 research projects (BMWFW und BMVIT 2015).[293] In 2014, FWF's Elise Richter career development programme for women in science and research was expanded to become the Elise Richter / PEEK Programme, which supports women with outstanding qualifications in arts-based research in their pursuit of a university career. The first two projects in this sub-programme were approved in November 2014.[294]

In terms of dedicated support programmes, the FEMtech research projects funding scheme and the Laura Bassi Centres of Expertise, both managed by FFG should be mentioned. FEMtech research projects were created as a funding scheme within the FEMtech programme in 2008. FEMtech – "Women in Research and Technology" was a programme of the Federal Ministry for Transport, Innovation and Technology (BMVIT) for promoting equal opportunities for women and men in research and technology within the fFORTE initiative[295] and ran during 2003 to 2010. After 2010, FEMtech RTI continued under the "Talents programme" as FEMtech research projects. These projects enabled researchers to gain first experience with incorporating the dimensions of gender and diversity into technological research. The FEMtech research projects funding scheme funded a total of 46 projects with €9,747,700 between 2009 and 2014 (BMWFW und BMVIT 2015).

The "Laura Bassi Centres of Expertise" (LBC) programme, commissioned by the Federal Ministry of Science, Research and Economy (BMWFW), establishes centres of excellence at the interface between academic and industrial research under the leadership of female scientists and seeks to increase visibility of female accomplishments in science as well as increase female participation in the long-run.[296] The development and implementation of the programme was a response to the low number of female directors of research centres focused on applied science research in cooperative research fields. The programme's objectives are:

- to improve the visibility of the research work undertaken and results achieved by highly qualified women in a way that addresses research, management and careers

[292] This considers those projects that reported the involvement of gender studies, gender research, women's studies, or feminism as scientific disciplines in a project, or where an abstract clearly indicated the inclusion of gender in a research project.
[293] According to FWF, another 9 gender related projects were funded by FWF with a budget of €1.3m in 2015. "Gender related project" is defined as a project which indicated relevant scientific disciplines.
[294] FWF 2015.
[295] fFORTE is an Austrian initiative that is meant to help promote the potential of women in professions previously dominated by men.
[296] See Dörflinger und Mayer 2011.

- to work as a learning and teaching instrument to contribute to increased equality of opportunity in Europe's scientific landscape (BMWFW und BMVIT 2014).

The output of the LBC was quite considerable:[297] By spring 2013 the eight centres produced 230 publications, 21 dissertations, 41 bachelor's and master's theses, two patents and two licenses. Some 90 researchers, in addition to the eight directors, were active at the centres. The programme was evaluated in 2014 and the evaluators recommended a dual approach for the future, namely to incorporate specific programme elements into mainstream processes and to continue the specific (adapted) LBC programme (BMWFW und BMVIT 2014).

Overall, the evaluations of the Austrian Research Promotion Agency (FFG) and the Austrian Science Fund (FWF) data show that experience with gender-specific research has been collected in a broad range of thematic fields and scientific disciplines in recent years. This was probably only possible because both funding agencies implemented measures for integrating gender as a dimension in research projects.

In this respect it has to be noted that only one-third (including Austria) of 33 ERA countries explicitly set aside budgeted funds for research projects that consider the dimension of gender (for example, in the form of programmes, calls for proposals, premiums, etc.). Moreover, only five countries (Austria, Spain, Iceland, Portugal, and Norway) have national guidelines for integrating gender aspects into research content in the framework of research programmes, research projects, and studies.

These guidelines aim at a demand-oriented consideration of issues and interests of both men and women in R&D agendas, a dismantling of existing barriers and disadvantages etc.

The Austrian public universities as well as the ÖAW and the BMWFW include gender equality provisions in all performance agreements. The 2015 amendment to the Austrian Universities Act stipulates that university decision-making bodies must ensure that 50% of their members are women, as well as requiring the preparation of plans for the promotion of women and gender equality, especially when it comes to the compatibility of work and family. In addition, strategic gender equality objectives will be defined for the universities in the performance agreements for the 2016-2018 period.

Also the ÖAW is committed to equal treatment of men and women and has embedded this in its rules of procedure in 2011. In 2014 there were 1,152 people (calculated as full-time equivalents) employed at the ÖAW. The share of women amounted to 43% (39% in terms of scientists) (BMWFW und BMVIT 2015). A large gender gap between the group of engineering and natural sciences on one side and SSH on the other side exists. Of 29 institute management positions[298], following the integration of the Austrian Archaeological Institute (OeAI) into the Academy, only two are currently occupied by a woman and women made up about 13% of the ÖAW membership in 2014, while 50% of new members admitted in 2014 were women.[299] As regards the other important non-university research organisation in the field of basic sciences in Austria, the Institute of Technology Austria, women occupied about 32% of research posts in 2014. There are, however, significant differences amongst career levels: 16% of professors are women, while 38% of PhD students and 34% of postdocs are women,[300] although the institute has launched several measures since its founding that are related to equal opportunities, especially with a focus on recruiting researchers. IST Austria has also established an

[297] See Laura Bassi brochure, available at: https://www.ffg.at/sites/default/files/downloads/131011_laura_bassi_broschuere_final.pdf; accessed on 10 September 2015.
[298] The number refers to the period after the integration of the Austrian Archaeological Institute (OeAI) into the Academy.
[299] BMWFW und BMVIT 2015.
[300] BMWFW und BMVIT 2015.

internal Dual Career[301] Advice Service and is also a member of the Dual Career Service Support network of the WWTF.[302]

Fellowship programmes administered by the ÖAW allow women researchers to interrupt and extend their contract for a maximum of 12 months during maternity leave. Also in terms of other individual person related grants (e.g. from FWF or OeAD), interruption is possible if the researcher wishes to finish the project after maternity leave.

To fight the underrepresentation of women, especially in leadership positions, the Diversity Award, which is given to higher education and research institutions which have implemented and are practising diversity management in their organisational structures and work processes, has been introduced.

There is very little data on the status quo for equal opportunities in the business enterprise sector. This is the largest R&D sector in Austria, and it has only had a very low proportion of women up to this point.

In addition to the central role of explicit funding opportunities considering gender and sex in R&D, long-term efforts and a consistent policy are required to increase the proportion of women in science and to integrate gender into research and development projects. This long-term perspective is also taken up by the national R&I strategy, which postulates the inclusion of gender-specific budgeting measures in all research support, the establishment of individualised support measures for women studying to become scientists as well as support measures for improved compatibility between career and family.[303]

4.5 Optimal circulation and Open Access to scientific knowledge

4.5.1 e-Infrastructures and researchers electronic identity

One Austrian example for e-infrastructure for large structured data is the establishment of the European bio-database (BBMRI) at the Medical University of Graz (see section 4.2). In total, Austrian universities hosted 16 electronic databases, according to an assessment based on the research infrastructure database by the BMWFW.[304] However, these are provided to third parties only to a limited extent ('open for collaboration').[305]

The European e-infrastructure OpenAIRE in which the University of Vienna participates can also be mentioned in this respect.[306] The aim of this research infrastructure is to create free-of-charge public access across Europe to quality-checked scientific articles via a central electronic portal. Moreover, the Centre for Digital Humanities (ZDG) at the Austrian Academy of Sciences or the research infrastructure CLARIN and DARIAH run by the University of Graz all aim at developing specific basic services, repositories and digital research methods for research in the humanities.[307]

[301] Dual-career offers support the mobility of researchers by providing assistance for researchers and their partners who come to IST Austria from abroad. The focus here is on job search assistance for partners.
[302] http://www.wwtf.at/other_activities/dual_career_service_support/; accessed on 24 October 2015. Other supporters are several Austrian universities, the ÖAW, the AIT, LBG, the Research Institute of Molecular Pathology, the Research Centre Telecommunication Vienna and the Centre for Virtual Reality and Visualisation Research Ltd.
[303] Federal Chancellery et al 2011.
[304] Heller-Schuh and Leitner 2012.
[305] Cuntz 2015.
[306] http://bibliothek.univie.ac.at/openaire.html; accessed on 21 October 2015.
[307] http://www.clarin-dariah.at/; accessed on 21 October 2015.

Lastly, big data projects have also been encouraged in Austria by the FFG since 2013 under the "ICT of the future" programme umbrella.[308] The internet portal data.gv.at offers a catalogue of open data records and services from public administration (Open Government Data). These data can be used freely, both for personal information as well as for commercial purposes.[309]

In January 2014, e-Infrastructures Austria, a three-year partnership project started, sponsored by the Federal Ministry of Science, Research and Economics (BMWFW). The objective of this project is the coordinated establishment and development of repository infrastructures for digital resources in research and science throughout Austria, including research data and other complex data objects. The project promotes the exchange of experiences on technical, organisational, legal, and content related issues between the libraries, IT services, scientists and researchers (at both local and national level) who take part in 12 different working groups,[310] events, and workshops of the project. Particular emphasis is placed on the handling of complex data such as research data and multimedia content.

e-Infrastructures Austria also participates in several international initiatives, such as COAR (Confederation of Open Access Repositories) and OpenAIRE (see above). The project is coordinated by the University of Vienna and implemented with 25 partners all over Austria. Associated membership for external partners is possible, but companies are not (yet) included. The University of Vienna also hosts the National Open Access Desk Linked to the OpenAIRE project. [311]

In 2014, a roadmap on Intelligent Data Analytics technologies has been published, commissioned by FFG and BMVIT providing orientation for the short-, medium- and long-term (year 2025) of the FFG funding programme ICT of the Future.[312] According to this study, Austrian strengths are in the areas of statistics, algorithmic efficiency, machine learning, computer vision and semantic web.

A recent study on big data in Austria confirmed that big data business awareness is still at a rather moderate level in Austria.[313]

In September 2015, the BMVIT ordered a study on open data and its implications for RTI policy whose results should be available mid of 2016.

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[308] https://www.ffg.at/en/ictofthefuture; accessed on 21 October 2015.
[309] Cuntz 2015.
[310] https://fedora.phaidra.univie.ac.at/fedora/get/o:387177/bdef:Content/get; accessed on 20 October 2015. e-Infrastructures Austria is organised in 12 so called clusters:
Cluster A: Monitoring and exchange to build document servers in local organisations
Cluster B: Design and implementation of a „National Survey" about research data
Cluster C: Development of a knowledge network for building repositories
Cluster D: Infrastructure development
Cluster E: Legal and Ethical Issues
Cluster F: Open Access
Cluster G: Visual data modelling
Cluster H: Life Cycle Management
Cluster I: Handling meta-data complexity
Cluster J: Permanent data security
Cluster K: Data from scientific research and arts & research
Cluster L: Cross-cutting project related issues
[311] https://www.fosteropenscience.eu/content/openaire-and-services-national-open-access-desk-noad; accessed on 20 October 2015.
[312] Berger, Dittenbach und Haas 2014.
[313] Köhler und Meir-Huber 2014.

Electronic identifiers for researchers in Austria have so far not been assigned, nor systematically collected in a national register, e.g. comparable to the Digital Author Identification (DAI) used in the Netherlands or the "Star Metrics" system in the US.[314] However, in 2015 FWF decided to request compulsory "Open Researcher Contributor ID" (ORCID)[315] for all its future call applications after 1 January 2016[316], which will doubtlessly increase digital identification of single researchers and probably contribute towards a standard in Austria.

4.5.2 Open Access to publications and data

Open Access to publications can already be considered as mainstreamed in Austria. This is not yet the case as regards the open access to research data. Six Austrian universities, research organisations and a funding agency are institutional signatories of the original "Berlin Declaration on Open Access (OA) to Knowledge in the Sciences and Humanities" (2004), namely the University of Salzburg, University of Vienna, International Institute for Applied Systems Analysis, Universities Austria, Karl-Franzens-Universität Graz and the FWF.[317] In 2010, Universities Austria recommended following the green road in Austria.[318]

In 2012 the "Open Access Network Austria" (OANA) was established as a joint activity under the organisational umbrella of the FWF and The Austrian Rectors' Conference (UNIKO).[319]

In a study based on an international comparison of countries published in August 2013, 48% of all sampled papers in Austria between 2008 and 2011 were published via open access.[320] More recent and extensive data for the period from 1996 to 2013 suggests a slightly higher share of 55%.[321] Of the latter, approximately 9.4% were of the green type. 8.8% were published via the gold route. The rest is of the other hybrid type. This positions Austria roughly around EU-28 average.[322]

The FWF can be seen as main promotor of OA in Austria.[323] It had already introduced an open access obligation in 2008 without strict monitoring. From January 2016 onward, however, final reports on FWF projects will no longer be accepted unless all peer-reviewed publications are reported as open access publications. This policy is in line with common practice in other funding agencies.

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[314] Cuntz 2015.

[315] ORCIDs are unique identifiers that enable the attribution of research results to specific authors

[316] FWF 2015.

[317] Until 2015, the following institutions from Austria have signed the *Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities* (in chronological order): FWF, Universities Austria, International Institute for Applied Systems Analysis (IIASA), University of Vienna, University of Graz, University of Salzburg, Institute of Science and Technology (IST) Austria, University of Innsbruck, University of Linz, Technical University of Graz, Austria Science Board (Wissenschaftsrat), the Academy of Fine Arts Vienna, University of Natural Resources and Life Sciences (Vienna), Donau-Universität Krems, MODUL University Vienna, Karl Landsteiner Privatuniversität für Gesundheitswissenschaften, Danube Private University, Privatuniversität Schloss Seeburg.

[318] Cuntz 2015.

[319] http://www.oana.at/en/home/; accessed on 20 October 2015. This network comprises representatives of all public universities and many private universities, universities of applied sciences, non-university research institutions, and funding agencies. Its main tasks include the coordination of and recommendations for the Austrian OA-task/ activities of the research institutions, funding organisations and research policies (incl. taking into account international developments) as well as positioning towards the information providers (mainly publishing houses).

[320] http://www.science-metrix.com/pdf/SM_EC_OA_Availability_2004-2011.pdf; accessed on 20 October 2015.

[321] http://science-metrix.com/files/science-metrix/publications/d_1.8_sm_ec_dg-rtd_proportion_oa_1996-2013_v11p.pdf; accessed on 20 October 2015.

[322] http://science-metrix.com/files/science-metrix/publications/d_1.8_sm_ec_dg-rtd_proportion_oa_1996-2013_v11p.pdf; accessed on 20 October 2015.

[323] http://www.fwf.ac.at/en/research-funding/open-access-policy/; accessed on 20 October 2015. See also Tonta, et al., 2015 and Bauer et al., 2015.

Under the gold road approach, FWF financed almost 900 journal and book publications only in 2012, with a total volume of €1.6m. Moreover, the FWF has participated in PubMed Central through UK PubMed Central. Since 2010, almost 3,000 publications from the field of life sciences have been made freely accessible through this initiative. Together with the BMWFW, the FWF decided to launch calls for start-up financing for OA journals in the humanities and social sciences. By the end of 2013, eight premium international OA journals were selected and publicly supported.[324]

In 2014, the FWF cooperated with the Austrian Academic Consortium (KEMÖ) and IOP (Institute of Physics) Publishing to develop one of the world's first models for reducing the subscription prices of journals to the same extent that the costs of open access are covered by the FWF. This model was also agreed upon with Taylor & Francis in 2015 and will be expanded to include additional publishing houses in the future. The costs are settled directly between the publisher and the FWF.[325]

In order to prevent certain publishers from constantly raising their prices, the FWF introduced maximum limits and does not cover certain costs in addition to the project budget for grants approved after November 1, 2014. This applies to Gold Open Access or Hybrid Open Access, as well as other publication costs such as submission fees, page charges and colour illustrations. In addition to the options which involve costs, the FWF still offers the option of Green Open Access (self-archiving) as well as a number of free open access journals.

In 2014 the Stand-Alone Publications Programme was expanded to include applications for new, web-based publication forms (e.g. apps, wiki models, databases or websites with scientific commentary; audio, video or animated publications, etc.).

With regard to licences for use, the Creative Commons CC-BY licensing model has been obligatory since the beginning of 2015.[326]

Also IST Austria and ÖAW, the two major non-university basic research organisations in Austria, have developed open access policies and created repositories.[327] While the ÖAW's publishing house is a so-called green publisher, IST Austria has also recently established a publication fund for financing the gold road.

[324] Cuntz 2015.
[325] FWF 2015.
[326] Ibid.
[327] http://epub.oeaw.ac.at/oa/ and https://ist.ac.at/news-media/news/news-detail/article/new-policy-encourages-open-access-publications/6/; both accessed on 20 October 2015.

5. Framework conditions for R&I and Science-Business cooperation

5.1 General policy environment for business

Austria ranks fairly high on 23rd position in terms of its political and regulatory environment according to the latest edition of the World Economic Forum (WEF)'s Global Competitiveness Index (2015).[328] This represents a loss of seven positions compared to the 2012/2013 ranking caused by high tax rates, restrictive labour regulations, inefficient government bureaucracy and complexity of tax regulations which are considered to be the most problematic factors for doing business.[329]. In the WEF Austria ranks best in the categories business sophistication (8th place), infrastructure (15th), higher education and training (16th), and innovation (17th).

In the Doing Business Ranking of the World Bank, Austria positions 21st as regards the ease of doing business (2014: 19th position), 16th as regards solving insolvency and only 101st for starting a business (which, however, is already an improvement of 12 ranks compared to the previous ranking).[330] The country, however, ranks among the top 5 countries for the ease of enforcing contracts (source: Doing Business Ranking, World Bank).

According to a study commissioned by the EC in 2011, Austria demonstrates a very high level of licensing complexity largely due to the high costs involved (towards public and private sector) and long duration for obtaining licenses[331], which is confirmed by the annual report of the Austrian Council for RTD.[332] On the other hand, the procedures per se involve a very small number of licenses (two licenses, the so called "Gewerbeanmeldung" and "Betriebsanlagengenehmigung", embrace all required licenses) and are considered to be effective and non-discriminatory. The introduction of the company service portal ("Unternehmensserviceportal") as one-stop shop can also be regarded as a success in this direction.

Existing bankruptcy laws are not very encouraging for experimentation and potential failure among innovating firms in Austria, in particular SMEs. In general, Austrian bankruptcy laws originate from German civil laws. They are an important ingredient of framework conditions for SMEs, in particular for those with innovative and risky practices. According to the EC (2011) study on second-chances-regulation for businesses, the bankruptcy system's effectiveness as an early warning system is relatively low in Austria.[333] Unfortunately, this also applies to the efficiency of out-of-court settlements in Austria. The debtor friendly system features and favours reorganisation of businesses rather than liquidation after insolvency.[334] At the positive side is the amendment of the "Neugründungs-Förderungsgesetz" ('new start-up funding law'), which reduced the waiting time to qualify for support for new start-up activities from 15 to 5 years after the last failed entrepreneurial activity. Moreover, previous business failure will not be considered anymore as formal exclusion criterion for a funding approval.[335]

[328] World Economic Forum 2015.
[329] Ibid.
[330] http://www.doingbusiness.org/rankings; accessed on 22 October 2015.
[331] European Commission 2011b.
[332] Rat für FTE 2015.
[333] European Commission 2011b.
[334] Cuntz 2015.
[335] Rat für FTE 2015.

5.2 Young innovative companies and start-ups

Due to the fact that there are traditionally low start-up dynamics of innovative companies to advance competition intensity in established industries or to initialise new businesses, the Austrian government aims to improve conditions for innovation and support to newly founded businesses, in particular innovative SMEs and high-tech start-ups. For this purpose also a dedicated promotion paper called "Land der Gründer" ('country of start-ups') has been published by the BMWFW in 2015 stating the ambitious goal to turn Austria into the most attractive location for start-ups in Europe.[336] 40 measures are proposed to accelerate entrepreneurship and start-up dynamics. Most of them refer to reduction of bureaucratic efforts and the provision of alternative financing instruments (such as crowdfunding and risk capital).[337]

To support business start-ups, several programmes have been implemented by AWS, such as the "Microcredit" programme in 2010 to encourage self-employment through provision of micro loans, or the "Jungunternehmer-Offensive" ('start-up offensive') in January 2013, which should ease access to venture capital for SMEs,.[338] In 2014 also innovative services were supported for the first time through the "AWS Innovative Service Call" programme; out of 141 submitted projects 18 young enterprises were supported with a financing budget of €1.8m. In 2014, AWS allocated €192m for start-up financing across all its programmes.[339]

Also FFG operates specific programmes for start-ups in Austria, such as the 'AplusB' programme, which facilitates spin-off company foundations from universities and research organisations or the 'Hightech Start-Up' programme. The latter was supported with €8.9m in 2014.

Venture capital is also an applied instrument within the so called 'Start-up Offensive', which also includes a start-up/incubation fund and a business angel fund. The AWS start-up or incubation fund ("Gründerfonds"), which was established in 2013, provides long-term growth capital through equity-holding and dormant equity holding. It focuses on early-stage and later-stage investments with a volume of €65m respectively €45m. The business angel fund, which was also implemented in 2013, doubles the capital which a business angel invests in a start-up.

The "Start-up Offensive" showed already first results in 2014. The number of AWS Start-up guarantees increased by 21% compared to 2013 and the number of AWS Start-up cheques increased by 7%. The project volume of the AWS "Gründerfonds" increased from €1.6m in 2013 to €26.2m in 2014. The business angel fund was able to conclude two agreements with venture-capital funds and thus raise fresh venture capital of more than €20m for young enterprises for the forthcoming years.

Start-up support is also foreseen in the new structural funds period in Austria (2014-2020). Measure 7 and Measure 8 are designed for this purpose (see Section 3.3.2

Table 6).

[336] BMWFW 2015c.
[337] http://diepresse.com/home/wirtschaft/economist/4710281/Initiative_Traum-vom-Land-der-Grunder?from=simarchiv; accessed on 1 February 2016.
[338] BMWFJ 2012.
[339] BMWFW und BMVIT 2015.

Small-scale policies to foster start-up activities also include, among others, awards and prizes for (female) entrepreneurs, e.g. ”Phönix“ and ”Phönix Frauen” (both initiated by BMWFW). In July 2014 Austria also changed the guidelines for its SME guarantee programme to focus more on innovative start-ups.[340] Among several other aspects, the new guidelines aim to be more oriented towards the needs of applying SMEs and financing banks, harmonise conditions in order to minimise differences caused by the regulation itself, extend the eligibility of start-ups from up to three years to up to five years after their foundation and provide financial grants for the establishment of capital market prospectuses.[341]

5.3 Enterpreneurship skills and STEM policy

Entrepreneurship culture in Austria is characterised by a rather risk-adverse attitude which in turn gets little support from innovation-related education and training curricula, although entrepreneurship education is explicitly mentioned as education policy objective. [342] In general, students and young graduates are not sufficiently prepared for self-employment, business and social entrepreneurship. To improve this situation, entrepreneurship education is seen as an integral part of Austria’s lifelong learning strategy.

Entrepreneurial education falls under the authority of the department of vocational education of the Austrian Federal Ministry of Education and Women (BMBF). It is an educational principle and embedded in different courses only taught in vocational schools (“Berufsschulen”) and secondary business schools (“Handelsakademien”) and practically complemented by virtual ‘practice firms’. [343]

Colleges organised by secondary business schools also offer entrepreneurship and management courses for graduates of other school types within a four-term long special curriculum.[344] In 2012 the federal working group Entrepreneurship for Engineers has encouraged a structural implementation of entrepreneurial thinking.

For teacher training, courses and seminars on ‘entrepreneurship and management’ are offered by Austrian pedagogical higher schools at the post-secondary level. Also a summer school on this issue has been organised in June 2014. In November 2015 a summit for entrepreneurship education has been organised by the BMBF, the Industrial Association and other partners.[345] To foster entrepreneurial spirit the BMBF founded a competence centre on ‘entrepreneurship education for school innovation’[346], which also certifies schools which excel in the field of entrepreneurship education and offer entrepreneurship education in a holistic, targeted and sustainable perspective. [347] By early 2014, 20 schools had been certified, which equals about 20% of all schools of business and colleges of business administration.

[340] OECD 2015b.
[341] https://www.awsg.at/Content.Node/service/banken/rundschreiben/3093.de.php; accessed on 1 February 2016.
[342] Thematic Working Group on Entrepreneurship Education, 2014.
[343] In 1993 the idea of practice firms was laid down in Austrian school curricula for the first time in Europe. A practice firm is the model of a real company, enabling the operational procedures of an actual company to be reproduced to varying degrees of complexity, with the aim of making them transparent for learning processes. Just as real companies have business contacts with other companies within the business world, practice firms also have external contacts, enabling students to discover their partners’ business culture in Austria and abroad. Austria has „exported” this model to several countries in Southeast Europe.
[344] https://www.bmbf.gv.at/schulen/bw/bbs/entrepreneurship.html; accessed on 23 October 2015.
[345] http://www.eesi-impulszentrum.at/global-entepreneurship-week/; accessed on 23 October 2015.
[346] http://www.eesi-impulszentrum.at/; accessed on 23 October 2015.
[347] http://www.eesi-impulszentrum.at/schulen/; accessed on 23 October 2015.

In addition, only few initiatives are employed to foster creativity, innovation and entrepreneurial thinking and understanding. At the federal level, innovation is particularly supported at school level through the 'Jugend innovativ'-Programme implemented to generate technological, business and design innovations.[348] It is a cost-efficient programme, highly demanded by especially technical oriented secondary schools to implement school projects.[349] Other ministerial initiatives seek to improve cooperation between secondary and tertiary education systems via direct contacts of pupils and researchers ("Young Science" networks or the "Sparkling Science"-programme), enhance skills training of existing R&D staff in small and medium-sized enterprises (SMEs) as well as increase female participation in industry innovation in the long-run ("FEMtech internships" providing scholarships to female MINT students).

To foster inter-sectoral mobility between academia and business enterprises which do not have an own research unit, the 'young experts'-programme has been launched, under whose framework master theses and PhD theses, which are firmly embedded in the R&D work of a company, can be supported for up to one year.[350] The programme has been recently extended towards the co-financing of post-doc and junior researcher positions employed at companies.

At tertiary level, entrepreneurship education in the HES is not considered a horizontal guideline, let alone a priority in Austria. Austrian university managers perceive entrepreneurship also as little developed in Austria.[351] In general, however, education and training curricula in higher education broadly focus on equipping people with the capacity to learn and to develop transversal competences such as critical thinking, problem solving, creativity, teamwork, and intercultural and communication skills. Formal and informal entrepreneurship education and training at universities in Austria is only provided by universities of economy and business administration. The initiative u:start provides support for university graduates who decide to found a start-up.[352]

The skill base of university graduates in Austria is fairly good in qualitative terms and mostly sufficient in quantitative terms. There are some shortages in some fields of natural and engineering sciences and mathematics. Therefore, initiatives in the context of enhancing human resources for R&D focussed on raising participation in MINT subjects (mathematics, informatics, natural and engineering sciences).

In general, the number of graduates from HEI is continuously increasing from 38,979 graduates in 2008/2009 to 54,310 graduates in 2012/2013. 34.7% of university graduates in 2012/2013 graduated in social sciences, economy and law and 20.7% in humanities and arts. Another 9.9% graduated in pedagogics and 4.8% in medicine and social services. 13.8% graduated in natural sciences, mathematics and informatics and another 12.0% in engineering studies. The rest graduated in agricultural and veterinary sciences and other studies.[353]

As regards support for staff training in young SMEs, several schemes are provided at federal and local level,[354] which are positively received by the BES. They cater for different needs ranging from financial support for innovative handicrafts to IPR advice and also address very diverse target groups ranging from low-skilled employees to executive managers. An extraordinarily high level of support is provided to companies offering apprenticeship training to their employees. 80 percent of all firms in Austria offer continuing education and professional development to their employees.[355]

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[348] AWS 2007.
[349] Schuch und Scheck 2007.
[350] https://www.ffg.at/getdownload.php?id=3234; accessed on 23 October 2015.
[351] They rate the fitting of this dimension in Austria with 4.5 on a scale from 1 to 10, which is below the EU average of 5.7. See also European Commission 2013b.
[352] http://www.awsg.at/Content.Node/foerderungen_alle/gruenden/121711.php; accessed on 25 April 2016.
[353] Data from BMWFW 2014, own calculations.
[354] https://www.wko.at/Content.Node/Service/Unternehmensfuehrung--Finanzierung-und-

The go-international programme of the Austrian Economic Chamber (WKÖ) even supports enterprises investing in qualifications of their employees in foreign subsidies, the mobility of trainees between the Austrian parent company and its subsidiaries abroad as well as internships for young Austrians in subsidiaries of Austrian companies located abroad and internships for young foreigners in companies located in Austria, which show a significant level of export orientation.[356] There are no vouchers or tax incentives to work with consultants, but funding for direct consultancy or coaching on HR is available for SMEs in Austria. Such funding is especially provided by social partners (e.g. WKÖ and Chamber of Labour) and by regional economic development agencies.

5.4 Access to finance

Access to finance, especially in terms of an alternative to regular bank lending, is traditionally a weak area in Austria. To improve SME access to finance, Austria has a portfolio of government loan guarantees, special guarantees and loans for start-ups, government export guarantees and trade credit, direct lending to SMEs and venture capital, equity funding, business angel support in place.[357] There is, however, a significant lack of private risk capital to finance small, young enterprises with high growth potential, which are expected to have an effect on employment and structural economic change. According to the latest available data by country of the portfolio company (source: EVCA), the amount of venture capital available in Austria recovered to €65.1m in 2013, after a short downturn in 2012 (€42.5m, equal to roughly 1% of GDP). However, this is not yet back on the level already observed in 2011 (€93.8m). Roughly 50% of these funds were constantly allocated to high-tech sectors.[358]

Total private equity investments in 2013 stood at 0.09% of GDP, which is far below the EU average (0.28%), and considerably lower than in other innovation followers and also lower than in neighbouring countries such as Hungary or the Czech Republic.[359] The IUS 2015 puts Austria at 28% of the EU median in VC investments, a decrease of 3.6% from 2014.[360] Also business angel investments are low in Austria. They amounted to only €2.9m in 2013.[361] However, according to OECD (2015), Austria belonged to only six countries out of 20 scrutinised countries whose seed and early stage venture capital investments surpassed 2008 levels, albeit from a very low starting level.

The low risk capital intensity in Austria seems to be both a supply and a demand problem.[362] The latter is foremost caused by the strained economic development in Austria during the last couple of years. Policy addresses the supply problem through a number of targeted measures, especially the "Gründerfonds" (start-up or incubation fund) and the Business Angel Funds, both operated by AWS (see Section 5.2). In terms of seed funds, AWS is also implementing the programmes 'AWS Seedfinancing' and 'AWS PreSeed', which address the pre-start and start-up phase of technology oriented (potential) start-ups and the start-up vouchers. In 2014, 6 pre-seed and 11 seed-financing projects with thematic priorities in ICT and physical sciences were funded in 2014 with €6.5m. In the field of life sciences another four pre-seed and six seed-financing projects with a funding volume of €6m could be supported.[363]

Foerderungen/Foerderungen/Foerderdatenbank---Foerderungen/fdb.html?branche=&schwerpunkt[]=ausundweiterbildung&searchTerm=; accessed on 23 October 2015.

[355] http://investinaustria.at/en/research-development/scientific-staff.php; accessed on 23 October 2015.

[356] https://www.wko.at/Content.Node/kampagnen/Bildungsexport/Foerderungen-im-Rahmen-von--go-international-.html

[357] OECD 2015b.

[358] Cuntz 2015.

[359] EVCA 2015.

[360] IUS 2015.

[361] EBAN 2014.

[362] Peneder 2013.

[363] BMWFW und BVMIT 2015.

The monetary funding and financing instruments of AWS to support innovation projects in companies encompass first of all low-interest credits, guarantees, and grants, but AWS also continues its Venture-Capital-Initiative, which sources funds from the National Foundation for Research, Technology and Development as well as from ERDF via the Austrian federal states ("Bundesländer"). However, the financial means provided by the public will not significantly reduce the gap between Austria and leading risk capital markets. The main problem for leveraging the VC market in Austria is to be seen in regulatory issues, e.g. the lack of a dedicated private-equity law, which would facilitate the engagement of institutional investors in Austria [364], e.g. through reducing the obligations on the equity issuer concerning information disclosure and investor protection.

Given the availability of public seed and pre-seed measures (see Section 5.2) a more developed VC sector would be especially instrumental in Austria to enable growth of start-ups in later stages after initial commercialisation, particularly for scaling up their commercial activities. In this phase of business development the traditional loan based banking sector works insufficiently because of scarce collaterals and volatile business forecasts of the start-ups.

Scoreboard data from OECD (2015) show that the proportion of SMEs reporting a rejection of their credit application varies considerably across countries. In Austria SME loan applications were seldom rejected in the sample of SMEs surveyed in 2013, suggesting relatively easy access to bank financing. Therefore, it is not surprising that only less than 10% of Austrian SMEs rank access to finance as their most pressing concern. However, the share of firms that did not get a bank loan increased from 20% in 2013 to 27% in 2014, according to the Business Survey conducted by the Austrian Institute of Economic Research (WIFO) of 1 250 enterprises (mostly SMEs).[365]

In August 2015, the "Alternative Financing Law" has been passed, which stipulates clear legal framework conditions for crowdfunding in Austria. It introduces consistent minimum information and publication requirements, precautions to combat crowd financing for criminal activities and money laundering, as well as minimum standards for web-based crowdsourcing platforms. In future larger emissions than previously can be issued without the need to take the heavy requirements of capital market prospectus into account, which reduces costs and liability risks.[366]

Other alternative financing instruments such as a tax exempt amount for business angels for strengthening equity or reduction of ancillary wage costs for start-ups and R&D-intense companies are not planned in Austria.

5.5 R&D related FDI

Private R&D financing from abroad is very important in Austria. In 2013, 14.7% of all R&D investments in Austria have been financed from abroad, almost exclusively from foreign companies.

44% of foreign-controlled enterprises, which are conducting R&D in Austria, originate from Germany, 12% from the USA, and 10% from Switzerland. The remaining third has its headquarters in adjacent as well as other European countries (Schibany et al. 2004). It is estimated that the total R&D financing from abroad will amount to €1.529b or 15.1% of total R&D in Austria in 2015 (including EU funding and some rather marginal contributions from international organisations). Although growing in absolute numbers, this share continuously decreased from the high level of 21.4% in 2002.

[364] Jud et al., 2013.
[365] Quoted in OECD (2015), p. 95.
[366] https://www.help.gv.at/Portal.Node/hlpd/public/module?gentics.am=Content&p.contentid=10007.163630; accessed on 26 October 2015.

According to the Austrian Business Agency, which is responsible for promoting the business location Austria abroad, Austria was ranked 21st in the A.T. Kearney Foreign Direct Investment Confidence Index 2015 and is appreciated because of its stable conditions and high R&D quota.[367] The study concluded that the SMEs in Austria are driving the corporate private sector in Austria. Examples of larger deals mentioned in the study are the acquisition of the Viennese biotech company Dutalys by Roche for €452m at the end of 2014 and the stake in Telekom Austria acquired by the Mexican company America Movil[368] in July 2014.

More than 300 regional headquarters of multinational companies coordinate transnational business operations from Austria. The Austrian tax system is attractive for companies, featuring the education allowance, training premium, tax loss carry forwards and the possibility to transfer hidden reserves. The corporate tax rate is set at 25 percent whereas the net worth tax and trade tax are not levied in Austria.

International companies such as Baxter, BMW, Bosch, Novartis and Infineon, which was the most research-intensive company in the country in 2013 and 2014, bundle their R&D activities and competence centres in Austria. Another inspiring example is Borealis, which decided in 2006 to turn its Austrian site located in Linz into the centre of its entire international research activities. It cooperates with numerous Austrian research facilities such as the Johannes Kepler University in Linz, universities of applied sciences and competence centres. In 2009 Borealis finally opened Innovation Headquarters (IHQ) in Linz, serving as its research and development centre.

A special incentive for doing private R&D in Austria is doubtlessly the research premium, which will be raised to 12% on 1st January 2016. It is an indirect pay-back-in-cash tax instrument on in-house research expenditures as well as contracted research. Moreover, the more than 30 research promotion programmes managed by FFG enable access to research funding services for companies based in Austria which operate in all business sectors, including subsidiaries of foreign industrial groups.

For companies aiming at establishing or expanding its research headquarters in Austria the Headquarter Strategy programme (now Competence Headquarters Programme[369], with an annual budget of around €10m[370]) has been introduced. The programme was redesigned in 2011 after a critical evaluation which hinted at windfall effects and weak programme logic[371] and is the evolution of the programme line Headquarter Strategy established in 2005. The new focus is on strengthening and expanding existing R&D - Headquarters through networking with Austrian research institutions. Also the establishment of new competence headquarters is encouraged by this programme.

[367] http://investinaustria.at/en/news/2015/05/Investment%20Confidence%20Index%20.php; accessed on 26 October 2015.
[368] http://investinaustria.at/en/news/2015/05/Investment%20Confidence%20Index%20.php; accessed on 26 October 2015.
[369] https://www.ffg.at/competence-headquarters; accessed on 26 October 2015.
[370] FFG 2015.
[371] Geyer und Tiefenthaler 2011.

5.6 Knowledge markets

Based on a recommendation of the Austrian Council for RTD from 6 June 2013, [372] Austria is currently in the process of developing a national IPR strategy expected to be published in 2016. The strategy should especially pave the way to improve the IPR applicability and accessibility for SMEs in terms of reduced costs, shorter duration of proceedings, less bureaucracy and better and more information provision. [373] The Austrian Council for RTD also requests profound scientific analysis on intellectual ownership and property in Austria, which is an underdeveloped field of research in Austria.

Like the majority of EU countries, Austria also addresses knowledge and IPR transfer on national level through overarching laws on the research system, obliging both research funders and public research organisations to play a full role in supporting national innovation and competitiveness (ERALAW 2011). Most Austrian public universities have specific IPR and exploitation strategies and maintain technology transfer offices. However, compared to enterprises but also individual inventors, the Austrian universities show relatively low patenting activities.

Out of a total of 3,978 patent applications in 2011 (last year of available data), only 104 patents have been registered by universities and universities of applied science, 2,300 by enterprises and 1,500 by individual inventors. [374] This number could be, however, misleading, because in many collaborative projects and science-business cooperation structures, such as COMET and CDG, enterprises are patenting although also the universities have contributed to it. Researchers from public organisations are entitled to patent their inventions, provided that their employer is not willing to file the patent application himself. Austria has special regulations, based on soft law, that guide research funding organisations when supporting academic spin-offs agglomerated in special centres ("AplusB" Centres). These guidelines offer advice on a variety of relevant areas, including management, eligibility, and funding for such activities (ERALAW 2011). In 2014 the number of spin-offs from universities was provided through the intellectual capital sheets ("Wissensbilanzen") for the first time. 11 spin-offs were reported,[375] which means in fact only 0.5 spin-offs per university in Austria.

The current role of the Austrian Patent Office (APO) as the main stakeholder of public IPR activities has been negatively assessed in 2013: The respective qualitative evaluation commissioned by the Austrian RTD Council[376] was based on an international comparison with other national offices. It argued that the APO does not seem to work on a fully balanced cost-benefit structure and with limited service orientation towards customers. APO, however, offers a few seminars, a library and provides general, legal and technical information and advice. In cooperation with AWS the service "discover.IP"[377] is provided for technology-oriented SMEs to analyse their IP potential.

[372] Rat für FTE 2013.

[373] https://science.apa.at/dossier/Nationale_Strategie_fuer_geistiges_Eigentum_im_Laufen/SCI_20150924_SCI63973462825474668; accessed on 27 October 2015.

[374] BMWFW 2015c.

[375] BMWFW 2015c.

[376] Oxfirst 2013.

[377] http://www.patentamt.at/Beratung/discover.IP/; accessed on 27 October 2015.

With regard to public support of IP management across borders, a national contact point (NCP) has been designated in 2010.[378] The NCP's tasks include the coordination of measures regarding knowledge transfer between public research organisations and the private sector, including tackling trans-national issues, in liaison with similar contact points in other Member States. The NCP is assisted by the BMWFW, the BMVIT, and the AWS. More specifically, in order to follow up the IP Recommendation, the Austrian National Contact Point concentrates on the following tasks: Reviewing and reporting on measures taken in Austria to implement the Recommendation and Code of Practice; analysing IP data; inspecting, cleaning and modelling data with the goal of highlighting useful information; conferences and workshops to enhance collaboration between universities and industry; and it settles legal issues (consolidation of model contracts, development of guidelines).

Notably, Austria is the first MS to ratify the Agreement on a Unified Patent Court in August 2013 and after signing the preliminary Agreement in February the same year. The "Comprehensive EU Patent Package" consists of three parts: two regulations on the EU Patent (substantive and procedural patent protection regulation and regulation concerning the translation of patents) as well as an international agreement on the creation of a unified patent jurisdiction. The Unified Patent Court will be responsible for disputes relating to future unitary patents as well as existing ”classic” European patents, making it easier for inventors and companies to protect their patents. However, it is far too early to assess the impact of the Unified Patent on the Austrian science and innovation system.

An interesting example of a private and cross-border trading platform that successfully matches IP supply from inventors and company demand in German speaking countries (Austria and Germany) is patent-net.de.

All of the IP offered on this platform needs to be protected by IP rights in advance. In general, there seem to be very few IP matchmaking and trading services in place.[379]

5.7 Public-private cooperation and knowledge transfer

5.7.1 Indicators

BES-funded/publicly-performed R&D

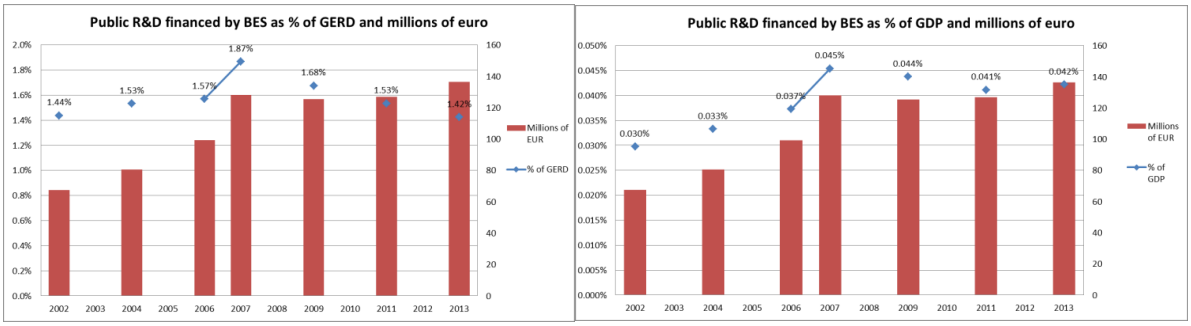


Figure 15: BES-funded public R&D in Austria as % of GERD (in €MLN; only reported biennially by Austria) and % of GDP

[378] http://era.gv.at/directory/175; accessed on 27 October 2015.
[379] Source: IP Industry Base, database by FhG MOEZ, http://ipib.ci.moez.fraunhofer.de/; accessed on 27 October 2015.

Public R&D expenditure funded by the Business Enterprise Sector has rather steadily increased in absolute amounts since 2002, with the exception of a dip in 2009 caused by the financial crisis. In terms of percentage of GERD however, BES funding of public R&D has decreased from its highest share of 1.87% in 2007 to 1.42% in 2013. Also as a percentage of GDP, it has not yet fully recovered to the 2007 value of 0.045% after the decline during the financial crisis. This reduction in relative terms is largely due to an increase in public funding, especially for universities and the Research Promotion Agency (FFG), in combination with near-stagnation of BES spending for R&D in general. The increase of the Research Premium (R&D tax incentive) in 2011 might also have made it fiscally more attractive for companies to carry out R&D in-house, but there is no evidence to support this conjecture, as the incentive effects of the research premium have never been evaluated so far.

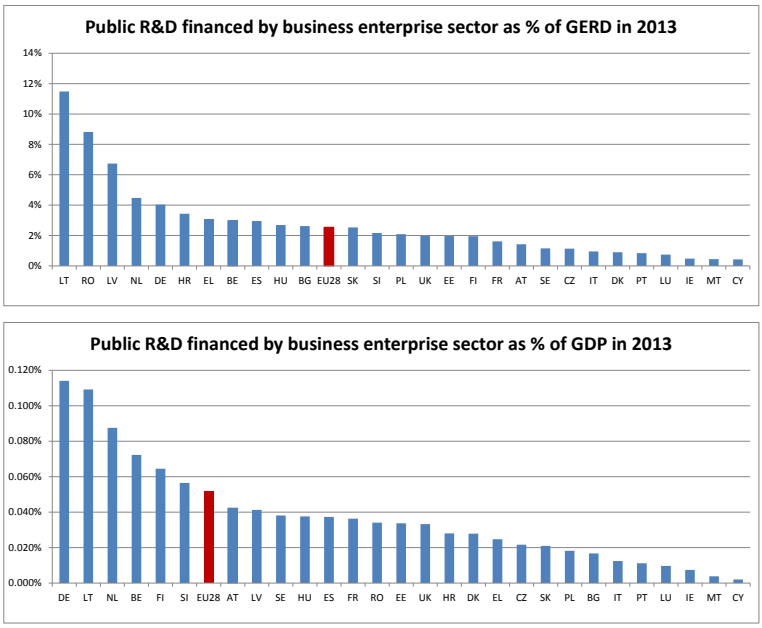


Figure 16: BES-funded public R&D as % of GERD and as % of GDP in 2013 in Member States[380]

The two charts in Figure 16 show the values of BES-funded public R&D in all EU-28 as percentages of GERD and GDP respectively.

Austria's levels are far below those of comparable countries (e.g. Netherlands, Belgium) and also below the EU-28 average for both indicators.

[380] 2013 was chosen as the latest data series providing a full comparison within EU-28.

Structural funds devoted to knowledge transfer

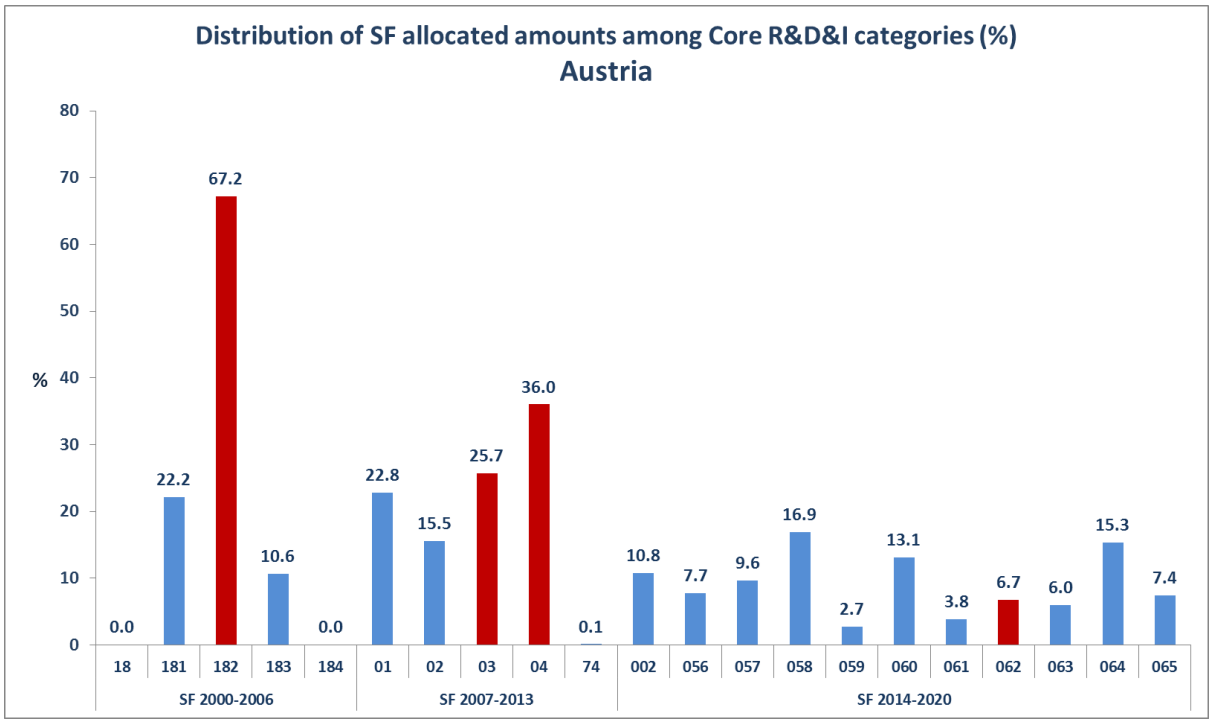


Figure 17: Structural Funds for core R&D activities 2000-2006, 2007-2013 and 2014-2020.[381] We use the categories: 182 (2000-2006), 03 and 04 (2007-2013) and 062 (2014-2020) as proxies for KT activities.

Austria has allocated 6.7% of its structural funds for core R&D activities to "Technology transfer and university-enterprise cooperation primarily benefiting SMEs" (compared to 67.2% for 2000-2006 and 51.7% in the 2007-2013 programming period). This is lower than the EU average of 15.7% in the current programming period (the EU average was 26.1% for 2000-2006 and 30.1% for 2007-2013).

[381] Figure 17 provides the Structural Funds allocated to Austria for each of the above R&D categories. The red bars show the categories used as proxies for KT. Please note that the figures refer to EU funds and they do not include the part co-funded by the Member State. The categories for 2000-2006 include: 18. Research, technological development and innovation (RTDI); 181. Research projects based in universities and research institutes; 182. Innovation and technology transfers, establishment of networks and partnerships between business and/or research institutes; 183. RTDI infrastructures; 184. Training for researchers.
The categories for 2007-2013 include: 01. R&TD activities in research centres; 02. R&TD infrastructure and centres of competence in specific technology; 03. Technology transfer and improvement of cooperation networks; 04. Assistance to R&TD particular in SMEs; 74. Developing human potential in the field of research and innovation.
The categories for 2014-2020 include: 002. Research and Innovation processes in large enterprises; 056. Investment in infrastructure, capacities and equipment in SMEs directly linked to Research and Innovation activities; 057. Investment in infrastructure, capacities and equipment in large companies directly linked to Research and Innovation activities; 058. Research and Innovation infrastructure (public); 059. Research and Innovation infrastructure (private, including science parks); 060. Research and Innovation activities in public research centres and centres of competence including networking; 061. Research and Innovation activities in private research centres including networking; 062. Technology transfer and university-enterprise cooperation primarily benefiting SMEs; 063. Cluster support and business networks primarily benefiting SMEs; 064. Research and Innovation processes in SMEs (including voucher schemes, process, design, service and social innovation); 065. Research and Innovation infrastructure, processes, technology transfer and cooperation of enterprises focusing on the low carbon economy and on resilience to climate change.

The reduction in the share of SF allocated to KT is partly explained by a new categorisation of measures (see table beneath Fig. 17), which differentiates networking initiatives, science parks/clusters, and vouchers from pure technology transfer instruments. Such measures make up a considerable share of KT support in Austria (see section on policy measures). Furthermore, technology transfer focusing on climate change/low carbon economy is also considered a separate category whose share is non-negligible in Austria. Moreover, Structural Funds play a significant role only on sub-national level in some regions. Given the relatively low amounts allocated (€536m for 2014-2020), the fluctuations over programming periods should not be overstressed.

Share of innovative companies cooperating with academia

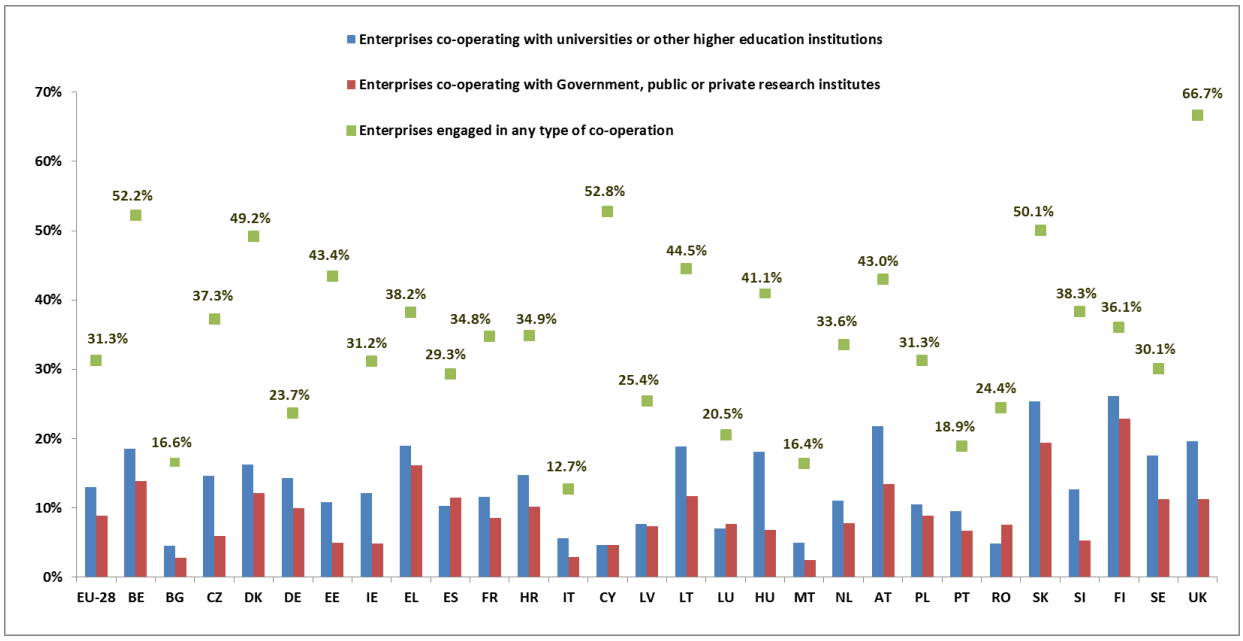


Figure 18: CIS survey 2012 – share of enterprises cooperating with academia

Figure 18 depicts the level of cooperation activities of innovative companies in the EU-28, according to the CIS 2012. The percentage of "enterprises engaged in any type of co-operation" (green dot) is rather high in Austria (43.0%), substantially above the EU-28 average of 31.3%. The percentage of enterprises involved in cooperation with universities or other HEIs (blue bar) is 21.8%, and that of enterprises cooperating with government, public or private research institutes (red bar) is 13.4%. Both indicators are above the values of the EU-28 average, which are 13.0% and 8.9% respectively. In the share of enterprises cooperating with HEIs Austria ranks third after Finland and Slovakia.

Technology Transfer Offices (TTOs), incubators and technological parks

Austria has 8 AplusB (Academia plus Business) centres with over 80 companies, 47 Competence Centres, 73 Christian-Doppler labs and centres, 7 Josef Ressel centres[382], 88 Impuls Centres with over 1.400 companies and 955 start-ups and 22 technology parks with over 630 companies and 404 start-ups.[383]

Under the uni:invent programme, whose aim was to unlock and exploit research outputs in economic terms, 13 university transfer offices were established, 50 transfer managers were professionally trained along a dedicated job profile and more than 30 innovation scouts were established at 17 Austrian universities, which increased the performance of the transfer offices.

382 https://www.cdg.ac.at/forschungseinheiten/?tx_cdglabors_labors%5Baction%5D=list&tx_cdglabors_labors%5Bcontroller%5D=Labor&cHash=fe58bf515098fed26266a05c7b757ddc

383 http://www.innovationszentren-austria.at/index.php?pid=10293&othertempl=karte_db.php

Despite the termination of this programme in 2009, technology transfer offices became institutionalised elements of the university fabric in Austria, although not on each and every university.[384]

Share of public-private co-publications

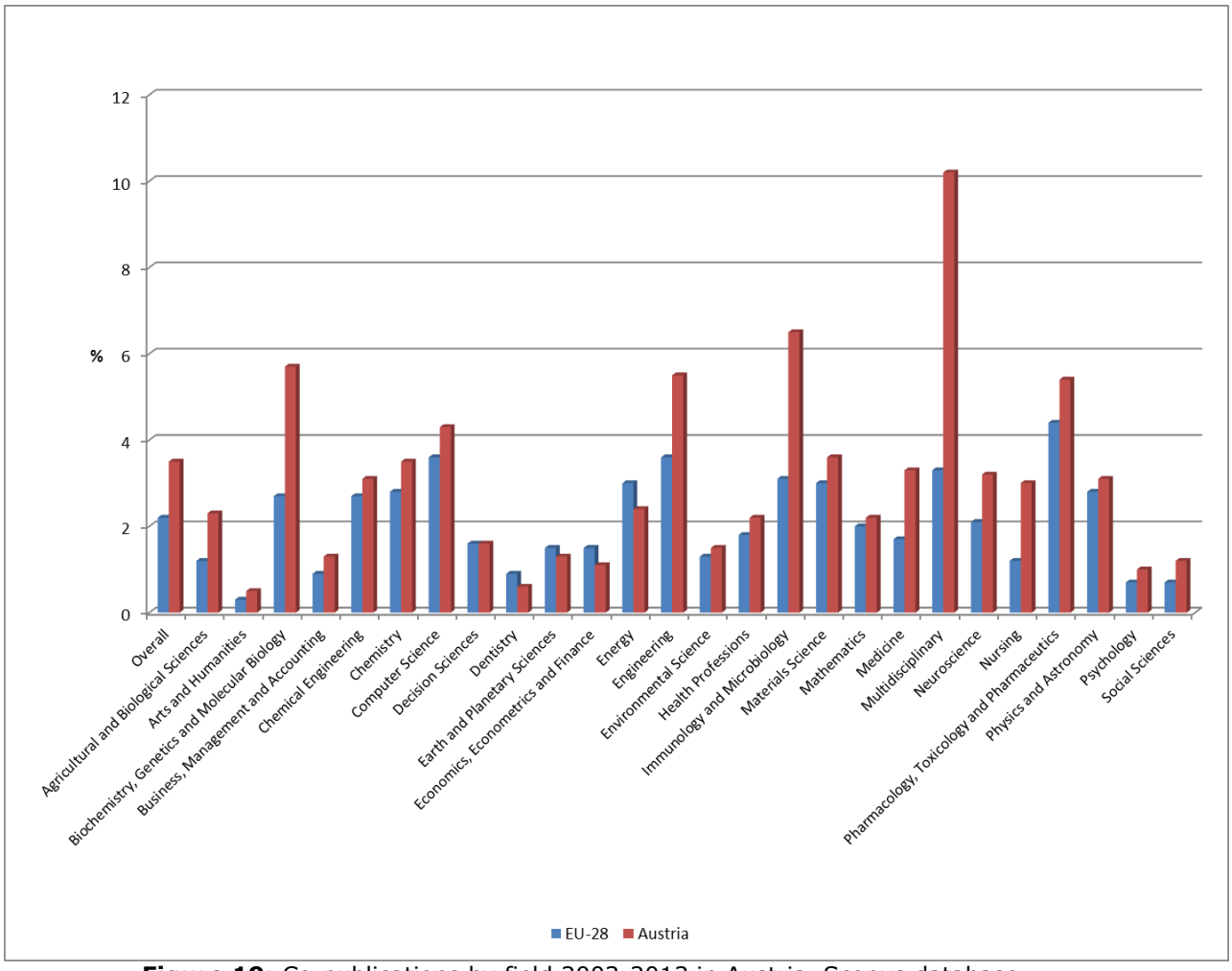


Figure 19: Co-publications by field 2003-2013 in Austria. Scopus database

Figure 19 shows the 2003-2013 average percentage of academia-industry co-publications by field in Austria compared to the European average. The total share of co-publications, displayed by the red "overall" bar on the left of the chart, is 3.5%, well above the EU-28 average of 2.2%. Excluding multidisciplinary publications, the domains recording the highest share of co-publications are immunology and microbiology, Biochemistry, genetics and molecular biology, engineering, and pharmacology, toxicology and pharmaceutics. In all these fields Austria considerably surpasses the EU average share of co-publications.

Scopus data also indicated that with 75.4 co-publications per million population, Austria by far exceeds the EU-28 average of 29, but remains below comparable innovation follower countries (Netherlands: 114.8, Belgium: 81.3). Nevertheless, it outranks one innovation leader, Germany (57.8).[385]

[384] Cuntz (2015) RIO Country Report Austria 2014

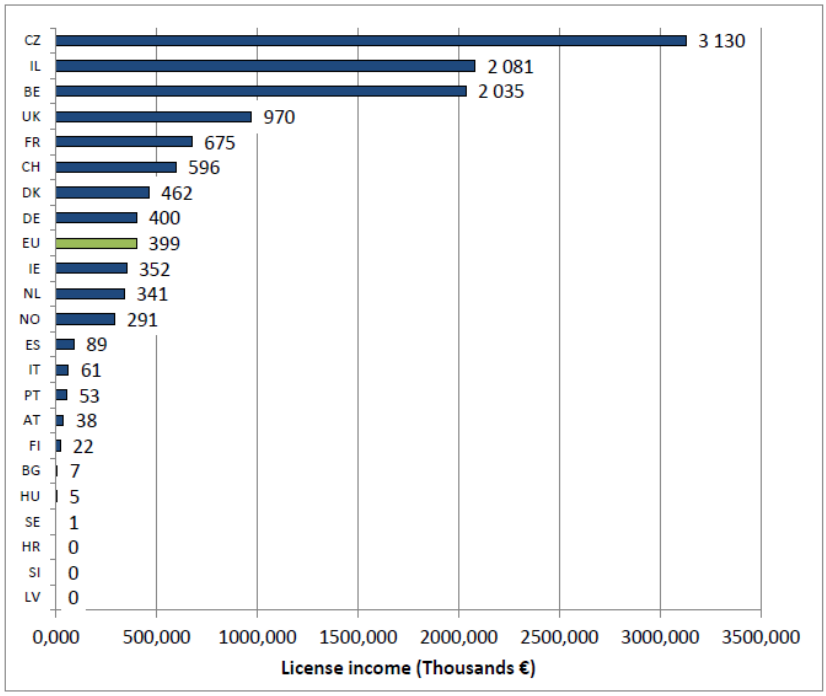
[385] The terms innovation leaders and followers are used as defined by the EC Innovation Union Scoreboard.

Patenting activity of public research organisations and universities together with licensing income

The Knowledge Transfer Study allows benchmarking the Austrian performances with the other surveyed countries as well as with the EU average.

Austria is in the bottom third in terms of patent grants, with 2.9 patents per 1 000 researchers, substantially lower than the EU average of 4.5. Also on license agreements Austria, with 1.6 agreements per 1000 research staff, is placed far behind the EU average of 6.5. Licensing income per 1 000 researchers is also quite low, with 38 000 Euro compared to 399 000 Euro of the EU average.

Exhibit 3-35: Thousands Euros of license income per 1,000 research staff by country, EKTIS 2011 and 2012 results combined



Source: MERIT, European Knowledge Transfer Indicator Survey 2011 and 2012.

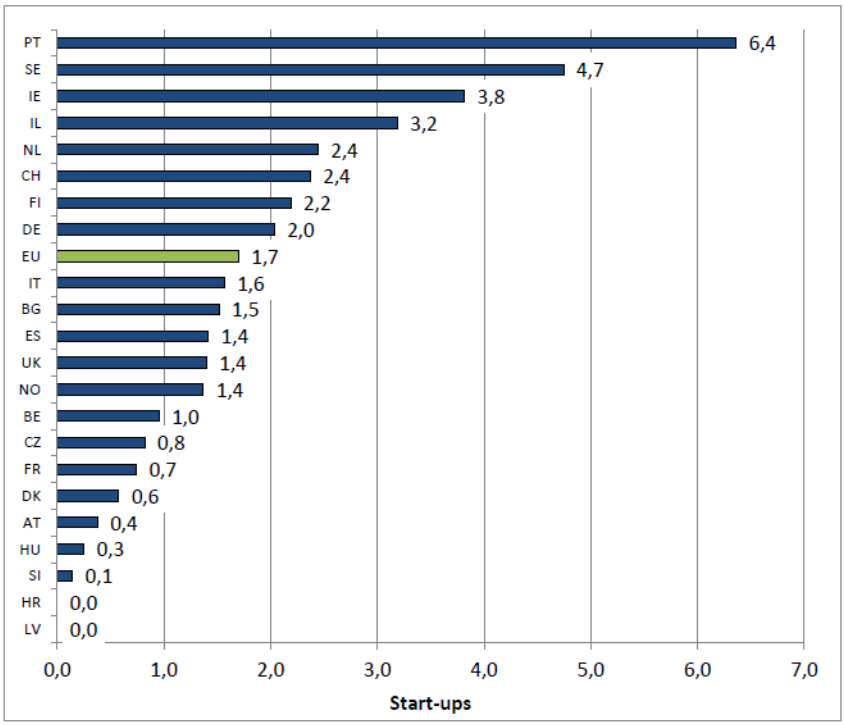
Figure 20: License income per 1 000 research staff by country. EKTIS 2011-2012 survey

Finally, Austria ranks mid-field in terms of number of research agreements with 73.3 agreements per 1 000 researchers, while the EU average is slightly higher at 82.8.

Companies

According to the RTD Knowledge Transfer Study 2010-2012, Austria ranks at the bottom end of the list of countries studied regarding start-ups with only 0.4 start-ups per 1 000 research staff (EU average: 1.7, Fig. 21).

Exhibit 3-33: Number of start-ups per 1,000 research staff by country, EKTIS 2011 and 2012 results combined



Source: MERIT, European Knowledge Transfer Indicator Survey 2011 and 2012.

Figure 21: Number of start-ups per 1 000 of research staff per country. EKTIS 2011-2012 survey

There are publicly funded programmes, however, such as the Academia plus Business (AplusB) programme that have a very good track record in terms of start-ups. Specifically, AplusB supports academic spin-offs. Until the end of 2014, 628 start-up projects had been serviced by the programme and 3,420 jobs created.

5.7.2 Policy Measures

The Austrian funding portfolio is still focused on technological research and technology transfer, while only recently more emphasis has been directed towards non-technological innovations in manufacturing and in the service sector, e.g. small-scale voucher schemes for the creative industries.[386]

In mid-2014, the Ministry for Science, Research and Economcy (BMWFW) established four regional "Knowledge Transfer and Exploitation of IPR Centres" (Wissenstransferzentren und IPR-Verwertung), with a total volume of €20m (administered by Austria Wirtschaftsservice). One main focus of the centres lies on collaborative projects in the humanities, social sciences, and cultural studies. The programme supports strategic patenting and prototype development at universities and public research institutions. The measure is a follow-up of the uni:invent scheme (i.e. technology transfer offices hosted at individual universities) which was phased out in 2009. Under uni:invent 13 university transfer offices were established, 50 transfer managers were professionally trained along a dedicated job profile and more than 30 innovation scouts were established at 17 Austrian universities. Despite the termination of this programme in 2009, technology transfer offices became institutionalised elements of the university fabric in Austria, although not on each and every university.

[386] Cuntz (2015) RIO Country Report Austria 2014

Among the many tasks these offices delivered, support and technology transfer for academic spin-offs is an important one.[387] In 2014, 313 patents by universities were registered.[388]

The Christian Doppler Research Association[389] (Christian Doppler Forschungsgesellschaft – CDG) has been one of the first organisations and initiatives to explicitly address the improvement of science-industry linkages as core ambition. The Association supports the establishment of temporary laboratories at universities that work on "application-oriented fundamental research". A precondition for establishing a new laboratory is the support of at least one industry partner. In 2014, CDG spent €25.7m on CD laboratories and JR centres.

The main Research Promotion Agency's (FFG) funding programmes targeting the promotion of knowledge and technology transfer make up over 30% of the agency's total funds and include:

- COMET: the programme's objectives are the development of new expertise by initiating and supporting long-term research cooperation between science and industry in top-level research. COMET is the follow-up funding measure for the competence centre programmes K-plus and had a budget of €106m in 2014;[390]
- COIN: the programme which was launched in 2008 contributes towards fostering Austria's innovation performance by the better and broader transposition of knowledge into innovation within two programme lines. The "Structure" line (COIN-Aufbau) focuses on application oriented research and technology organisations and should lead to an increase in the overall number of qualified R&D partners, particularly competent for the requirements of SMEs. The "Network" line (COIN-Net) encourages technology transfer within entrepreneurial cooperation schemes, thus raising the level of innovation within businesses and strengthening their cooperation capacities. It focuses on output-oriented cooperation projects to develop and improve innovative products, processes and services (Service Innovations Initiative-BMWFW). The budget in 2014 added up to €13.3m;[391]
- Bridge: the initiative's main goal is to support and improve links between basic research and applied research. This initiative provides the opportunity to individual researchers, research teams or consortia of researchers and companies to further develop their research results towards applicable products, processes or services. It had a budget of 17.1 million Euro in 2014;[392]

Since 2001 the FFG has also been funding the Academia plus Business (AplusB) programme supporting spin-offs from universities, universities of applied sciences and non-university research organisations. The centres include around 130 partners coming from different institutional background, such as foreign academic partners, domestic R&D partners, financial partners, media partners, intermediary partners such as incubators and business partners.[393] Until the end of 2014, 628 start-up projects had been serviced by the programme and 3,420 jobs created.

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[387] Cuntz (2015) RIO Country Report Austria 2014

[388] https://suasprod.noc-science.at/XLCubedWeb/WebForm/ShowReport.aspx?rep=009+wissensbilanzen+universit%u00e4ten%2f007+output+und+wirkungen+der+kernprozesse+-+forschung+und+entwicklung-+und+erschlie%u00dfung+der+k%u00fcnste%2f003+3-b-3+anzahl+der+patentanmeldungen.xml&toolbar=true; last accessed 13 April 2016.

[389] http://www.cdg.ac.at/ ; http://www.bmwfw.gv.at/Innovation/Foerderungen/Seiten/CDG-ChristianDopplerForschungsgesellschaft.aspx

[390] https://www.ffg.at/program/comet-competence-centers-excellent-technologies , http://www.bmvit.gv.at/bmvit/innovation/strukturprogramme/comet/index.html

[391] https://www.ffg.at/coin-cooperation-innovation

[392] https://www.ffg.at/bridge; http://www.bmvit.gv.at/innovation/strukturprogramme/bridge/index.html

[393] Cuntz (2015) RIO Country Report Austria 2014.

Between 2008 and 2013, 3 Josef-Ressel (Pilot) Centres were supported via the Austrian Research Promotion Agency (FFG) as part of a pilot initiative.

Following the end of this pilot action, a new funding programme for Josef Ressel Centres was established, which is geared towards the established cooperation model for CD-Laboratories and thus also managed by the Christian Doppler Forschungsgesellschaft (CDG).

Josef Ressel Centres can be stablished exclusively at Universities of Applied Sciences for a five-year R&D cooperation with business partners in the area of applied research at a high level. The annual budget per centre is set at up to €400,000. In 2014, the expenditure for 5 Josef Ressel Centres amounted to €1,2m.

The Laura Bassi Centres of Expertise[394] are close to industry and are headed by highly qualified female experts. A Laura Bassi-consortium has to consist of at least one academic partner (as applicant) and at least one corporate partner. The centres were funded with €2.4m in 2011.

More recently, 1.43 million Euro of funds for prototype research were distributed under the new technology transfer center program "PRIZE". The program launched by BMWFW in mid-2013 supports prototype development at higher university institutions and across scientific disciplines. Projects are selected by an international jury and upon an assessment of commercialization chances.[395]

Like many other EU countries, Austria also offers innovation cheques[396] to support innovation at SMEs. There are basically two different voucher schemes available which are distributed by FFG: vouchers of up to €5,000 and vouchers of up to €10,000 can be granted when SMEs partner with a publicly financed research institution. For the latter scheme, SMEs need to share part of the costs with a self-contribution of €2,500. A third voucher scheme called "Kreativwirtschaftsscheck", intended to support creative industries, is distributed by Austria Wirtschaftsservice.[397] It supports SME activities that specifically target and involve partners in the creative industries in Austria, often SMEs themselves. Since 1998, the FFG also funds feasibility studies[398] carried out by research institutions and other qualified institutions for SMEs. Funding (max. €30,000 per study) is granted if a small or medium-sized enterprise submits an idea worthy of greater consideration and an offer from a partner who can demonstrate the necessary competence and experience to carry out a feasibility study.[399]

The programme line FEMtech Career Paths[400] promotes cooperation between tertiary education institutions and R&D-intensive companies in order to encourage young female scientists to pursue a career in industry. Since 2011, the programme line forms part of the "Talente" programme of the Ministry of Transport, Innovation and Technology (BMVIT).

To foster inter-sectoral mobility between academia and business enterprises which do not have their own research unit, the young experts-programme has been launched, under whose framework master theses and PhD theses, which have to be firmly embedded in the R&D work of a company, can be supported for up to one year.[401] The programme has been recently extended towards the co-financing of post-doc and junior researcher positions employed at companies.

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[394] https://www.ffg.at/laura-bassi-centres-expertise-0; http://www.w-fforte.at/at/laura-bassi-centres.html
[395] Cuntz (2015) RIO Country Report Austria 2014
[396] https://www.ffg.at/innovationsscheck10000
[397] http://www.awsg.at/Content.Node/foerderungen_alle/kreativwirtschaft/67656.php
http://www.awsg.at/Content.Node/79110_1.php
http://www.awsg.at/Content.Node/foerderungen_alle/kreativwirtschaft/67656.php
[398] https://www.ffg.at/feasibility-studies-im-basisprogramm
[399] Cuntz (2015) RIO Country Report Austria 2014
[400] https://www.ffg.at/femtech-karriere
[401] https://www.ffg.at/getdownload.php?id=3234, accessed on 24 October 2015.

An industrial PhD programme, financed by the National Foundation for Research, Technology and Development and administered by FFG has been recently established. The programme aims at further qualification of research and innovation staff in companies and non-university research institutions. An industrial PhD project is a three-year industrially focused PhD project where the student is hired by a company and enrolled at a university at the same time. The 1st Call in 2014 had a funding volume of €2.9m.[402]

5.7.3 Assessment

Most measures relating to increased science-business cooperation were established over the last decade and are considered effective and have led to a higher level of transfer activities. Many of the above mentioned programmes and initiatives have been evaluated at least once at one point during their lifetime.

The uni:invent scheme was positively evaluated in 2011. Among the many tasks that transfer offices deliver, support and technology transfer for academic spin-offs were identified as the most important. This often includes e.g. holding equity in start-ups on behalf of the university.[403]

However, technology and knowledge transfer schemes involving SMEs (e.g. Josef Ressel[404] and Laura Bassi Centres[405]) still leave room for improvement and require evidence-based modifications or strategic reorientation (e.g. COMET[406]).

Other evaluations were carried out for the Femtech-FFORTE programme line FEMtech Career Paths in 2011[407], for COIN[408] in 2011, and for the Christian Doppler Research Labs in 2005[409] and 2012[410]. Favourable indicators included among others the number of patent applications by CD labs and number of researchers who changed to jobs in industry.

A recent study [411], however, argues that whereas funding for science-industry cooperation is already at a very high level and quite saturated, the potential for commercialising research results from HEI is not yet fully exploited, which concurrently requires also further strengthening of core activities of the universities. There are no standardised incentives, rewards and programmes for individual public researchers involved in cooperation with industry/users, but such engagement is in general appreciated in Austria, and sometimes individually rewarded on case-by-case basis by the employing research organisation. Please consult section 5.6 to learn more about the right to patent for researchers employed at public research organisations.

Inter-sectoral mobility as another important knowledge transfer mechanism in Austria is still relatively low, although no hard factors restrict mobility of researchers between the public and the private sector. Researchers employed in the public sector are allowed to work for industry on a part-time, consultancy or other basis, provided that their contracts do not include competition clauses which prohibit such arrangements. Through the gradual abolishment of civil servants status at universities and the introduction of private law-based labour contracts further mobility obstacles have been removed.

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[402] https://www.ffg.at/en/research-partnerships; accessed on 24 October 2015.
[403] http://www.fteval.at/de/evaluation_studies/programmes/2011/568/
[404] http://www.fteval.at/de/evaluation_studies/programmes/2010/560/
[405] http://www.w-fforte.at/fileadmin/Redaktion/Intern/Begleitevaluierung_LBC/Laura_Bassi_Zwischenergebnisse_2010.pdf
[406] An overall evaluation of the COMET programme is not available, but single competence centres are evaluated on a regular basis: https://www.ffg.at/page/comet-downloadcenter#Anker_2_Zwischenevaluierung
[407] http://www.fteval.at/en/evaluation_studies/all/2011/572/
[408] http://www.fteval.at/de/evaluation_studies/all/2011/571/
[409] http://www.fteval.at/en/evaluation_studies/all/2005/410/
[410] http://www.fteval.at/en/evaluation_studies/all/2012/1059/
[411] Leitner et al., 2015

Different soft factors, however, still hamper inter-sectoral mobility. The increasing centrality of number and quality of publications as a criterion for obtaining academic positions and career promotions constitutes a systemic inter-sectoral mobility dilemma, because industry researchers are less encouraged or even not allowed to publish results of their work.[412]

To sum up, knowledge and technology transfer as well as science-industry collaboration are well established in Austria. Since around 15 years a host of policy measures has been in place mainly aiming at the interaction of academia and industry in the Austrian innovation system. Maybe due to the "saturation" of this set of policies, only few new initiatives have been introduced in the last years. Notwithstanding the existing variety of instruments in place, the issue of KT remains high on the policy agenda. This is testified by the establishment (2011) of an inter-ministerial working group "knowledge transfer and start-ups" in the course of the national R&I strategy implementation.

Some evaluations have shown the need for restructuring or refocusing of some initiatives. In spite of its extensive array of knowledge transfer policy instruments, the level of privately-funded public R&D expenditure in Austria is relatively low and in some areas soft factors still hinder the flux of knowledge and personnel between sectors. To further exploit the potential for commercialising research results, increasing the number and quality of university spin-offs could be helpful. This would require further incubation support, a roll-out of practice-oriented entrepreneurship training across the tertiary sector, and mostly a change of mind-set among the faculty.[413]

5.8 Regulation and innovation

Although the coalition agreement signed in late 2013 foresaw several measures reducing red tape for entrepreneurship and general funding processes, e.g. expansion of online-registration processes of start-up businesses and harmonisation of certain aspects of R&D funding rules, the connection between regulation and innovation is hardly an issue in the public discourse in Austria. This is somewhat surprising, because according to the Community Innovation Survey 27.9% of the non-innovation active as well as of the innovation active enterprises in the years 2010-2012 consider the high costs to fulfil the legal requirements as a barrier for innovation. This is the second highest hampering factor after the sharp competitiveness in terms of prices respectively costs. Concern in this direction is especially raised by small enterprises (below 50 employees).[414] Also the Global Information Technology Report 2015, published by the World Economic Forum, stipulates that the overall business and innovation environment in Austria requires simplification and more reforms.[415]

In 2012, an important regulatory step was taken by the federal government when it adopted a national Action Plan on Public Procurement Promoting Innovation (PPPI) and, accordingly, amended the Public Procurement Act (BVergG) in mid-2013 to include innovation as a secondary procurement criterion.[416] In late 2013, BMWFW and BMVIT) also established an PPPI service centre within the Federal Procurement Agency (BBG) that serves as a first point of contact and supports pilot projects of interested public bodies.[417] The service centre also partners with other institutions in this area, namely Bundesimmobiliengesellschaft (BIG), the Austrian Energy Agency (AEA), AWS and FFG, and offers education and training modules.

[412] Cuntz (2015) RIO Country Report Austria 2014
[413] Cuntz (2015) RIO Country Report Austria 2014
[414] Statistik Austria 2013.
[415] Cited in WKÖ 2015.
[416] BMWFJ, BMVIT, BBG und AIT (2012).
[417] http://www.ioeb.at/; accessed on 28 October 2015.

In Austria the impact of regulation and legislation on innovation is - at least qualitatively - monitored by the Austrian Economic Chamber (WKÖ). It claims that regulations and measures not directly targeting innovation objectives, such as complicated and inflexible labour market regulations, are impacting innovation more severely than regulations with primary innovation objectives. The monitoring of the WKÖ is, however, not backed by a sufficient number of reliable and relevant indicators. This deficit is caused by the complexity of the manifold direct and indirect, intended and non-intended relationships between regulation and innovation. In its monitoring report 2014 [418], the WKÖ exemplifies these relationships with three cases of EU regulations such as REACH (Registration, Evaluation, Authorisation and Restriction of Chemicals)[419], which effected a shift of resources away from R&D and innovation to regulation compliance.

Occasionally, also the Austrian Council for RTD points to regulatory impact on research and innovation. An example is its recommendation for simplified administrative procedures as regards ERDF funding for R&D in Austria.[420]

Until now, however, there are no structured government initiatives to assess the impact (ex post) or improve the effects of regulation on innovation. Concurrently, also no overall systematic attempts are being made to reduce the negative impact or to improve the positive impact of regulations on innovation. If attempts are initiated, they usually arise out of a particular occasion. One exception to this rule was the so called "Systemevaluierung" ('system's evaluation') implemented in 2008 and 2009 which scrutinised the system of competitive R&D funding in Austria and which identified an unnecessarily high complexity of funding programmes, procedures and responsibilities, which favoured R&D insiders (i.e. companies and other research organisations which are experienced in the system of research and innovation in Austria).[421]

5.9 Assessment of the framework conditions for business R&I

Austria has broadly followed the OECD-wide trend towards more liberal product market regulations. Only in a few service sectors regulation remained restrictive, in particular in retail (licenses and permits, opening hours) as well as few liberal professions such as notaries and pharmacies. In order to better oversee and promote competition in Austria, the Austrian Council for RTD, in line with the country specific recommendations of the EC to Austria in 2014, recommends more resources and more power to the Austrian competition authority and calls for sector specific analysis to identify innovation barriers more systematically.[422]

In general, however, the framework conditions for business research and innovation are very supportive in Austria. R&D and innovation funding support is well-tailored to the needs of companies: 25.9% of public funding for R&D in Austria, i.e. €846.8m, directly financed the business enterprise sector in 2013. These €846.8m represented 12.5% of the R&D funding consumed by the BES in total. Roughly one quarter of this sum benefited the so called cooperative research institutes including the Austrian Institute of Technology and the Competence Centres. Three quarters of this sum financed regular companies' R&I activities.

A major component of Austrian total funding for the BES is indirect funding using a uniform system of R&D tax credit ("research premium"). The system itself keeps bureaucracy in Austria to a minimum, compared to selection processes associated with direct funding effort, both for the public administration as well as for companies applying for funds.

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[418] WKÖ 2015b.
[419] Regulation (EC) No 1907/2006.
[420] Rat für FTE 2013b.
[421] https://www.bmvit.gv.at/service/publikationen/innovation/forschungspolitik/endbericht_syseval.html; accessed on 28 October 2015.
[422] Rat für FTE 2015b.

Despite the internationally comparatively generous provision of public financing for private R&D, the private financing shares stagnated and absolute R&D investments by businesses did not increase significantly faster than public ones.

In terms of overall regulation, supply and demand-side policies and instruments have only been coordinated to a limited extent in Austria. Even though demand-side policies such as innovative public procurement are increasingly being used at large, little effort is put into policies so far to fine-tune their co-evolution. One notable exception is the thematic field of green tech and support to sustainable growth. Here, green public procurement is essentially coupled with public efforts to provide additional venture capital and a variety of other supply-side activities under the roof of the Austrian climate and energy fund.[423]

[423] Cuntz 2015.

6. Conclusions

The table below identifies the main structural challenges faced by the national innovation system.

Challenges	Justification
1. Improve effectiveness of public support for private-sector innovation	Stagnating innovation performance of the private sector despite rising BERD and an array of public support instruments for private R&I Substantial shift from direct to indirect support during the past decade may have reduced system's ability to respond flexibly to specific needs
2. Increase supply of private equity, especially venture capital	In comparison with other Member States of similar innovation capacity, underdeveloped supply of private equity and venture capital Low supply of private equity affects all development stages of young companies, not only the scale-up phase Regulation for retail investment imposes considerable obligations on the equity issuer concerning information disclosure and investor protection

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Abbreviations

ACR	Austrian Cooperative Research
AIT	Austrian Institute of Technology
APART	Austrian Programme for Advanced Research and Technology
AplusB	Academia plus Business
APO	Austrian Patent Office
AQ	*AQ Austria – Agentur für Qualitätssicherung und Akkreditierung* (Agency for Quality Assurance and Accreditation)
AT	Austria
AWS	*Austria Wirtschaftsservice GmbH* (Austria Business Service)
BBMRI	Biobanking and Biomolecular Resources Research Infrastructure
BERD	Business Expenditure for Research and Development
BES	Business Enterprise Sector
BMBF	*Bundesministerium für Bildung und Frauen* (Austrian Federal Ministry for Education and Women)
BMeiA	*Bundesministerium für Europa, Integration und Äußeres* (Austrian Federal Ministry of Europe, Integration and Foreign Affairs)
BMF	*Bundesministerium für Finanzen* (Austrian Federal Ministry of Finance)
BMLFUW	*Bundesministerium für Land- und Forstwirtschaft, Umwelt und Wasserwirtschaft* (Austrian Federal Ministry for Agriculture, Forestry, Environment and Water Management)
BMVIT	*Bundesministerium für Verkehr, Innovation und Technologie* (Austrian Federal Ministry of Transport, Innovation and Technology)
BMWF	Former Austrian Federal Ministry of Science and Research

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)
BRIDGE	Programme to support knowledge transfer
BVergG	*Bundesvergabegesetz* (Public Procurement Act)
BV-G	*Bundesverfassungsgesetz* (Federal Constitutional Act)
CDG	*Christian Doppler Forschungsgesellschaft* (Christian Doppler Research Society)
CERN	European Organization for Nuclear Research
CESSDA	Council of European Social Science Data-Archives
CIS	Community Innovation Survey
CLARIN	Common Language Resources and Technology Infrastructure
COIN	Cooperation and Innovation Programme
COMET	Competence Centres for Excellent Technologies
CSO	Civil Society Organisations
CTA	Cherenkov Telescope Array
D-A-CH	Germany, Austria and Switzerland
DAI	Digital Author Identification
DARIAH	Digital Research Infrastructure for the Arts and Humanities
DFG	*Deutsche Forschungsgemeinschaft* German Research Foundation
DK	DoktoratsKolleg
DOC	Doctoral Programme of the ÖAW

EC	European Commission
ECRIN	Pan-European Infrastructure for Clinical Trials and Biotherapy
E-ELT	European Extremely Large Telescope for Optical Astronomy
ELETTRA	Elettra Sincrotrone Trieste
ELIXIR	Upgrade of the European Life-science Infrastructure for Biological Information
EMBC	European Molecular Biology Conference
EMBL	European Molecular Biology Laboratory
EPO	European Patent Office
ERA	European Research Area
ERA-NET	European Research Area Network
ERC	European Research Council
ERIC	European Research Infrastructure Consortium
ERDF	European Regional Development Funds
ESA	European Space Agency
ESF	European Science Foundation
ESFRI	European Strategy Forum on Research Infrastructures
ESIF	European Structural and Investment Funds
ESO	European Organisation for Astronomical Research in the Southern Hemisphere
ESRF	European Synchrotron Radiation Facility
ESRF upgrade	European Synchrotron Radiation Facility Upgrade
ESS	European Social Survey
EU	European Union
EUMETSAT	European Organisation for the Exploitation of Meteorological Satellites

EU-OPENSCREEN	European Infrastructure of Open Screening Platforms for Chemical Biology)
EuroBioImaging	Research infrastructure for imaging technologies in biological and biomedical sciences
EU-15	European Union including 15 Member States
EU-27	European Union including 27 Member States
EU-28	European Union including 28 Member States
EVCA	European Private Equity Venture Capital Association
FAIR	Facility for Antiproton and Ion Research
FDI	Foreign Direct Investments
FEMTECH	Initiative to support women in research and technology
FFG	*Österreichische Forschungsförderungsgesellschaft mbH* (Austrian Research Promotion Agency)
fFORTE	*Frauen in Forschung und Technologie* (Women in Research and Technology)
FP	Framework Programme
FPA	Federal Procurement Agency
FTE	Full-time Equivalent
FTEVAL	*Österreichische Plattform für Forschungs- und Technologiepolitikevaluierung* (Austrian Platform for Research and Technology Policy Evaluation)
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
GOVERD	Government Intramural Expenditure on R&D
GUF	General University Funds
HEI	Higher Education Institution

HERD	Higher Education Expenditure on R&D
HES	Higher Education Sector
HETA	Heta Asset Resolution AG is a wind-down company owned by the Republic of Austria
HR	Human Resources
HRS4R	Human Resources Strategy for Researchers
HRST	Human Resources in Science and Technology
IARC	International Agency for Research on Cancer
ICT	Information and Communication Technologies
IHS	*Institut für Höhere Studien* (Institute of Advanced Studies)
ILL	Institut Laue-Langevin, European Neutron Spectroscopy Facility
ILL Upgrade	Institut Laue-Langevin, European Neutron Spectroscopy Facility Upgrade
Infrafrontier	European infrastructure for phenotyping and archiving of model mammalian genomes)
INSTRUCT	Integrated Structural Biology Infrastructure
IODP/ICDP	Integrated Ocean Drilling Program (*IODP*) and International Continental Scientific Drilling Program (*ICDP*)
IP	Intellectual Property
IPP	Innovation-friendly Public Procurement
IPR	Intellectual Property Rights
IPTS	Institute for Prospective Technological Studies
ISCED	International Standard Classification of Education
IST	Institute of Science and Technology Austria
IU	Innovation Union
JPI	Joint Programming Initiative

KIRAS	*Österreichisches Förderungsprogramm für Sicherheitsforschung* (Austrian Security Research Programme)
KORANET	Korean Scientific Cooperation with the European Research Area
LBG	*Ludwig Boltzmann Gesellschaft* (Ludwig Boltzmann Society)
MATIMOP	Executive agency of the Office of the Chief Scientist (OCS) of the Israeli Ministry of Economy
MNE	Multinational Enterprises
MORE	Mobility of Researchers
MS	Member State
NCP	National Contact Point
NRP	National Reform Programme
NWO	The Netherlands Organisation for Scientific Research
OA	Open Access
ÖAW	*Österreichische Akademie der Wissenschaften* (Austrian Academy of Sciences)
OeAD	*Österreichische Austauschdienst GmbH* (Austrian Agency for International Cooperation in Education and Research)
OECD	Organisation for Economic Co-operation and Development
ÖNB	*Österreichische Nationalbank* (Austrian Federal Reserve)
OpenAIRE	Open Access Infrastructure for Research in Europe
ORCID	Open Researcher Contributor ID
OSTA	Offices of Science and Technology Austria
ÖVP	*Österreichische Volkspartei* (Austrian People‘s Party)
PCT	Patent Cooperation Treaty

PhD	Philosophiae Doctor
PRACE	Partnership for Advanced Computing in Europe
PRO	Public Research Organisation
R&D	Research and Development
R&I	Research and Innovation
RDI	Research, Development and Innovation
RI	Research Infrastructure
RIS3	Regionale Forschungs- und Innovationsstrategie für intelligente Spezialisierung (*Smart Specialisation*)
RTD	Research, Technology and Development
RTI	Research, Technology and Innovation
S3	Smart Specialisation Strategy
S&T	Science and Technology
SF	Structural Funds
SHARE	Survey of Health, Ageing and Retirement in Europe
SME	Small and Medium Sized Enterprise
SNSF	Swiss National Science Foundation
SPÖ	*Sozialdemokratische Partei Österreichs* (Social Democratic Party of Austria)
STEM	Science, Technology, Engineering and Mathematics
STI	Science, Technology and Innovation
TT	Technology Transfer
UK	United Kingdom
UNIKO	*Österreichische Universitätenkonferenz* (Austrian Rectors‘ Conference)
WEF	World Economic Forum

WIFO	*Österreichisches Institut für Wirtschaftsforschung* (Austrian Institute of Economic Research)
WIPO	World Intellectual Property Organization
WKÖ	*Wirtschaftskammer Österreich* (Austrian Economc Chamber)
WTZ	Wissenschaftlich-Technische Zusammenarbeit Science and Technology Cooperation Agreements
WWTF	*Wiener Wissenschafts-, Forschungs- und Technologiefonds* (Vienna Science and Technology Fund)
X-FEL	Production of intense X-ray flashes to identify biological structures and chemical reaction processes
ZDG	Centre for Digital Humanities
ZSI	*Zentrum für Soziale Innovation* (Centre for Social Innovation)

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Annex 1 – List of the main research performers

Table 8: Number of employed researchers at Austrian universities, number of publications and number of contracted participations in FP7 and Horizon 2020

Rank	University	Number of researchers				No. of publications	Number of participations	Number of participations
		2011	2012	2013	2014	2014	FP7	Horizon 2020
1	University of Vienna	6342	6314	6474	6427	8025	181	34
2	Technical University Vienna	3230	3170	3136	3207	4727	213	41
3	University of Innsbruck	2820	2917	2908	2937	3540	98	12
4	Medical University Vienna	2749	2843	2885	2861	2915	108	12
5	University of Graz	2517	2540	2588	2696	3266	55	9
6	Technical University Graz	1992	2053	2091	2160	2380	134	22
7	University of Natural Resources and Life Sciences	1553	1704	1768	1775	2302	83	14
8	University of Salzburg	1610	1711	1713	1747	2821	40	5
9	University of Linz	1701	1670	1662	1707	2118	59	10
10	Vienna University of Economics and Business	1281	1340	1422	1479	973	32	3

Source: BMWFW (Ministry of Science, Research and Economy) (2015e); for number of researcher see: https://suasprod.noc-science.at/XLCubedWeb/WebForm/ShowReport.aspx?rep=012+statistisches+taschenbuch%2f005+personal%2f020+5-2+professorinnen+sowie+wiss-+und+k%u00fcnstl-+mitarbeiterinnen+nach+universit%u00e4ten.xml&toolbar=true
For number of publications see: https://suasprod.noc-science.at/XLCubedWeb/WebForm/ShowReport.aspx?rep=009+wissensbilanzen+universit%C3%A4ten/007+output+und+wirkungen+der+kernprozesse+-+forschung+und+entwicklung-+und+erschlie%C3%9Fung+der+k%C3%BCnste/001+3-b-1+wissenschaftliche+k%C3%BCnstlerische+ver%C3%B6ffentlichungen.xml&toolbar=true

Note: Deadline for Horizon 2020 participations: 07/2015

Table 9: Top 10 private R&D performers in Austria

EU Rank	Company name	Industry	R&D exp. 2014 (€m)
176	VOEST ALPINE	Industrial Metals and Mining	142.4
220	BOREALIS	Chemicals	104.5
234	BENTELER INTERNATIONAL	Automobiles & Parts	99.4
249	ZUMTOBEL	Electronic & Electrical Equipment	89.7
261	ANDRITZ	Industrial Engineering	84.3
280	NOVOMATIC	Travel & Leisure	75.5
293	AUSTRIA MICROSYSTEMS	Technology Hardware & Equipment	69.8
324	AUSTRIA TECHNOLOGIE & SYSTEMTECHNIK	Electronic & Electrical Equipment	57.9
338	KAPSCH TRAFFICCOM	Electronic & Electrical Equipment	54.0
377	KTM	Automobiles & Parts	45.2

Source: EU Industrial R&D Investment Scoreboard (2015; http://iri.jrc.ec.europa.eu/scoreboard15.html)

Annex 2 – List of the main funding programmes

Table 10: List of the main funding programmes

Name of the funding programme	Timeline	Budget (2014)	Target group
Stand-alone projects (incl. clinical research) / FWF	ongoing	€90.8m	public research
Priority Research Programmes (SFB, NFN) / FWF	ongoing	€31.1m	public research
International programmes /FWF	ongoing	€27.2m	public research
Doctoral Programmes /FWF	ongoing	€24.8m	public research
General Programme / FFG	ongoing	€171.9m	private research
COMET / FFG	ongoing	€106.1m	public and private research
Energy Research (e!MISSION) / FFG	ongoing	€37.1	public and private research
Produktion der Zukunft (Production for the future) / FFG	ongoing	€25.0	public and private research

Note: budget in cash value
Source: BMWFW und BMVIT (2015)

Annex 3 – Evaluations, consultations, foresight exercises

Evaluations

During the last year more than a dozen of evaluations of research programmes were commissioned / finalised including

The evaluation of the programme "Forschungskompetenzen für die Wirtschaft" ("research competence for the economy") aiming at supporting companies (mainly SMEs) in capacity building and qualification of their D&D&I staff Moreover, the programme aims at establishing research groups at universities in fields that are relevant for companies (on behalf of the Federal Ministry of Science and Research [BMWF])

Evaluation of CEEPUS Teacher Mobility within CEEPUS III programme (commissioned by the international CEEPUS secretariat)

Evaluation of research funding for universities of applied sciences in Austria commissioned by the Federal Ministry of Science, Research and Economy (BMWFW)

Evaluation of the AplusB-programme commissioned by the Federal Ministry of Transport, Innovation and Technology (BMVIT)

Ex-post evaluation of the strategic aviation R&D program Take Off (2002-2013) commissioned by the Federal Ministry of Transport, Innovation and Technology (BMVIT)

The interim evaluation of the innovation voucher, (on behalf of the Federal Ministry of Science and Research [BMWF])

the accompanying evaluation of the "Laura Bassi Centres of Expertise" Programme targeting science-industry centre of excellence lead by female researchers, 2014 Final Report (on behalf of the Federal Ministry of Economy, Family and Youth (BMWFJ), now Federal Ministry of Science and Research [BMWF]);

the ex-post evaluation of the "K-plus and K-ind/K-net programmes for competence centres" (on behalf of the Federal Ministry for Transport, Innovation and Technology (BMVIT) and the Federal Ministry of Economy, Family and Youth [BMWFJ]);

"FOR-AUS", an international comparison of criteria applied to organisations that fund research (on behalf of the Federal Ministry for Transport, Innovation and Technology [BMVIT]);

the evaluation of international research cooperation resulting from bilateral treaties and agreements with other countries ("WTZ Programm") (on behalf of the Federal Ministry of Science and Research [BMWF]);

the ex-post evaluation of the Austrian genome research programme, "GEN-AU" (on behalf of the Federal Ministry of Science and Research [BMWF]);

the ex-post evaluation of the Austrian electronic network ("AT:net") funding programme (on behalf of the Federal Ministry for Transport, Innovation and Technology – BMVIT);

the evaluation of the "FHplus programme" dedicated to fostering research with industry at the Austrian Universities of Applied Sciences (Federal Ministry for Transport, Innovation and Technology – BMVIT);

the Impact Evaluation of the outgoing "Erwin Schrödinger Fellowship Programme" with Return Phase (Austrian Science Fund – FWF);

the interim evaluation of the Human Capital Development Programme "Talents" (Federal Ministry for Transport, Innovation and Technology – BMVIT);

the Austrian security research programme "KIRAS" (Federal Ministry for Trans-port, Innovation and Technology – BMVIT);

the Doctoral Programme "DK-plus" (the Austrian Science Fund – FWF);

the educational evaluation of the "Sparking Science" programme targeting cooperation between schools and researchers (the Federal Ministry of Science, Research and Economy – BMWFW);

the evaluation of the "Research Expertise for Industry programme" (Federal Ministry of Science, Research and Economy – BMWFW);

and the evaluation of the creative industries initiative "evolve" (Federal Ministry of Science, Research and Economy – BMWFW).

All evaluation reports can be downloaded from http://www.fteval.at/en/evaluation_studies/all/

Consultations

Several consultation processes were implemented in course of thematic RTI strategy development processes including

consultation for developing the open innovation strategy

consultation for developing the strategy for social sciences and humanities

consultation for establishing the Austrian RTI bio-economy strategy

Foresight Excercises

No specific R&I related foresight exercises have been carried out in 2015 in Austria.

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